

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

**Petition of PECO Energy Company for
Approval of a Default Service Program for the
Period of June 1, 2021 through May 31, 2025**

Docket No. P-2020-3019290

DIRECT TESTIMONY OF HARRY GELLER

ON BEHALF OF

THE COALITION FOR AFFORDABLE UTILITY SERVICES AND
ENERGY EFFICIENCY IN PENNSYLVANIA (“CAUSE-PA”)

June 16, 2020

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PREPARED DIRECT TESTIMONY OF HARRY GELLER

Q. Please state your name, occupation, and business address.

A. Harry Geller. I am an attorney. Though I am currently retired, I have maintained an office at the Pennsylvania Utility Law Project (PULP), 118 Locust St., Harrisburg, PA 17101, and serve as a consultant to PULP and its clients. Since the Governor’s COVID-19 Emergency Directives, I have been working from 4213 Orchard Hill Road, Harrisburg, PA 17110.

Q. Briefly outline your education and professional background.

A. I received my B.A. Degree from Harpur College, State University of New York at Binghamton in 1966, and a J.D. degree from Washington College of Law, American University in 1969. Upon graduation from law school, I entered the Volunteers in Service to America (VISTA) program, where I was assigned to the New York University Law School. I took courses in the Law School’s Urban Affairs and Poverty Law program and worked with the Community In Action Program on the West Side of Manhattan in New York City from 1969-1971. In 1971, I started as a Staff Attorney for the New York City Legal Aid Society, Criminal Court and Supreme Court Branches in New York County. In 1974, I moved to Pennsylvania and began working for Legal Services, Incorporated (LSI). LSI was a civil legal aid program serving Adams, Cumberland, Franklin and Fulton Counties. I worked at LSI from 1974-1987 first as a Staff Attorney, then as Managing Attorney, and ultimately became Executive Director. Through a restructuring with other legal services programs, LSI became part of what is now known as MidPenn Legal Services and Franklin County Legal Services.

In 1988, I was hired to be the Executive Director of PULP, a statewide legal services program dedicated to the rights of low-income utility customers. At PULP, I represented low-income individuals with utility and energy concerns, and supported organizations advocating for

1 low income households in utility and energy matters. As the Executive Director of PULP, I
2 consulted and co-counseled on a wide variety of individual utility consumer cases, and I
3 participated in task forces, work groups and advisory panels. For many years, I served as Chairman
4 of the LIHEAP Advisory Council to the Department of Human Services and the Consumer
5 Advisory Council to the Public Utility Commission. Throughout my career, I regularly trained
6 community organizations, legal aid staff, and advocacy groups across Pennsylvania about the
7 various utility and energy matters affecting Pennsylvania's low-income population. I retired from
8 PULP on June 30, 2015. Although no longer employed by PULP, I now serve as a consultant to
9 PULP and its clients. In sum, I have over 50 years' experience working with and providing
10 services to households in poverty, including the past 32 years focusing specifically on utility and
11 energy issues affecting low-income consumers. My resume is attached as Appendix A.

12 **Q. Please describe the focus of your work, including relevant work experience on issues**
13 **of low-income families' ability to afford essential goods and services such as utilities?**

14 A: I have represented low-income individuals and organizations serving low income
15 populations in a wide variety of legal matters, including family law, public benefits,
16 unemployment compensation, utility shut-offs, debtor/creditor, bankruptcy, and housing related
17 disputes. Over the past 32 years, my focus has been ensuring that low-income households can
18 connect to, afford, and maintain utility and energy services.

19 In all of these legal matters, I worked almost exclusively on behalf of individuals and
20 households that subsist on income that is at or below 150% of the Federal Poverty Level (FPL).
21 Through this work, I have become intimately familiar with the daily lives of countless of our
22 poorest citizens. I have spent thousands of hours assisting clients to comb through their budgets
23 to attempt to assist them to make ends meet. Over the years, I have consistently been surprised by

1 the almost complete inability of low-income families to pay the most basic monthly necessities on
2 the incomes they have. Each and every month, my clients faced the stark choice of choosing
3 which bills they could forgo with the least drastic consequences. That struggle is even more
4 profound today than when I retired several years ago, as low income communities face
5 unprecedented economic disparities as a result of the pandemic response.

6 In addition to my deep understanding of the daily monetary struggles facing poor families,
7 I have an extensive knowledge of the array of programs designed to allow low-income individuals
8 to afford electric service and other essential utility services.

9 While at PULP, I was involved in countless proceedings evaluating the effectiveness of
10 required Universal Service Programs to assist low-income families. I have spent thousands of
11 hours identifying program issues in Universal Services and making recommendations for changes
12 to Universal Service programming to better serve low-income consumers. Ultimately, this
13 advocacy led to the recognition that integrated programs for low income consumers were
14 necessary. As the Executive Director of PULP, I played an instrumental role in the development,
15 oversight, and monitoring of the initial pilot programs that have since evolved into the current
16 statutorily required low-income Universal Service Programs. Each of these programs is structured
17 to provide a different and complementary form of assistance to low-income customers, such that
18 those customers have the ability to afford and maintain basic utility service.

19 For example, the Customer Assistance Program (CAP) provides alternatives to traditional
20 collection methods for low income, payment troubled utility customers. The Low Income Usage
21 Reduction Program (“LIURP”) is a targeted weatherization and energy efficiency program
22 designed to assist low-income households with the highest energy consumption, payment
23 problems, and arrearages. These programs work in tandem and are designed to assist low-income

1 households in maintaining affordable utility services and safe living environments while reducing
2 utility collection, thereby benefitting other ratepayers.

3 **Q. For whom are you testifying in this proceeding?**

4 A. I am testifying on behalf of the Coalition for Affordable Utility Services and Energy
5 Efficiency in Pennsylvania (“CAUSE-PA”).

6 **Q. Please state the purpose of your Direct Testimony.**

7 A. The purpose of my testimony is to address issues presented by the Petition of PECO Energy
8 Company (“PECO” or “the Company”) for Approval of its Default Service Programs for the
9 Period of June 1, 2021 through May 31, 2025 (hereinafter “DSP V”), including issues related to
10 PECO’s role in ensuring vulnerable consumers have access to affordable rates.

11 Specifically, I will first provide an overview of PECO’s proposals and the
12 recommendations I intend to make throughout my testimony in section I, below. In section II, I
13 will provide a data-driven assessment of residential shopping as a whole, and the impact of
14 residential shopping on confirmed low income customers and other vulnerable customer groups.
15 In sections III-V, I will then separately address PECO’s Time of Use (TOU) Rate proposal, its
16 proposal to continue its Standard Offer Program without modification, and its proposal to
17 implement of a Customer Assistance Program (CAP) Shopping plan. In section VI, I will also
18 briefly discuss the need for PECO to improve its residential customer bills to allow consumers to
19 easily compare the price they pay to the applicable default service price to compare. Finally, in
20 section VII, I will provide a brief summary of my recommendations.

1 **I. SUMMARY OF PECO’S PROPOSALS**

2 **Q: Please summarize PECO’s DSP V proposal.**

3 A: PECO filed the docketed DSP proceeding in accordance with its responsibilities as a
4 Default Service Provider pursuant to Pennsylvania’s Electricity Generation Customer Choice and
5 Competition Act, 66 Pa. C.S. § 2891 *et seq.* (the “Competition Act”), as amended by Act 129 of
6 2008 (“Act 129”); the Commission’s default service regulations found at 52 Pa. Code §§ 54.181-
7 54.189; and the Commission’s Policy Statement on Default Service at 52 Pa Code §§ 69.1801-
8 1817. Specifically, PECO is obligated to provide electric generation service to all customers
9 within its service territory who do not select a retail electric generation supplier (“EGS”) or who
10 chose to return to default service at the conclusion of a contract for generation service, or when
11 the EGS providing electric generation is unable or unwilling to continue to serve the customer.
12 Through this Petition, PECO seeks to establish the terms and conditions under which it will
13 procure default service supply, provide default service to non-shopping customers, and satisfy the
14 requirements of the Alternative Energy Portfolio Standards Act.

15 For its residential default service customer class, PECO proposes to continue the same
16 procurement strategy from its DSP IV – and will procure approximately 99% of the residential
17 class default service supply through a mix of one- and two-year full requirements products,
18 approximately 38% of which would be one year products and 61% would be two-year products.¹
19 The remaining 1% of the residential default service load will be supplied by a mix of long-term,
20 five-year, fixed-price full requirements products and spot market purchases.²

¹ PECO St. 1 at 17.

² PECO St. 1 at 15-17.

1 PECO is proposing to continue recovering default service costs through its Generation
2 Supply Adjustment (GSA) rates, consistent with its approved rate design in its DSP IV.³ GSA rates
3 “currently recover generation supply costs, Alternative Energy Portfolio Standards (“AEPS”)
4 compliance costs, and ancillary service costs.”⁴ GSA rates also include PECO’s administrative
5 costs associated with administering competitive market enhancement programs.⁵ Residential
6 default service customers are categorized as GSA1 customers.

7 **Q: Is PECO proposing any alternative default service rate structures for residential**
8 **consumers?**

9 A: Yes, PECO is proposing a Time of Use (TOU) rate for residential default service
10 customers.

11 **Q: Please summarize PECO’s TOU Rate Proposal**

12 A: PECO’s proposed residential TOU rate would “differentiate prices across three periods
13 (peak, off peak and super off peak) that remain constant year-round based on price multipliers
14 designed to motivate shifting of usage from the higher-cost peak period to lower-cost off-peak
15 periods.”⁶ The peak period would be Monday through Friday, 2 p.m. to 6 p.m.; super off-peak
16 would be every day from midnight (12 a.m.) to 6 a.m.; and the off-peak period would be during
17 all other hours of the day.⁷ As a ratio to super off peak periods, which would have a multiplier of
18 1, peak periods would have a multiplier of 6.5 and off-peak periods would have a multiplier of
19 1.5.⁸ PECO is proposing to exclude customers enrolled in the Customer Assistance Program, as
20 TOU rates can be harmful to low income consumers that are unable to shift their load during high-

³ PECO St. 1 at 27.
⁴ PECO St. 2 at 4.
⁵ PECO St. 2 at 4-5.
⁶ PECO St. 2 at 14.
⁷ PECO St. 2 at 14.
⁸ PECO St. 2 at 19.

1 cost peak periods. PECO is not proposing to exclude other vulnerable customer groups from this
2 variable rate structure, such as those who are reliant on energy intensive medical equipment or
3 other users that may have difficulty shifting their load during peak periods of time.

4 PECO estimates that the cost to implement the TOU rate will be approximately \$3.8M,
5 which it intends to recover through the administrative cost factor of the GSA.⁹

6 **Q: Does PECO propose any additional programs related to the provision of default
7 service or residential customer shopping?**

8 A: Yes. PECO proposes to continue its current Standard Offer Program (SOP), without
9 modification, and to implement a new Customer Assistance Program (CAP) Shopping Plan.

10 **Q: Please summarize PECO's Standard Offer Program.**

11 A: Under PECO's current SOP, residential customers contacting PECO's customer service
12 center are encouraged to select among a group of EGSs who have voluntarily chosen to offer
13 customers a 12-month contract priced at 7% below PECO's default service rate at the time of the
14 offer.¹⁰ PECO proposes to continue its current recovery for the program, which charges Electric
15 Generation Suppliers (EGSs) a \$30 participant fee, and recovers any remaining costs equally from
16 EGSs through the Purchase of Receivables discount and from residential and small commercial
17 default service customers through the GSA.¹¹

18 **Q: Please summarize PECO's CAP Shopping Plan.**

19 A: PECO's CAP Shopping Plan would permit customers enrolled in CAP to shop for electric
20 supply from a competitive electric generation supplier (EGS). Participating EGSs would be
21 required to charge CAP customers a rate that is at or below PECO's default service price (otherwise

⁹ PECO St. 2 at 24.

¹⁰ PECO St. 3 at 16.

¹¹ PECO St. 1 at 24.

1 known as the price to compare or PTC), and will prohibit suppliers from charging early
2 cancellation or termination fees or other fees unrelated to generation service – though it does not
3 propose to monitor or enforce these restrictions.¹² Implementation of PECO’s CAP Shopping Plan
4 is estimated to be approximately \$1.2M – though PECO provided no estimate of ongoing costs
5 associated with the program.¹³ PECO proposes to recover costs for CAP customer education
6 initiatives associated with the program (approximately \$500,000) from the residential customers
7 through the Consumer Education Charge (approved at docket P-2011-2279773) – and proposes to
8 recover the balance of the program implementation costs (approximately \$700,000) “from
9 residential customers in a subsequent base rate case.”¹⁴

10 **Q: Do you have concerns about PECO’s DSP V proposals?**

11 A: Yes.

12 **Q: Please summarize your concerns.**

13 A: I am concerned that PECO’s DSP V proposals do not provide an appropriate level of
14 consumer protection, and will expose PECO’s residential consumers – especially those with
15 limited economic means – to substantial economic and other hardships.

16 As I will explain in detail below, data revealed through discovery in this proceeding shows
17 a disturbing and prolonged pattern in the competitive market: Residential shopping customers in
18 PECO’s service territory have paid tens of millions of dollars more for electricity each and every
19 month for more than five years...to the tune of over \$733 million dollars in net charges in excess
20 of the default service price over the last five years. Even more disturbing, evidence suggests that
21 the financial harms associated with the competitive market may be concentrated in low income

¹² PECO St. 1 at 25-28; PECO St. 3 at 5-6.

¹³ PECO Exhibit JAB-6.

¹⁴ PECO St. 2 at 25, Exhibit JAB-6.

1 communities and communities of color. As I will explain in great detail below, PECO's DSP
2 program proposals are inadequate to protect consumers from harm, and must be substantially
3 amended or otherwise eliminated from the Plan to address and respond to these troubling trends.

4 **Q: Do you have any recommendations regarding PECO's DSP V proposals?**

5 A: Yes, I have a number of recommendations.

6 First, with regard to PECO's proposed TOU rate, I recommend that PECO implement
7 additional consumer protections to ensure that consumers who do not have the ability to
8 meaningfully shift or reduce their electric load through the day are protected from price spikes.

9 Further, in light of the substantial evidence of financial harm to residential ratepayers in
10 this and other Commission proceedings, I recommend that PECO's SOP be amended to return
11 customers to default service at the conclusion of the SOP contract unless the customer
12 affirmatively elects to remain with their supplier or selects a new supplier.

13 Also, consistent with data showing that low income consumers are particularly vulnerable
14 to excessive pricing and that similar CAP shopping restrictions have failed to curtail significant
15 financial harm, I recommend that PECO's CAP Shopping proposal be rejected in its entirety.
16 Before PECO proposes another CAP shopping proposal, it should be required to conduct a
17 thorough assessment of shopping within its service territory, and should specifically examine the
18 disparate impact in low income and minority communities – as well as the impact of excessive
19 supplier pricing on arrearage forgiveness costs.

20 Finally, to affirmatively respond to and remediate persistent overcharging of residential
21 shopping customers, I recommend that PECO be required to improve its residential customer bills
22 to allow consumers to conduct simple, apples-to-apples cost comparisons between the default
23 service rate and the price that they are currently paying per kWh for competitive service.

1 I will explain each of these recommendations in detail throughout my testimony, and will
2 offer data and information in support thereof.

3 **II. RESIDENTIAL CUSTOMER SHOPPING DATA**

4 **Q: You note above that residential shopping customers have paid hundreds of millions**
5 **of dollars more than the price to compare since 2015. Please explain.**

6 A: Overall, on a net and average basis over the last five years, PECO's residential shopping
7 consumers have paid approximately \$733,197,940 more than they would have paid if they did not
8 shop.¹⁵

9 As further extrapolated in CAUSE-PA Exhibit 1, the lowest monthly average price that
10 residential shopping customers paid for electricity since January 2015 was \$0.0926/kWh in
11 January 2017.¹⁶ In just the first four months of 2020, and straight through the pandemic, PECO's
12 residential shopping customers overpaid for electricity by approximately \$49,652,774.¹⁷

13 **TABLE 1: Residential Shopping – Total Charges Over PTC¹⁸**

2015	\$113,471,564
2016	\$116,054,003
2017	\$134,489,911
2018	\$159,115,583
2019	\$160,414,105
2020 (Jan-Apr)	\$ 49,652,774
Total	\$733,197,940

14
15 These figures demonstrate that the amount that residential shopping customers pay on
16 average in excess of the default service price has increased each year for the last five years,

¹⁵ CAUSE-PA Exhibit 1.

¹⁶ CAUSE-PA Exhibit 1.

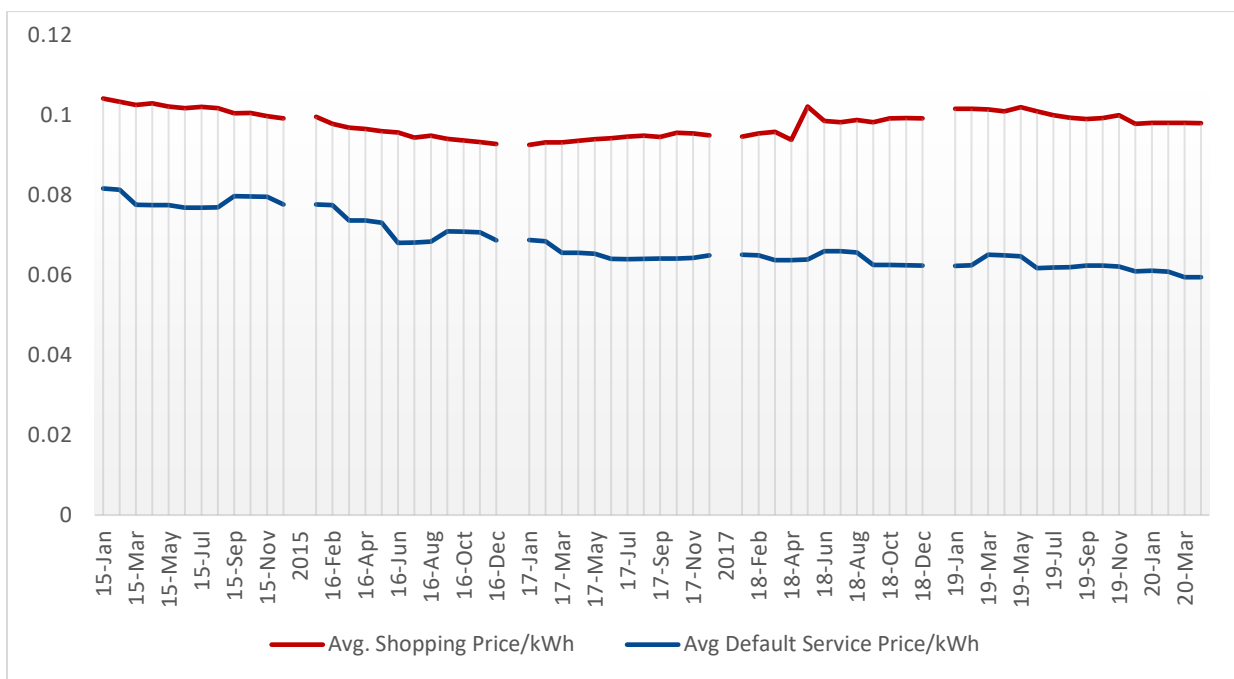
¹⁷ CAUSE-PA Exhibit 1.

¹⁸ CAUSE-PA Exhibit 1.

1 signifying to me that the problem is getting worse – notwithstanding substantial efforts of PECO
2 and the Commission to educate residential customers about how to effectively shop for competitive
3 electric supply.

4 Chart 1, below, shows that average residential shopping has grown increasingly divergent
5 from energy market patterns in the default service price, revealing that pricing for competitive
6 supply is not market based.

7 **CHART 1: Avg. Residential Shopping Rates vs. Avg. Residential Default Service Rates**



8
9 **Q: Could you please explain how you reached the conclusion that residential customers**
10 **overpaid for electricity by roughly \$733M since 2015?**

11 A: PECO has a “bill ready billing” platform, which means that it does not receive information
12 from suppliers about the exact per kWh charge that an individual customer pays for electricity.¹⁹
13 However, it does have information about the overall amounts billed to residential consumers for

¹⁹ TURN to PECO I-17, CAUSE-PA to PECO I-38. See Appendix B for all cited interrogatory responses.

1 generation supply service and the total kWh used by residential consumers. With simple division,
2 subtraction, and multiplication, I was able to approximate the average per kWh rate paid on a
3 monthly basis by both residential shopping and non-shopping customers. I excluded CAP
4 customers from this analysis, as CAP customers are not currently permitted to shop for competitive
5 supply.

6 Importantly, PECO was clear in response to discovery that it “does not allow any
7 unregulated non-basic energy products or services to be placed on a customer’s utility bill.”²⁰ This
8 means that – unless a supplier is violating PECO’s billing rules – the total billed charges for electric
9 generation supply in a given month can simply be divided by the total energy consumed by
10 shopping customers in that same month to arrive at the average monthly price per kWh paid by
11 shopping customers.

12 Once I arrived at the average kWh price paid by shopping and non-shopping customers, I
13 was able to determine the difference between the average price paid by non-shopping customers
14 from the average price paid by shopping customers to arrive at the monthly difference in average
15 rates. This is the amount per kWh that residential shopping customers paid in excess of the price
16 that non-shopping residential customers paid in any given month. From there, I multiplied that
17 excess price by the kWh consumed by those customers in a given month to arrive at the total
18 monthly dollar amount charged to residential shopping customers in excess of the default service
19 price.

20 **Q: Exhibit 1 appears to have very minor variations between the average \$/kWh for non-**
21 **shopping customers and the applicable price to compare for that month. What accounts for**
22 **these variations?**

²⁰ CAUSE-PA to PECO I-14.

1 A: These slight variations are likely due to the fact that the data PECO produced in response
2 to discovery rounded up or down to the whole dollar.

3 **Q: Do these variations have a significant impact on your analysis?**

4 A: No. At most, the variations in any given month were between \$0.0001 and \$0.0007 – and
5 occurred on both sides. Rounding on both sides to a thousandth of a cent on either side (up and
6 down) would not measurably impact this analysis.

7 **Q: Is there any additional data to support your conclusion that residential shopping**
8 **customers have overpaid for electricity by hundreds of millions of dollars over a five year**
9 **period?**

10 A: Yes. In response to discovery, PECO provided a similar comparison, and calculated what
11 shopping customers would have paid for default service in each month over the last five years.²¹
12 PECO's data comparison reveals the same patterns of overpayment in the residential market as the
13 analysis I provided above. Consistently, in each and every month since at least January 2015,
14 residential customers paid over \$10M more than they would have paid if they remained on default
15 service.²² The same patterns of overpayment are notably also present for the small and large
16 commercial and industrial classes, though to a lesser degree. From January 2015 to April 2020,
17 small commercial and industrial shopping customers had average net savings in just 7 of 64
18 months, and large commercial and industrial shopping customers had average net savings in just
19 8 of 64 months. In every other month, PECO's large and small commercial and industrial
20 customers also paid more than they would have paid for default service.

21 In the face of data like this, it is undeniable that the cost savings anticipated by the
22 Competition Act have not been achieved and that residential customers, as a class, have not fared

²¹ CAUSE-PA to PECO I-13(a) (Attachment).

²² Id.

1 well. Fortunately, to date, these negative outcomes have not been exacerbated by the additional
2 financial burden inherent in CAP customer shopping for both CAP customers and other residential
3 ratepayers. However, as I will explain in detail in section V of my testimony, PECO’s proposal to
4 initiate CAP shopping would eliminate this current protection and increase the burden on both
5 CAP customers and other ratepayers.

6 **Q: Is there evidence that consumers do not trust the market?**

7 A: Yes. I am advised by counsel for CAUSE-PA that, through the course of a lengthy public
8 input hearing, several members of the public – including several elected officials – noted their lack
9 of confidence in the market. For example, Philip Dague, the Mayor of Downingtown
10 Pennsylvania, testified that he wanted to purchase 100% solar energy, and was well aware that he
11 could do so through the competitive market, but was hesitant to enter the competitive supplier
12 because of teaser rates. I understand from counsel that a number of testifiers rejected the idea that
13 they turn to the competitive market to purchase renewable energy, notwithstanding their
14 knowledge of the competitive market and desire to access clean and renewable energy sources.
15 This is not a surprise to me. Over the course of my career, and since competitive shopping began
16 in Pennsylvania, I have represented hundreds of clients who were similarly disillusioned with the
17 market after finding they had paid significantly more than they otherwise would have had to pay.

18 **Q: You noted in the outset of your testimony that low income customers are disparately**
19 **impacted by the financial harm associated with high supplier pricing. Please explain.**

20 A: It is important to first note that there are some data constraints that limit the full analysis
21 of low income customer shopping. Namely, PECO is only able to report specific low income
22 customer data for “confirmed low income customers,” which PECO defines as “a customer with
23 verified household income between 0% and 150% of the Federal Poverty Level in the two-year

1 period prior to the month being analyzed.”²³ Because PECO only includes those who have verified
 2 their income within the last two years, a significant percentage of PECO’s low income customers
 3 are not accounted for when using this metric.²⁴ On the other hand, PECO’s estimated low income
 4 customer count is based on local census data, adjusted proportionally to the number of PECO’s
 5 residential customers. This figure is more representative of the level of poverty in PECO’s service
 6 territory.

7 **TABLE 2: Confirmed Low Income vs. Estimated Low Income Customers**

Year	Confirmed Low Income ²⁵	Estimated Low Income ²⁶
2016	211,114	381,799
2017	174,653	386,185
2018	142,251	389,621
2019	119,654	not available
2020 ²⁷	111,857	not available

8
 9 Despite these limitations, the confirmed low income customer group is generally representative of
 10 the overall low income customer group and provides a helpful metric to assess the impact of
 11 various policy and program changes– even if it only represents a small percentage of the overall
 12 low income customer group.

13 **Since 2015, confirmed low income customers in PECO’s service territory have paid a**
 14 **net average of nearly \$10M more than they otherwise would have paid if they remained on**
 15 **default service.** Table 2, excerpted from data in CAUSE-PA Exhibit 2, shows the annual average
 16 over-payment for confirmed low income shopping customers. Again, this is not a full snap-shot

²³ CAUSE-PA to PECO I-11.

²⁴ PECO’s confirmed low income customer count has declined significantly since 2016 as a result of changes to its CAP design. This is not due to a decline in poverty rates in PECO’s service territory.

²⁵ CAUSE-PA to PECO I-12(a) (Attachment).

²⁶ See Pa. PUC, BCS, 2018 Report on Universal Service Programs and Collections Performance, at 7 (Dec. 2019), available at http://www.puc.state.pa.us/General/publications_reports/pdf/EDC_NGDC_UniServ_Rpt2014.pdf.

²⁷ January – April 2020

1 of low income shopping, as it only shows those with verified income information on file with
 2 PECO within two years prior to the period of time being analyzed.

3 **TABLE 3: Confirmed Low Income Shopping – Total Charges Over Default²⁸**

2015	\$1,926,060.08
2016	\$1,741,923.20
2017	\$1,610,591.22
2018	\$1,953,437.89
2019	\$2,119,617.86
2020 (Jan-Apr)	\$ 534,596.68
Total	\$9,886,226.93

4
 5 In developing CAUSE-PA Exhibit 2, I used the same analysis that I used for determining the
 6 amount of over-payments by all residential shopping customers (explained above), though the
 7 analysis was performed on an annual instead of a monthly basis.²⁹

8 On a per customer basis, confirmed low income shopping customers paid well over \$100
 9 more each year for competitive electric supply. As Table 4 shows, and with the exception of this
 10 partial year, the average net amount that confirmed low income shopping customers paid over the
 11 default service price has increased from \$9.37/month in 2015 to \$16.04/month in 2019.

12 **TABLE 4: Confirmed Low Income Shopping – Per-Customer Annual Charges Over Default**

Year	Avg. Annual \$ Over Default – Confirmed Low Income	Average Monthly \$ Over Default – Confirmed Low Income
2015	\$112.39	\$9.37
2016	\$116.31	\$9.69
2017	\$118.61	\$9.88
2018	\$160.20	\$13.35
2019	\$192.43	\$16.04
2020 (Jan-Apr)	\$ 106.51	\$8.88

²⁸ CAUSE-PA Exhibit 2.

²⁹ PECO estimated that it would have taken over 30 hours of time for its team to produce confirmed low income shopping data on a monthly basis. Thus, to conserve resources and litigation expenses borne by ratepayers, CAUSE-PA agreed to accept annual as opposed to monthly data.

1 As I will explain more thoroughly below, in section V of my testimony, low income households
2 already struggle to make ends meet – often foregoing basic life necessities to afford energy services
3 to their home. An increase in basic utility costs, such as those faced by confirmed low income
4 shopping customers, exacerbates unaffordability, increases uncollectible expenses, and results in
5 significant impacts to the health and safety of low income consumers.

6 **Q: You also noted at the outset of your testimony that there is evidence of racial**
7 **disparities in the competitive market. Please explain.**

8 A: While time in this proceeding is compressed, and did not leave adequate time for in-depth
9 data collection and analysis, the evidence I have reviewed thus far indicates a troubling pattern in
10 competitive market participation in predominately low income and Black and Latinx communities.
11 As CAUSE-PA Exhibit 2 illustrates, the zip codes in PECO’s service territory with the greatest
12 level of non-CAP low income shopping participants also have the highest concentrations of
13 poverty, and the highest number of Black and Latinx members. More data is necessary to conduct
14 a complete review; however, based on this preliminary data – coupled with information from other
15 states and the data discussed above regarding excessive pricing for residential shopping customers
16 – indicates to me that there may be racial equity issues in the competitive electric market.

17 **Q: What information are you referring to from other states?**

18 A: A number of states have initiated investigations into their local competitive markets and
19 found not only that residential customers pay more for third party service, but that low income and
20 minority communities are the hardest hit.³⁰ These reports have led to the call for the prohibition of

³⁰ See 2018 MA AGO Report at 2, 39; see also La Risa Lynch, Alternative energy scams hit poor blacks and Latinos the hardest, complaints show, The Chicago Reporter, Nov. 16, 2018. see also Laurel Peltier & Arjun Makhijani, Ph.D., Abell Foundation, Maryland’s Dysfunctional Residential Third-Party Energy Supply Market: An Assessment of Costs and Policies (Dec. 2018) (hereinafter “Abell Report”), available at: <https://www.abell.org/publications/marylands-dysfunctional-residential-third-party-energy-supply-market>.

1 third party residential supply contracts in some states and full scale overhaul of the market in
2 others.³¹

3 In Massachusetts, the state Attorney General’s office initiated an investigation into the
4 competitive market after receiving numerous complaints about door-to-door and telemarketing
5 activities by competitive suppliers.³² The report found that residential customers of competitive
6 suppliers actually paid \$253 million more than they would have for default service over a three
7 year period.³³ The state Attorney General’s report found the harm to low income households to be
8 “overwhelming” and “alarming,” with low income households participating at double the rate of
9 all other households while being charged higher rates.³⁴ The report stated:

10 *Specifically, a community’s percentage of minority households; African American*
11 *households; Hispanic households; households with limited English proficiency;*
12 *and low-income households correlates with higher rates of participation in the*
13 *individual residential market for electric supply.*³⁵

14 The report further noted: “Not only are participation rates significantly higher in communities with
15 five of the six demographic attributes...analyzed, but also the premiums that residents in these
16 communities pay as a result of choosing competitive suppliers is greater than in other areas of
17 Massachusetts.”³⁶ Based on the results of this investigation, the Attorney General has called for a
18 ban on suppliers contracting directly with residential customers and an end to the individual
19 residential electric supply market.³⁷

³¹ See 2018 MA AGO Report at 2, 39; see also Abell Report at 21-23.

³² 2018 MA AGO Report at 2, 39.

³³ MA Attorney General, Are Consumers Benefiting from Competition? An Analysis of the Individual Residential Electric Supply Market in Massachusetts, August 2019 Update, at vii, 6 (hereinafter “MA 2019 Update”) available at: https://www.mass.gov/files/documents/2019/07/31/Massachusetts%202019%20Update_August%202019.pdf

³⁴ 2018 MA AGO Report, at 38 (101,922 low income households payed \$23.6 million more than they would have paid for default service. “The average low-income household on competitive supply lost \$231 over the course of the year. Some households lost more than \$541”).

³⁵ 2018 MA AGO Report at 27 (emphasis added).

³⁶ 2018 MA AGO Report at 27.

³⁷ 2018 MA AGO Report at 40-42; see also MA HD 1204/SD 880 - An Act Relative to Protecting Residential Electric Customers.

1 In Illinois, consumers in zip codes with a majority of Black residents made three times as
2 many competition related complaints to the Public Utility Commission than majority white zip
3 codes per household.³⁸ In these zip codes, nearly 90 percent of third party supplier customers
4 overpaid for electricity, adding up to more than \$138 million more from June 2017 through May
5 2018.³⁹ These findings led to a new law providing increased consumer protections.⁴⁰ This
6 legislation specifically limits the enrollment of any consumer who has received assistance from
7 Low Income Home Energy Assistance Program (LIHEAP) or the state’s Percentage of Income
8 Payment Plan (Illinois’s Customer Assistance Program).⁴¹

9 In New York, similar problems led the Public Services Commission (PSC) to ban the sale
10 of competitive energy products to New York’s Customer Assistance Plan participants.⁴² Continued
11 problems later led the PSC to order a comprehensive restructuring of the state’s competitive supply
12 market after finding that customers of competitive suppliers (referred to in New York as Energy
13 Service Companies – or ESCOs) paid \$1.2 billion more than they would have paid for default
14 service over a three year period.⁴³ The PSC observed that, “[I]t appears that a material level of

³⁸ See La Risa Lynch, Alternative energy scams hit poor blacks and Latinos the hardest, complaints show, The Chicago Reporter, Nov. 16, 2018, (investigating consumer complaints before the Illinois Public Utility Commission, and finding: “Majority Black ZIP codes have twice as many complaints per household as Latino ZIP codes and three times the rate of white ZIP codes”).

³⁹ See Illinois OAG, Attorney General Madigan Secures \$2.65 Million in Refunds for Illinois Residents Defrauded by Sperian Energy, Oct. 15, 2018, available at http://www.illinoisattorneygeneral.gov/pressroom/2018_10/20181015.html; see also Annual Report to the General Assembly, the Governor, and the Illinois Commerce Commission, Submitted pursuant to Section 20-110 of the Illinois Public Utilities Act, Office of Retail Market Development, Illinois Commerce Commission, June 2018 (hereinafter “Illinois 2018 Annual Report”), available at: <https://www.icc.illinois.gov/reports/report.aspx?rt=22>.

⁴⁰ See Illinois Home Energy Affordability and Transparency (HEAT) Act, SB 651 of 2019.

⁴¹ See Ill. HEAT Act Sec. 16-115E(a) (exceptions provided for community aggregation and guaranteed savings programs).

⁴² State of New York Public Service Commission, Order Adopting a Prohibition on Service to Low-Income Customers by Energy Service Companies, Case Nos. 98-M-1343, 06-M-0647, 98-M-0667, (Dec. 16, 2016) (hereinafter “NY Low Income Order”).

⁴³ State of New York Public Service Commission, Order Adopting Changes to the Retail Access Energy Market and Establishing Further Process, Case Nos. 15-M-0127, 12-M-0476, 98-M-1343, at 8 (Dec. 12, 2019) (hereinafter “NY ESCO Order”).

1 misleading marketing practices continues to plague the retail access market,” and that customers
2 pay more for products with no added benefit.⁴⁴ The PSC took decisive steps to overhaul its
3 competitive market in an effort to bar suppliers from overcharging residential consumers and small
4 commercial entities, including strengthening supplier eligibility requirements, prohibiting ESCOs
5 from marketing products and services that are unrelated to commodity service, and improving
6 customer access to transparent product information.⁴⁵

7 Similar concerns have arisen in other states. Over approximately three years in Maryland,
8 residential consumers paid \$255 million more to competitive energy suppliers than they otherwise
9 would have paid for default service and, again, low income households were impacted most
10 profoundly by the increased costs.⁴⁶ In Connecticut, residential customers of retail electric
11 suppliers overpaid by \$38.2 million from September 2017 through August 2018.⁴⁷ In Rhode
12 Island, competitive supply customers paid \$55 million more over five years than they would have
13 paid if they had been on Standard Offer, \$28 million of which was paid by residential customers.⁴⁸
14 This data demonstrates a clear pattern. Suppliers overcharge residential consumers, and low
15 income and minority customers are disproportionately overcharged. Considering the above cited
16 data in this proceeding, it seems PECO’s service territory is no exception.

⁴⁴ Id. at 88-89.

⁴⁵ See Id.

⁴⁶ Abell Report at 2, 10; see also Susan M. Baldwin and Sarah M. Bosley, obo Maryland Office of People’s Counsel, Maryland’s Residential Electric and Gas Supply Markets: Where Do We Go from Here? (Nov. 2018) at vi, (hereinafter “OPC Report”)(Residential consumers pay \$54.9 million more annually for electricity and gas than if they had purchased energy from their utilities.)

⁴⁷ “OCC Fact Sheet: Electric Supplier Market, September 2017 through August 2018,” Office of Consumer Counsel, updated on September 26, 2018, available at:

https://www.ct.gov/occ/lib/occ/fact_sheet_electric_supplier_market_august_2018.pdf

⁴⁸ “DPUC Enacts New Rules for Competitive Electricity Suppliers Initiates Review of Competitive Supply Marketplace,” Rhode Island Division of Public Utilities & Carriers, Press Release, May 8, 2018 (hereinafter “RI DPUC Press Release”); see also OPC Report at 35; see also Susan Campbell, Switching to a competitive power supplier could cost you, data shows, WPRI 12 Providence, Aug 8, 2018, available at:

<https://www.wpri.com/news/switching-to-a-competitive-power-supplier-could-cost-you-data-shows/>.

1 **III. TIME OF USE RATE PROPOSAL**

2 **Q: Why is PECO proposing a residential TOU rate?**

3 A: PECO explains that its TOU rate proposal stems from recent litigation regarding the scope
4 of an EDC’s obligation to offer TOU rates to default service customers pursuant to Act 129.⁴⁹ In
5 designing its TOU rate proposal, PECO noted that its objectives were to comply with the Orders
6 that resulted from that litigation, as well as to (1) offer simplicity and “value proposition” for
7 customer enrollment; (2) promote retail-to-wholesale market connection; and (3) to incentivize
8 electric vehicle adoption.⁵⁰

9 **Q: Does PECO propose any customer protections as part of its proposal?**

10 A: Yes. In its TOU rate proposal, PECO indicates that it intends to exclude customers enrolled
11 in its Customer Assistance Program (CAP) from participating in the TOU Rate.

12 **Q: Why is PECO proposing to exclude CAP customers from the TOU rate?**

13 A: PECO notes in its testimony that time varying rates such as the proposed TOU rate may
14 adversely impact CAP customer benefits, as “CAP customers may not have the flexibility to shift
15 usage outside of the higher-priced peak period.”⁵¹ Citing to a pending CAP rulemaking, PECO
16 also explains that “a CAP customer’s evaluation of whether CAP benefits outweigh the potential
17 bill savings under a TOU rate is dependent on PECO’s current CAP design, which may change
18 during the DSP V term.”⁵² Importantly, as I will explain in greater detail below with regard to
19 PECO’s CAP Shopping proposal, PECO’s CAP design not only *may* change as a result of the

⁴⁹ PECO St. 2 at 12.

⁵⁰ PECO St. 2 at 13.

⁵¹ PECO St. 2 at 15.

⁵² PECO St. 2 at 15-16.

1 Commission’s recently amended CAP policy statement⁵³ and the forthcoming CAP rulemaking,⁵⁴
2 but PECO is now currently working to make changes to its CAP to address widespread
3 unaffordability in its current Fixed Credit Option (FCO) CAP Program design.⁵⁵ PECO intends
4 to file a Petition by June 30, 2020 “to re-design its Customer Assistance Program to calculate
5 benefits based on a customer’s Percentage of Income as opposed to its current Fixed Credit Option
6 program design.”⁵⁶

7 In response to discovery, PECO further elaborated on the potential impact of TOU rates on
8 CAP benefits for economically vulnerable households:

9 The CAP credit is calculated based on the customer’s actual undiscounted bills over the
10 previous twelve months. If CAP customers were eligible to select a TOU rate and did so
11 for the first time, their previous twelve months of bills would not reflect pricing under TOU
12 rates. This could adversely impact the benefits received by a customer under the CAP
13 program if the customer’s usage patterns on the TOU result in higher bills than the previous
14 twelve months on a non-TOU rate.⁵⁷

15 PECO also explained the potential impact of TOU rates on all residential consumers, who pay for
16 the cost of CAP through rates:

17 Assuming PECO’s proposed TOU rate option was available to CAP customers, the usage
18 patterns of those customers might change the cost burden on all residential customers. If
19 participating CAP customers principally use energy within the TOU on-peak period hours,
20 their default service charges and CAP credits may increase, thereby increasing the cost
21 burden on residential customers who pay for CAP.⁵⁸

22 **Q: Do you agree with PECO’s decision to exclude CAP customers from its proposed**
23 **TOU rate?**

⁵³ 2019 Amendments to Policy Statement on Customer Assistance Program, 52 Pa. Code § 69.261-69.267, Final Policy Statement and Order, Docket No. M-2019-3012599 (order entered Nov. 5, 2019).

⁵⁴ Universal Service Rulemaking, Order, Docket No. L-2019-3012600 (order entered Jan. 2, 2020).

⁵⁵ CAUSE-PA to PECO II-4.

⁵⁶ Id.

⁵⁷ OCA to PECO II-19.

⁵⁸ OCA to PECO II-20.

1 A: Yes. I agree with PECO’s conclusion that TOU rates are not compatible with PECO’s
2 FCO CAP design, and note that TOU rates are not generally compatible with any CAP design. The
3 purpose of CAP is to provide low income households with an affordable bill based on the
4 participant’s household income. When the cost of service for a CAP customer increases above the
5 PTC, as is distinctly possible for customers who subscribe to PECO’s proposed TOU rates, there
6 are three possible outcomes: (1) the CAP customer will be charged an unaffordable bill, and may
7 exceed the maximum annual CAP benefits prematurely; (2) residential consumers who finance
8 CAP through rates pay more for the program; or (3) the increased cost will be shared by both CAP
9 participants and residential consumers.

10 In short, if a CAP customer is unable to shift their usage during peak hours, they will be
11 faced with substantial levels of unaffordability, while residential consumers who pay for the
12 program will face increased costs. Both of these potential outcomes would cause harm and
13 undermine the explicit affordability goals that are intrinsic to CAP.

14 PECO’s assessment regarding the inability of low income households to reasonably shift
15 usage during off peak hours is also correct.⁵⁹ Economically vulnerable households often have very
16 little discretionary energy usage, such as washing machines, dish washers, and other large
17 appliances, and are more likely to live in smaller homes with less efficient heating and cooling
18 spaces – all factors which make it difficult to shift load during peak periods. Consumers who are
19 home during the day or are reliant on electric-powered medical devices are at even greater risk, as
20 usage curtailment during peak hours can have an immediate and substantial impact on health

⁵⁹ See John T. Colgan et al., Guidance for Utilities Commissions on Time of Use Rates: A Shared Perspective from Consumer and Clean Energy Advocates, at 26-27, Equity and Distributional Bill Impacts (July 15, 2017), <https://uspirg.org/sites/pirg/files/reports/TOU-Paper-7.17.17.pdf>; see also TURN to PECO I-12(a) (Attachment), Lee V. White & Nicole Sintov, Health and Financial Impacts of Demand-Side Response Measures Differ Across Sociodemographic Groups, *Nature & Energy* Vol. 5 (Jan. 2020).

1 outcomes.⁶⁰ This includes seniors, individuals with disabilities, and families with young children
2 – all of whom are generally more likely to be low income or income constrained. For these
3 households, usage patterns are often fixed or otherwise inflexible. Indeed, a household cannot
4 shift their laundry routine to the late evening hours if they do not have a washer or dryer in their
5 home...nor can they turn off their air conditioner during the hottest hours of the day if they are
6 home during those hours. Imposing time-varying pricing on consumers with fixed or inflexible
7 usage patterns could disproportionately increase the cost of energy for Pennsylvania’s most
8 vulnerable consumers, and therefore is an inappropriate rate structure for CAP customers.

9 **Q: In summarizing your testimony above, you recommended that PECO implement**
10 **additional consumer protections in its TOU rate proposal. Please explain.**

11 A: PECO’s proposal to protect CAP customers from rate variability does not go far enough
12 to protect vulnerable consumers, including the low income PECO customers not in CAP, who do
13 not have the ability to meaningfully shift or reduce their electric load through the day. As I just
14 explained, time varying rates expose all economically vulnerable households to increased risks of
15 significant financial harm and negative health impacts. A recent study of time varying rates across
16 sociodemographic groups, published in January 2020, found that “assignment to TOU [rates] ...
17 disproportionately increases bills for households with elderly and disabled occupants, and *predicts*
18 *worse health outcomes for households with disabled or ethnic minority occupants than those for*
19 *non-vulnerable counterparts.*”⁶¹ The researchers explained that this health nexus with TOU rates

⁶⁰ See id.

⁶¹ TURN to PECO I-12(a) (Attachment), Lee V. White & Nicole Sintov, Health and Financial Impacts of Demand-Side Response Measures Differ Across Sociodemographic Groups, Nature & Energy Vol. 5 (Jan. 2020) (emphasis added).

1 may be attributable to service deprivation during peak periods – particularly amongst Hispanic
2 customers and customers with a disability.⁶²

3 While research tells us that TOU rates are likely to be more expensive for low income and
4 other vulnerable households, these same households may be more likely to seek out alternative
5 rate designs in hopes of reducing their monthly bills to an affordable rate. But, just as PECO has
6 recognized inflexible usage as a distinct TOU issue for CAP households, most non-CAP low
7 income households have the same inflexibility of usage. Thus, TOU rates may offer false hope to
8 these financially struggling households. By the time a TOU participant receives their first bill,
9 they will be half-way into their second month of TOU rates – unable to undo potentially substantial
10 impacts on their monthly bill – and disrupting the households’ already precarious financial footing.

11 Given these unique financial and health-related impacts of time varying rates on vulnerable
12 low income populations and communities of color, I recommend that PECO implement additional
13 protections for all confirmed low income customers – as well as those with known medical usage.
14 These households should first receive targeted and personalized outreach about available universal
15 service programs – including CAP, hardship fund grants, and energy efficiency and usage
16 reduction programs – to help resolve affordability concerns. If the household still wishes to enroll
17 in the TOU rate, instead of enrolling in CAP or other assistance program, they should receive an
18 individualized bill impact assessment based on their actual usage patterns over the prior year so
19 that they can determine, with specificity, what the bill impact will be if they decide to knowingly
20 and voluntarily opt in to a TOU rate.

21 In addition to this additional protection, PECO should be required to closely track
22 participant income, as well as other critical metrics – including the participant’s age, race or

⁶² Id.

1 ethnicity, and disability status. Tracking these additional program metrics will help to holistically
2 assess PECO’s TOU rates to determine whether there are disparities in the impact of TOU rates
3 on participants. PECO should be required to engage a third party evaluator to assess PECO’s TOU
4 rates to determine whether and to what extent the rates have impacted these vulnerable customer
5 groups.

6 **Q: Have you reviewed the Final Report of PECO’s TOU (“Smart Time”) Pilot Program?**

7 A: Yes.

8 **Q: Did the report include any conclusions regarding participation of low income**
9 **households, seniors, and individuals with a disability?**

10 A: Yes. The report found that low income households, seniors, and individuals with a
11 disability who participated in PECO’s TOU pilot program achieved both bill savings and peak
12 load reductions.⁶³

13 **Q: Did you account for this finding in your recommendation?**

14 A: Yes. This is why I do not recommend the wholesale exclusion of confirmed low income
15 customers and other vulnerable consumers from the rate option.

16 While indicating encouraging results, PECO’s pilot was very controlled, with enhanced
17 communications and a bill protection feature that guaranteed rate protection for participating
18 consumers.⁶⁴ Moreover, it is not at all clear whether the bill savings achieved by these households
19 was attributable to deprivation during peak periods – as opposed to conservation. As the study I
20 referenced earlier found, many vulnerable consumers suffered negative health impacts as they
21 attempted to curtail usage during peak periods. Because of the probability of a tension between
22 health and potential savings, I am recommending that PECO adopt reasonably measured

⁶³ OCA to PECO II-18(b) (Attachment).

⁶⁴ PECO St. 2 at 11.

1 safeguards to ensure that any TOU household enters the program knowingly – and with full
2 appreciation of the individualized impact of TOU rates on their monthly bill.

3 My recommendations to provide low income and other vulnerable consumers with
4 enhanced outreach and individualized referrals before accepting them into the TOU rate provides
5 critical screening and rate assessment tools which will help to ensure that vulnerable households
6 are matched with the most appropriate bill assistance programs – and are not forced to otherwise
7 choose between affordable access to energy and their physical health and wellbeing.

8 **IV. STANDARD OFFER PROGRAM**

9 **Q: At the outset of your testimony, you explained that PECO is proposing to continue its**
10 **current Standard Offer Program (SOP) without modification. What was the basis for**
11 **PECO’s decision to continue its SOP without any changes?**

12 A: In support of its decision to continue its SOP, PECO notes that 26,000 residential customers
13 have participated in the program, and explains that in approving PECO’s current SOP, the
14 Commission noted that the program was “beneficial” to all customers.⁶⁵

15 **Q: Do you agree that PECO’s program is “beneficial” to all customers?**

16 A: There is insufficient data to make such a determination. Ostensibly, a 7% discount off the
17 price to compare for a 12 month period is beneficial to residential ratepayers. However, the SOP
18 does not appear to actively teach residential consumers how to engage in the competitive market,
19 and how to assess the merit of offers. Essentially, the program simply funnels new and moving
20 customers into the competitive market without providing the proper supports for the customer to
21 learn about and engage in the market to determine whether shopping is right for them. This is a
22 serious deficiency that very well may be doing more harm than good over time.

⁶⁵ PECO St. 3 at 16-17.

1 At the conclusion of the 12-month SOP contract period, it is unclear from available data
2 whether residential consumers are actively engaging in the competitive market, though – based on
3 decades of experience working directly with consumers – I believe it is most likely that households
4 do not actively engage with the competitive market at the end of the SOP contract, and are therefore
5 at a higher risk of being rolled into a high cost, variable rate contract. This conclusion is consistent
6 with the above data showing that, notwithstanding the fact that 26,000 residential consumers
7 received an initial 7% discount off the price to compare for a full year, residential customers have
8 paid suppliers more than \$773M more for competitive electric supply than they would have paid
9 if they remained on default service.

10 **Q: In support of its proposal to continue its Standard Offer Program (SOP), did PECO**
11 **conduct any analysis of the price that customers participating in the program pay for electric**
12 **supply either during or after the initial 12 month program period?**

13 A: No.⁶⁶

14 **Q: Did PECO examine the frequency with which consumers return to default service**
15 **after the initial 12 month program period?**

16 A: No.⁶⁷

17 **Q: Has PECO conducted any survey or assessment of customer satisfaction with the**
18 **SOP?**

19 A: No.⁶⁸

⁶⁶ OCA to PECO I-5.

⁶⁷ OCA to PECO I-8.

⁶⁸ OCA to PECO I-10.

1 **Q: Are you aware of any other utility that has performed an analysis of its SOP?**

2 A: Yes. PPL Electric conducted an in-depth review of its customers who participated in the
3 SOP from 2015 through 2019 – and examined those customers’ shopping decisions for four
4 months after the end of their SOP contract.⁶⁹ In its study, PPL concluded that the vast majority of
5 its residential SOP customers – roughly 72% – did not make any affirmative decision at the
6 expiration of their contract, and instead rolled onto a new contract.⁷⁰ PPL conducted an assessment
7 of the rates that these residential customers paid after the conclusion of the SOP, and found that
8 93% of residential customers who took no affirmative action to select a new supplier or return to
9 default service paid more than the PTC in the first month.⁷¹ That number rose to 94% within 4
10 months after their SOP contract ended, 89% of which were paying 10% or more over the applicable
11 PTC.⁷² Just 6% of these customers were paying at or below the PTC.⁷³

12 **Q: Is it reasonable to conclude that PECO’s residential SOP customers are likely to**
13 **follow the same patterns?**

14 A: Yes. While PECO and PPL serve different geographic regions, the behavior of residential
15 consumers in this context are generally consistent – and do not vary by geographic region. PECO
16 and PPL both use third parties to administer their SOP – and both have similar scripting and
17 program terms.

⁶⁹ Petition of PPL Electric Utilities Corporation for Approval of a Default Service Program and Procurement Plan for the Period June 1, 2021 through May 31, 2025, Direct Testimony of Michelle LaWall-Schmidt, Docket No. 2020-3019356, at 8-12 (filed March 25, 2020).

⁷⁰ Id. at 9.

⁷¹ Id. at 11-12.

⁷² Id. at 12.

⁷³ Id.

1 **Q: Do you have any recommendations for improvements to PECO's SOP?**

2 A: Yes. Based on the evidence of overpayment by residential consumers, both in this
3 proceeding and in other Commission proceedings, I recommend that PECO amend its SOP to
4 return customers to default service if they do not make an affirmative decision to stay with their
5 current supplier or select a new competitive supplier at the end of the 12 month SOP contract.
6 PECO should be required to conduct outreach to SOP customers about their shopping decision
7 throughout the 12-month SOP contract, especially in the month leading up to the expiration of the
8 SOP contract, to educate them about their options and to provide information about how to
9 compare and select an offer that is right for them. As I noted above, education about the
10 competitive market is a critical missing piece to PECO's SOP. Adoption of my recommendations
11 would ensure that the SOP is actively teaching consumers about how to engage with the
12 competitive market at the outset of the SOP process and at its conclusion – rather than serving as
13 a mere funnel to the market.

14 **Q: Does your recommendation serve any other important competitive market purposes?**

15 A: Yes. Actively educating consumers about how to effectively engage in the competitive
16 market while ensuring reasonable protections from excessive pricing will help encourage
17 consumer confidence in the market and will promote a healthy and vibrant market that requires
18 suppliers to actively compete for market share. Unfortunately, the competitive market has been
19 subject to repeated abuses that have caused consumers to lose confidence in the market.⁷⁴ We can

⁷⁴ Over the last 8 years, marketers have continually violated state and federal law and the Commission's regulations. Issues with deceptive marketing and unauthorized switching (slamming) arose almost immediately after the price caps were lifted, and have not subsided. PUC v. Public Power, M-2012-2257858; PUC v. MX Energy, M-2012-2201861; IDT Energy, M-2013-2314312; PUC v. APG&E, M-2013-2311811; PUC v. Pa G&E, M-2013-2325122; PUC v. ResCom Energy, M-2013-2320112; see also Pa. PUC, 2018 Utility Consumer Activities Report and Evaluation (UCARE), at 9 (Dec. 2019). The significant financial impact of these deceptive, high-pressure marketing tactics on consumers became undeniably apparent when dramatic price spikes during the 2014 polar vortex led to a series of formal Commission enforcement actions against suppliers. See PUC v. Respond Power, C-2014-2427659, C-2014-2438640; PUC v. IDT Energy, C-2014-2427657; PUC v. Hiko Energy, C-2014-2427652, C-2014-2431410;

1 see that reflected in the market participation rates, which have plateaued over the last several
2 years.⁷⁵

3 As is, the SOP serves up a ready pipeline of residential consumers that are lulled into
4 passive acceptance of higher rates at the program's conclusion. This model is not promoting a
5 healthy marketplace, and must be amended to better serve the needs of consumers and the
6 marketplace.

7 V. CAP SHOPPING PLAN

8 **Q: Please briefly describe the demographics of PECO's low-income population.**

9 A: PECO has a substantial low-income population. As I explained above, PECO tracks its
10 low income population using both a confirmed low income and estimated low income customer
11 count. Confirmed low income customers include all those whose income has been verified to be
12 at or below 150% of the federal poverty level within the last two years. PECO also has a significant
13 number of customers actively enrolled in CAP. These customers have already demonstrated an
14 inability to afford their electric service without assistance.

15 Table 4 provides a quick glance at the metrics for PECO's low income customer population
16 in 2018, the most recent year for which this data was publicly reported by the Commission.

PUC v. Blue Pilot Energy, C-2014-2427655; PUC v. Energy Service Providers D/B/A PA G & E, C-2014-2427656; PUC v. Clearview Electric, C-2016-2543592; PUC v. Plymouth Rock Energy, C-2016-2579276. Since then, despite further, repeated, and increasingly aggressive Commission guidance and enforcement actions, suppliers have continued this problematic behavior. See PUC v. Liberty Power Holdings LLC, M-2019-2568471; PUC v. Vista Energy Marketing LP, M-2019-2633094; PUC v. Astral Energy LLC, M-2018-2529738; PUC v. Residential Energy, M-2017-2511372; PUC v. Vista Energy Marketing LLC, M-2018-2624484; PUC v. WGL Energy Services, M-2015-2401964; PUC v. SFE Energy Services, M-2016-2546422; PUC v. Choice Energy LLC, C-2016-2581006; PUC v. American Power & Gas of PA, M-2017-2508002; PUC v. Liberty Power Holdings LLC, M-2019-2568471; PUC v. Oasis Power, F-2017-2618558; PUC v. American Power & Gas of PA, M-2017-2508002; see also PUC, 2018 Utility Consumer Activities Report and Evaluation (UCARE) at 9, http://www.puc.state.pa.us/filing_resources/consumer_activities_report_evaluation.aspx; 2017 UCARE at 8; 2016 UCARE at 8.

⁷⁵ Electric Suppliers Coalition to PECO, I-8.

1 **Table 4 – PECO Low Income Population**⁷⁶

Company	Number of Confirmed Low-Income Customers	Percentage of Customers who are Confirmed Low-Income Customers	Estimated Number of Low-Income Customers	Percentage of Customers who are Estimated to be Low-Income	Number of Active CAP Customers as of 12/31/18	CAP Participation Rate
PECO	146,100	9.9%	389,621	26.4%	117,162	80.2%
EDC Total / Avg	640,352	12.8%	1,247,801	24.9%	269,402	39.5%

2 In 2018, PECO had the highest confirmed and estimated low-income customer population when
 3 compared to other electric distribution companies.⁷⁷ In fact, PECO’s 146,100 confirmed low-
 4 income customers represented 23% of the confirmed low-income customers in the entire state, and
 5 its 389,621 estimated low-income customers represented 31% of the estimated low-income
 6 customers across Pennsylvania.⁷⁸ PECO’s CAP participation rate also represents a higher
 7 percentage of its overall confirmed low income population – accounting for 80.2% of its confirmed
 8 low income population as opposed to a statewide average enrollment rate of just 39.5%.⁷⁹

9 **Q: How serious of a problem is home energy affordability for PECO’s low-income**
 10 **customers?**

11 **A:** Very serious. Energy insecurity – or the inability to afford basic energy services – threatens
 12 stable and continued housing, employment, and education; has substantial and long-term impacts
 13 on mental and physical health; creates serious risks to the household and the larger community;
 14 and negatively impacts the greater economy.⁸⁰ Even in relatively good economic periods, low-

⁷⁶ 2018 Universal Service Report at 5, 6, 51.

⁷⁷ Id.

⁷⁸ These percentages are the quotient of PECO’s reported numbers divided by the statewide numbers found in the PUC’s 2018 Universal Service report.

⁷⁹ 2018 Universal Service Report at 51.

⁸⁰ See Diana Hernandez, Understanding Energy Insecurity and Why It Matters to Health, 167 Soc. Science Medicine (Oct. 2016), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5114037/>; see also Diana Hernandez, Yumiko Aratani, and Yang Jiang, Energy Insecurity Among Families with Children (Jan. 2014), http://www.nccp.org/publications/pub_1086.html.

1 income families struggle to make ends meet each month, and are often unable to afford basic
2 energy services. These households are often forced to choose between critical necessities each
3 month, including housing, food, water, heat, and medicine.⁸¹

4 Even with financial assistance, low-income households are often still unable to afford the
5 cost of energy: According to a 2018 survey conducted by the National Energy Assistance
6 Directors' Association, 72% of LIHEAP recipients reported that they forego other necessities to
7 afford energy, and 26% reported keeping their home at unsafe or unhealthy temperatures.⁸² Indeed,
8 as recent research and data has continually and repeatedly showed, many vulnerable low-income
9 and minority families simply cannot afford the cost of energy services.

10 Ultimately, any increase in rates necessarily results in increased unaffordability, and is
11 likely to result in a corresponding increase in uncollectible expenses and, in turn, involuntary
12 payment-related terminations. These impacts can and do have a deep and lasting impact on the
13 health and wellbeing of those in the household and the welfare of the community as a whole.
14 Indeed, a recent report of Pennsylvania's Joint State Government Commission on Homelessness
15 found that utility assistance ranked in the top three types of assistance noted by survey respondents
16 (24.1 percent) that would have prevented homelessness.⁸³

⁸¹ According to the US Energy Information Administration, roughly 1 in 5 households in 2015 – when the economy was experiencing a relatively prosperous economic period – reported that they had to reduce or forego other critical necessities like food and medicine to afford their home energy costs, and more than 1 in 10 reported keeping their home at an unsafe or unhealthy temperature. See US EIA, Residential Energy Consumption Survey (2015), <https://www.eia.gov/consumption/residential/reports/2015/energybills/>; see also NEADA, 2018 National Energy Assistance Survey, at 17, 20 (Dec. 2018), <http://neada.org/wp-content/uploads/2015/03/liheapsurvey2018.pdf> (hereinafter NEADA Survey).

⁸² NEADA Survey at 17, 20.

⁸³ Joint State Government Commission, Homelessness in Pennsylvania: Causes, Impacts, and Solutions, at 112, 157, 160 (April 2016), available at http://jsg.legis.state.pa.us/publications.cfm?JSPU_PUBLN_ID=447 (“When asked if there were any services that may have prevented them from becoming homeless, the women responded overwhelmingly that assistance with past-due rent and utilities, security deposit, and first and last months’ rent would have been most beneficial.”).

1 CAP is not a panacea to resolve energy insecurity. The average CAP household is
2 desperately poor, and these extremely low income households routinely run out of money even
3 with the assistance of CAP.⁸⁴ In 2018, the average household income CAP participants was just
4 \$14,291.⁸⁵ For context, this level of income was just over 50% of the federal poverty level for a
5 family of four in that year. According to an independent third party evaluation of PECO's
6 universal service programs, released in June 2019, approximately one quarter of PECO's CAP
7 participants had income at or below 50 percent of the poverty level, about 40 percent had income
8 between 50 and 100 percent, and about 30 percent had income above 100 percent of the poverty
9 level.⁸⁶

10 Importantly, PECO's CAP design has long fallen short of achieving conformity with the
11 Commission affordability standards, thus producing unaffordable bills even with a CAP subsidy.⁸⁷
12 In 2016, PECO redesigned its CAP to improve affordability; however, PECO's recent third party
13 program evaluation found that this redesign fell short of achieving its objective – resulting in high
14 levels of unaffordability, especially for those with income between 0-50% of the federal poverty

⁸⁴ In 2014, the household income of the average Pennsylvania household enrolled in CAP was \$13,134, which with an average universal service household size of 3, which is approximately 66% of the federal poverty level. See *ibid.* at 35.

⁸⁵ See US Dep't of Health and Human Services, 2018 Federal Income Poverty Guidelines, <https://aspe.hhs.gov/2018-poverty-guidelines>.

⁸⁶ APPRISE, PECO Energy Universal Services Program: Final Evaluation Report (June 2019), at vii, <http://www.puc.state.pa.us/pcdocs/1626073.pdf>

⁸⁷ The unaffordability of PECO's CAP Rate structure has been addressed by the Commission multiple times, and led to an overhaul of PECO's CAP in 2016. PECO Energy Company Universal Service and Energy Conservation Plan for 2013-2015 Submitted in Compliance with 52 Pa. Code §§ 54.74 and 62.4, Tentative Order, Docket No. M-2012-2290911, at 8–9 (Nov. 8, 2012); see also PECO Energy Company Universal Service and Energy Conservation Plan for 2013-2015 Submitted in Compliance with 52 Pa. Code §§ 54.74 and 62.4, Final Order, Docket No. M-2012-2290911, at 12–19 (April 4, 2013). A recent third party evaluation of PECO's CAP design once again showed that PECO's CAP was not appropriately addressing persistent levels of unaffordability – especially for those with the lowest income levels. See APPRISE, PECO Energy Universal Services Program: Final Evaluation Report (June 2019), <http://www.puc.state.pa.us/pcdocs/1626073.pdf>. Thus, PECO is planning to once again redesign its CAP to better meet the affordability needs of its most economically vulnerable CAP customers, and intends to file a Petition to do so by June 30, 2020. See CAUSE-PA to PECO II-4.

1 level.⁸⁸ Approximately 80% of CAP participants with income between 0-50% of the federal
2 poverty level received an unaffordable bill, and the average “depth” of unaffordability was
3 approximately \$800 per year.⁸⁹ As noted above with regard to PECO’s proposed TOU rates,
4 PECO intends to file a Petition by June 30, 2020 to redesign its CAP structure⁹⁰ to address these
5 persistent and substantial levels of continued unaffordability within its Fixed Credit Option (FCO)
6 program design.

7 Put simply, PECO’s confirmed low-income customers are economically vulnerable and
8 unable to pay for essential services like electricity without substantial and meaningful assistance.
9 It is precisely for this reason that CAP programs were created to assist low-income customers
10 maintain and afford utility service.

11 **Q: Please explain CAP generally.**

12 A: As a regulated public utility serving more than 100,000 customers, PECO is required to
13 offer an integrated package of universal service programs, including a Customer Assistance
14 Program, designed to help low-income, payment troubled ratepayers maintain and afford essential
15 utility services. These programs are statutorily required by the Choice Act⁹¹ and are further subject
16 to Commission regulations.⁹²

17 CAP programs provide a discounted bill for payment troubled, low-income ratepayers with
18 household incomes at or below 150% of the federal poverty income guidelines. CAP programs
19 also provide the benefit of allowing these households to have their pre-CAP arrearages frozen and
20 forgiven over time through payment of on-time, in-full CAP payments over a period of years.

⁸⁸ APPRISE, PECO Energy Universal Services Program: Final Evaluation Report (June 2019),
<http://www.puc.state.pa.us/pdocs/1626073.pdf>

⁸⁹ *Id.* at 131, 133, and Tables VIII-8F & VIII-81.

⁹⁰ *See* CAUSE-PA to PECO II-4.

⁹¹ *See* 66 Pa. C.S. §§ 2802(10), (17); 2804(9).

⁹² 52 Pa. Code 54.71 *et seq.*

1 The universal service provisions of the Choice Act tie the affordability of electric service
2 to a customer’s ability to pay for that service: The Choice Act requires the Commission to ensure
3 that utilities appropriately fund and make available the programs and services necessary to achieve
4 affordability of electric service in each electric distribution territory.⁹³ The statutory goals of
5 universal service are achieved through the enactment, establishment and maintenance of policies,
6 practices and services that help low-income customers maintain their electric service. Universal
7 service programs include the special rates or discounts provided by CAP, energy efficiency,
8 service termination protections, and consumer education.⁹⁴ While, I primarily focus on CAP in
9 the context of this proceeding, it is important to realize that each of PECO’s universal service
10 programs – CAP, LIURP, CARES, and Hardship Funds – offer essential services. All universal
11 service programs are intended to work together to allow low-income households access to an
12 affordable, safe and reliable electric supply.

13 **Q: Please summarize the history of and prior litigation related to PECO’s CAP Shopping**
14 **Plan.**

15 A: In its DSP II, PECO filed a CAP shopping plan that would have allowed CAP customers
16 to shop for competitive electric supply from an EGS and retain CAP benefits only if the EGS
17 guaranteed a rate that would be no greater than PECO’s price to compare. In that proceeding, the
18 Office of Consumer Advocate (OCA) proposed that PECO’s CAP shopping program also permit
19 CAP customers to exit EGS contracts with no termination/cancellation fees. The Commission
20 rejected both proposals, stating that these program features amounted to price restrictions that it

⁹³ 66 Pa. C.S. § 2804(9); *see also*, CAUSE-PA et al. v. Pa PUC and McCloskey v. PA PUC, 120 A.3d 1087, 1103 445 CD 2014, 596 CD 2014 (Commw. Ct., July 14, 2015) (“The obligation to provide low-income programs falls on the public utility under the Choice Act, not on the EGSs. Moreover, the Choice Act expressly requires the PUC to administer these programs in a manner that is cost-effective for both the CAP participants and the non-CAP participants, who share the financial consequences of the CAP participants’ EGS choice.”)

⁹⁴ 66 Pa. C.S. § 2803.

1 did not have statutory authority to approve.⁹⁵ The Commission also determined, based on the
2 evidence before it at the time of its DSP II consideration, that even if it did have authority to
3 approve price limitations and fee restrictions for shopping CAP participants, it believed such
4 limitations and restrictions would impede development of the competitive market, and that only a
5 “robust competitive market coupled with effective customer education will result in the least-cost
6 option” for CAP participants.⁹⁶ Both CAUSE-PA⁹⁷ and the OCA appealed the PUC’s decision to
7 the Commonwealth Court.

8 By opinion and order dated July 14, 2015,⁹⁸ the Commonwealth Court reversed the
9 Commission’s determination concerning its legal authority, and clarified that both utilities and the
10 Commission have the legal ability to set different rules for CAP customers. Specifically, the Court
11 stated that the Electricity Generation Customer Choice and Competition Act⁹⁹ (“Choice Act”)
12 “does not demand absolute and unbridled competition,”¹⁰⁰ and found:

13 What is particularly noteworthy about the legal arguments of the PUC and Direct
14 Energy is their focus on the PUC’s lack of authority to regulate rates EGSs charge
15 customers. **We are persuaded, however, by Petitioners’ contention that the**
16 **absence of authority to regulate EGS rates alone does not compel the**
17 **conclusion that the PUC lacks authority to adopt rules attendant to universal**
18 **service programs that may have the effect of limiting competition and choice**
19 **with respect to low-income customers.**¹⁰¹

⁹⁵ Petition of PECO Energy Company for Approval of its Default Service Plan, Opinion and Order, Docket No. P-2012-2283641, at 14, 16-17 (Jan. 24, 2014) (January 2014 Opinion and Order).

⁹⁶ Petition of PECO Energy Company for Approval of its Default Service Plan, Opinion and Order, Docket No. P-2012-2283641, at 11 (March 12, 2014) (March 2014 Opinion and Order).

⁹⁷ CAUSE-PA was joined in its appeal by two other organizations representing the interests of low-income customers, the Tenants Union Representative Network (TURN) and Action Alliance for Senior Citizens of Greater Philadelphia (Action Alliance) (collectively TURN *et al.*). TURN *et al.* are also parties to this proceeding.

⁹⁸ CAUSE-PA et al. v. Pa. PUC and McCloskey v. PA PUC, 120 A.3d 1087, 445 CD 2014, 596 CD 2014 (Commw. Ct., July 14, 2015).

⁹⁹ See 66 Pa. C.S. §§ 2802(10), (17); 2804(9).

¹⁰⁰ CAUSE-PA et al., 120 A.3d at 1101.

¹⁰¹ CAUSE-PA et al., 120 A.3d at 1101 (emphasis added).

1 The Court went on to state that “under certain circumstances, unbridled competition may have to
2 give way to other important concerns,”¹⁰² and specifically found that the PUC has the authority to
3 limit CAP customer shopping:

4 [W]e conclude that the PUC has the authority under Section 2804(9) of the Choice
5 Act, in the interest of ensuring that universal service plans are adequately funded
6 and cost effective, **to impose, or in this case approve, CAP rules that would limit**
7 **the terms of any offer from an EGS that a customer can accept and remain**
8 **eligible for CAP benefits.** The obligation to provide low-income programs falls on
9 the public utility under the Choice Act, not the EGSs. Moreover, the Choice Act
10 expressly requires the PUC to administer these programs in a manner that is cost
11 effective for the CAP participants and the non-CAP participants, who share the
12 financial consequences of the CAP participant’s EGS choice.

13 Our conclusion finds support in the Choice Act’s legislative declaration of policy,
14 which both encourages deregulation to allow consumers the opportunity to
15 purchase directly their supply from EGSs and emphasizes the need to continue to
16 maintain programs that assist low-income customers to afford electric service. 66
17 Pa. C.S. § 2892 (7), (9), (10), (14), (17). **So long as it “provides substantial**
18 **reasons why there is no reasonable alternative so competition needs to bend”**
19 **to ensure adequately-funded, cost-effective, and affordable programs to assist**
20 **customers who are low-income to afford electric service . . . the PUC may**
21 **impose CAP rules that would limit the terms of any offer from an EGS that a**
22 **customer could accept and remain eligible for CAP benefits – e.g. EGS rate**
23 **ceiling, prohibition against early termination/cancellation fees, etc.**¹⁰³

24 The Commonwealth Court determined that the Commission erred as a matter of law
25 regarding its determination that it did not have the legal authority needed to impose price
26 restrictions on the terms and conditions surrounding CAP customer’s access to EGS products while
27 enrolled in CAP. However, the Commonwealth Court deferred to the Commission’s determination
28 regarding the evidence presented in the DSP II proceeding. Specifically, the Court found that the
29 Commission had substantial evidence for its determination to reject the price ceiling requested by

¹⁰² CAUSE-PA et al., 120 A.3d at 1103.

¹⁰³ CAUSE-PA et al., 120 A.3d at 1103-04 (emphasis added) (internal citation to authority omitted).

1 PECO, but that there was not substantial evidence for the Commission’s determination to reject
2 the OCA’s proposal to prohibit early termination and cancellation fees.¹⁰⁴

3 In response to the Commonwealth Court’s decision, the Commission filed a Petition for
4 Allowance of Appeal with the Pennsylvania Supreme Court, and CAUSE-PA, along with TURN
5 et al., filed a Cross-Petition for Allowance of Appeal. On April 5, 2016, the Supreme Court of
6 Pennsylvania denied both petitions. Consequently, on May 11, 2016, the Commission sent a
7 Secretarial Letter to the parties in the DSP II proceeding in which it ordered PECO to do the
8 following:

9 In light of the Court’s Order, and the denial of allocatur by the Supreme Court,
10 through this Secretarial Letter, the Commission hereby directs PECO to file with
11 the Secretary and serve on the parties at its current Default Service Plan (DSP) and
12 Universal Service and Energy Conservation Plan (USECP) dockets a proposed rule
13 revision to its CAP Shopping Plan in its current DSP III consistent with the
14 Commonwealth Court’s Order. PECO’s filing should include: (1) proposed
15 language of the rule; (2) a proposed timeline and effective date; and (3) a proposed
16 plan to collect data upon which to base an analysis of the CAP shopping program
17 experiences, evaluations, and recommendations. PECO’s filing will be subject to
18 public comment and final review and approval by the Commission.¹⁰⁵

19 **Q: Was CAP Shopping addressed in PECO’s DSP III, consistent with the May 11, 2016**
20 **Secretarial Letter that you cite above?**

21 A: No. As a result of other then-pending litigation regarding CAP Shopping in the PPL
22 Electric service territory,¹⁰⁶ and the Commission’s initiation of a subsequent statewide policy
23 proceeding into the appropriate structure for a CAP Shopping program,¹⁰⁷ the parties agreed to

¹⁰⁴ CAUSE-PA et al., 120 A.3d at 1107-08.

¹⁰⁵ Petition of PECO Energy Company for Approval of its Default Service Plan, May 11, 2016 Secretarial Letter, Docket No. P-2012-2283641 (May 11, 2016) (internal citation omitted).

¹⁰⁶ Retail Energy Supply Ass’n v. Pa. PUC, 185 A.2d 1206 (Pa. Commw. Ct. 2018).

¹⁰⁷ Electric Distribution Company Default Service Plans – Customer Assistance Program Shopping, Proposed Policy Statement Order, Docket No. M-2018-3006578 (order entered Feb. 28, 2019).

1 settle the matter as part of PECO’s then-pending DSP IV proceeding and to defer any further
2 litigation of the issue for DSP V.¹⁰⁸

3 **Q: What is the basis of PECO’s decision to propose a CAP shopping plan in its DSP V?**

4 A: The only reason PECO cites in its filing to support its decision to implement a CAP
5 Shopping plan is to comply with the Commission’s *proposed* CAP Shopping Policy Statement,
6 which is still pending before the Commission, and a January 23, 2020 Secretarial Letter directing
7 electric distribution companies (EDCs) “to *consider* the Commission’s prior guidance in the
8 Proposed Policy Statement Order and recent decisions in previous default service proceeding in
9 developing CAP proposals for upcoming DSP filings.”¹⁰⁹

10 **Q: Is this an appropriate justification to support PECO’s proposed CAP Shopping Plan?**

11 A: No. A proposed policy statement has no legal effect and in and of itself provides no
12 justification for PECO’s proposal to make critical changes to its CAP that may substantially impact
13 both the affordability of CAP for CAP participants and other residential ratepayers who finance
14 CAP. In fact, since the proposed policy statement has not been acted on by the Commission, it is
15 not yet official policy guidance of the Commission – which itself is nonbinding. A proposed policy
16 statement is a proposal, which is pending review before the Commission’s duly appointed
17 Commissioners. While Commission Staff, through the Commission Secretary, requested that
18 EDCs “consider” the Commission’s Proposed CAP Shopping Policy Statement in the context of
19 its DSP filing, the Commission did not order or mandate PECO to do so, nor did it suggest that

¹⁰⁸ Petition of PECO Energy Company for its Default Service Program (Customer Assistance Program Shopping Plan) (DSP II) & Petition of PECO Energy Company for Approval of Its Default Service Program for the Period June 1, 2017 through May 31, 2021 (DSP IV), Joint Petition for Settlement, Docket Nos. P-2012-2283641, P-2016-2534980 (filed March 29, 2019).

¹⁰⁹ PECO St. 3 at 5, citing Investigation into Default Service and PJM Interconnection, LLC Settlement Reforms, January 23, 2020 Secretarial Letter, Docket M-2019-3007101 (Jan. 23, 2020) (emphasis added).

1 PECO should do so in a vacuum without consideration of other critical factors - such as an
2 assessment of applicable shopping data and potential harms.

3 As with every proposal, PECO should have conducted an analysis of all available
4 information and data to determine whether exposing CAP customers to competitive shopping is
5 just and reasonable and consistent with PECO's statutory obligations to offer accessible and
6 appropriately funded universal service programs before setting forth a proposal to do so.

7 **Q: Is PECO's CAP shopping plan just and reasonable, and consistent with PECO's**
8 **statutory obligations to offer accessible and appropriately funded universal service**
9 **programs?**

10 A: No. PECO's CAP Shopping Plan provides absolutely no oversight of supplier pricing, and
11 fails to provide appropriate tools for consumers to reasonably protect themselves from financial
12 harm. As the data and evidence above clearly shows, each and every day that a CAP customer
13 continues with a supplier at a price that exceeds the price to compare, additional costs are borne
14 by both the low income CAP customer and all other residential consumers – undermining the
15 purpose and design of universal service programs.

16 For these reasons, and as explained more fully below, I believe that PECO's CAP shopping
17 proposal should be rejected in its entirety. PECO's current policy has proven to be the only
18 effective and verifiable way to protect CAP customers and other residential ratepayers from
19 significant financial harm and other negative impacts to health and safety of low income
20 consumers associated with utility unaffordability.

21 **Q: Where does the money come from to pay for the CAP program, specifically the CAP**
22 **credits that are allocated to each CAP customer?**

1 A: In aggregate, the predetermined CAP credit/CAP shortfall amount for all CAP customers
2 is paid for by all residential customers through PECO's Universal Services Fund Charge
3 ("USFC").¹¹⁰ CAP customers are responsible for paying the difference between the amount billed
4 and the amount covered by their predetermined CAP credit.

5 **Q: Please explain how CAP shopping causes financial harm to CAP customers and other**
6 **residential customers.**

7 A: As PECO explained in its filing, PECO's CAP provides participants with a discounted
8 energy bill that is targeted to achieve a consistent level of targeted affordability.¹¹¹ PECO's current
9 CAP is structured as a Fixed Credit Option program. This means that CAP customers receive a
10 fixed bill credit each year, which is calculated as follows:

11 PECO calculates the CAP credit by taking the sum of the CAP customer's actual
12 undiscounted bills over the last twelve months ("Base Charges") and subtracting
13 the reduced CAP bill amount based on the ability to pay ("CAP Payment"). The
14 CAP customer's maximum household payment contribution for total electric home
15 energy is calculated as a percentage of income (ranging from 3% to 17%) and
16 converted to a percentage of the annual bill (the "Allowable Energy Burden"). For
17 each CAP customer, the CAP Payment is determined by multiplying the Base
18 Charges by the Allowable Energy Burden.¹¹²

¹¹⁰ All PECO's residential customers, including CAP customers, help pay for the cost of CAP. 2018 Universal Service Report at 79.

¹¹¹ Currently, PECO's CAP targets affordability by applying the energy burden standards in the Commission's prior CAP Policy Statement. PECO St. 3 at 4. On November 5, 2019, the Commission approved substantial revisions to its CAP Policy Statement, and its applicable energy burden standards. 2019 Amendments to Policy Statement on Customer Assistance Program, 52 Pa. Code § 69.261-69.267, Final Policy Statement and Order, Docket No. M-2019-3012599 (order entered Nov. 5, 2020). PECO is under a settlement obligation to amend its applicable energy burden rates consist with the Commission's revised CAP Policy Statement, though it has not yet filed a Petition with the Commission to do so. PECO Energy Company Universal Service and Energy Conservation Plan for 2013-2015, Joint Petition for Settlement, Docket No. M-2012-2290911, at 2 n.3 ("If the Commission changes the energy burden ranges set forth in its Policy Statement, PECO will utilize the new maximum allowable energy burden for each poverty level.").

¹¹² PECO St. 3 at 3-4.

1 Currently, PECO uses the default service rates in effect for the previous 12-month period
2 to calculate a CAP customers' credit amount, and will recalculate the credit in coordination with
3 each PTC change to "roll-in" the previous 3 months' usage calculated at the default service rates.
4 That is, the base from which PECO currently calculates a customer's monthly credit is derived
5 from the price to compare, not the customer's actual rate paid, given all CAP customers currently
6 receive default service. Under PECO's CAP shopping proposal, the PTC would be used to
7 calculate the first 12 month look-back to determine the applicable credit; however, moving
8 forward, the bill credit for CAP shopping customers would be re-calculated using the applicable
9 EGS charges.¹¹³

10 PECO's CAP Shopping proposal will create added costs for both CAP customers and
11 ratepayers.

12 First, PECO's CAP Shopping proposal will impact the amount of CAP credits that a CAP
13 participant receives, and may cause CAP customers to prematurely expire their maximum CAP
14 credits. If a CAP customer is paying more than the PTC when they enter CAP – *even for a short*
15 *time, such as in the first two months of their transition to CAP because of a hold-over contract*
16 *prior to entering CAP*¹¹⁴ – the credits calculated using the PTC will be insufficient to reach the
17 programs' target affordability. Thereafter, while the price the customer pays for competitive
18 supply will be factored into subsequent adjustments to the applicable CAP credit, CAP customers
19 who are shopping may prematurely exceed their maximum allotted CAP credits for the year if the
20 price they pay exceeds the price to compare in any month.¹¹⁵ Importantly, there will always be a

¹¹³ PECO St. 3 at 12; see also TURN to PECO I-18, I-19.

¹¹⁴ PECO St. 3 at 10 ("An EGS may continue to serve existing customers who subsequently enroll in PECO's CAP if the EGS complies with the pricing restrictions and other terms set forth in the Supplier Tariff within two billing cycles of receipt of the Company's CAP Change Notice.").

¹¹⁵ Since 2017, 2,715 PECO CAP customers exceeded the maximum CAP credit limit, 1,013 of which are currently in arrears. See CAUSE-PA to PECO I-4(a) (Attachment). As I will discuss further below, experience with CAP

1 significant lag in the effect of a shopping decision on the calculation of the CAP customers'
2 applicable credit – leading to potential chronic unaffordability and payment issues, and
3 undermining the effectiveness of PECO’s CAP to achieve a consistent level of affordability each
4 month for program participants.

5 PECO’s CAP Shopping proposal also has the potential to cause significant harm to other
6 residential ratepayers. If a CAP customer pays more than the price to compare in any month, the
7 subsequent calculation of CAP credits for the shopping participant will increase.¹¹⁶ This will, in
8 turn, artificially inflate the cost of CAP for other residential consumers. As a result of CAP
9 shopping, there is also a very real potential for an increase in unaffordable bills for CAP customers,
10 which over the long term will lead to more unpaid CAP bills and increased involuntary termination
11 of service.¹¹⁷ The experience in other service territories in which CAP customers are permitted to
12 shop for electric generation has demonstrated that this is not speculative, but is a very real and
13 significant concern that reasonable pricing restrictions have been unable to effectively address.

14 In my view, the potential adverse impact on energy burdens caused by CAP shopping, and
15 the potential for unnecessary increased costs to other residential consumers that do nothing to
16 address unaffordability, together violate core protections required by the Choice Act. The universal
17 service provisions of the Choice Act tie the affordability of electric service to a customer’s ability

shopping pricing restrictions in other service territories has shown that suppliers are not voluntarily complying with pricing rules – and that CAP customers are continuing to overpay for electricity at a high rate. If this bears true in PECO service territory, which I believe it will if CAP shopping is permitted to proceed, CAP customers will more often exceed their maximum CAP credit limit and, as a result, will be more likely to accrue arrears.

¹¹⁶ See TURN to PECO I-18, I-19.

¹¹⁷ CAP customers already have a high rate of termination. Since 2015, 80,888 CAP customers were terminated for non-payment. CAUSE-PA to PECO I-9(a)(Attachment). Overall, confirmed low income customers also have a significantly higher rate of termination. In 2018, 15.5% of PECO’s confirmed low income customers were terminated for nonpayment, compared to just 5.8% for all residential customers. See 2018 Universal Service Report at 14.

1 to pay for that service.¹¹⁸ The Commission has the responsibility to ensure that the means to
2 achieve the affordability of electric service is appropriately funded, cost effective, and available in
3 each electric distribution territory. This requires the enactment, establishment, and maintenance
4 of policies, practices and services that allow low-income customers to maintain their electric
5 service.¹¹⁹ The existence of a competitive market for generation supply does not change this
6 requirement. The Choice Act contains within it the coexisting goals and obligations to promote
7 competition as well as to protect low-income customers within the competitive framework to
8 ensure rate affordability.

9 Any plan which allows PECO's CAP customers to receive service from an EGS must
10 continue to tie the affordability of electric service to a customer's ability to pay for that service
11 through policies, practices, and services that help low income customers maintain utility service.
12 The Commission recognized this very principal in its recent Tentative Order seeking comments
13 on PECO's proposed Universal Service and Energy Conservation Plan for 2016-2018:

14 The Electricity Generation Customer Choice and Competition Act (Electric
15 Competition Act), 66 Pa. C.S. §§ 2801-2812, became effective on January 1, 1997.
16 The primary purpose of this legislation was to introduce competition into the retail
17 electric generation market. The Act established standards and procedures for the
18 restructuring of the electric utility industry. While opening up the electric
19 generation market to competition, the Act also includes several provisions relating
20 to universal service to ensure that electric service remains available to all customers
21 in the Commonwealth.

22 The universal service provisions of the Competition Act, among other things, tie
23 the affordability of electric service to a customer's ability to maintain utility service.
24 The Competition Act defines "universal service and energy conservation" as the
25 policies, practices and services that help low-income customers maintain utility
26 service. The term includes customer assistance programs, usage reduction
27 programs, service termination protections and consumer education. 66 Pa. C.S. §
28 2803. Section 2802(10) of the Act commits the Commission to continuing, at a
29 minimum, the policies, practices and services that were in existence as of the
30 effective date of the law. 66 Pa. C.S. § 2802(10). Finally, the Act requires the

¹¹⁸ 66 Pa. C.S. § 2804(9).

¹¹⁹ 66 Pa. C.S. § 2803.

1 Commission to ensure that universal service and energy conservation services are
2 appropriately funded and available in each electric distribution territory. 66 Pa.
3 C.S. § 2804(9).¹²⁰

4 Again, the first principal for any CAP program must be – regardless of whether a CAP
5 customer remains on default service or receives generation service from an EGS – that CAP bills
6 must remain affordable. This is a core component of the obligation that PECO and the
7 Commission must fulfill pursuant to the Choice Act and the Commission’s regulations.¹²¹ As
8 such, I believe PECO’s CAP Shopping Plan fails to fulfill these basic principles and obligations
9 regarding universal services in Pennsylvania, and must be rejected.

10 **Q: PECO’s proposal would limit CAP customers to the applicable price to compare. Is**
11 **that enough to protect against the harms you outlined above?**

12 A: No. PECO is proposing to allow suppliers to self-police their compliance with the CAP
13 shopping rules, noting its belief “that the Commission is the appropriate entity to monitor and
14 enforce EGS compliance” with its CAP shopping terms.¹²² This proposed system for monitoring
15 is wholly inadequate to ensure that current CAP customers do not enter a non-compliant offer and
16 equally inadequate to confirm that CAP customers who enter CAP are dropped by their supplier
17 within the two-month grace period proposed in PECO’s CAP Shopping proposal.

18 First, PECO’s complicated CAP design will not allow for CAP customers to reasonably
19 identify when they are being charged an excessive price. PECO’s CAP credit calculations are
20 based on a rolling 12 month average. As I noted before, there will be a significant lag in the impact

¹²⁰ See PECO Energy Company Universal Service and Energy Conservation Plan for 2016-2018 submitted in Compliance with 52 Pa Code § 54.74, Docket M-2015-2507139 (Feb. 25, 2016) at 2-3.

¹²¹ 52 Pa. Code 54.71 et seq.; see also, CAUSE-PA et al., 120 A.3d at 1103 (“The obligation to provide low-income programs falls on the public utility under the Choice Act, not on the EGSs. Moreover, the Choice Act expressly requires the PUC to administer these programs in a manner that is cost-effective for both the CAP participants and the non-CAP participants, who share the financial consequences of the CAP participants’ EGS choice.”)

¹²² PECO St. 2 at 11.

1 of a poor shopping decision on the calculation of CAP benefits, making it very difficult for CAP
2 customers to recognize when they are overpaying for electricity and to respond accordingly to
3 switch away from the supplier and/or to take action against the supplier for the months that they
4 were overcharged in violation of the CAP Shopping rules.

5 Moreover, even if there were not a lag in the effect of a shopping decision on a customer's
6 CAP bill, the ability of CAP customers to compare billed electricity prices and the applicable price
7 to compare are significantly constrained. PECO's residential bill allows suppliers the *option* of
8 presenting the price per kWh that they charge for electric supply, but does not require suppliers to
9 disclose this information on the bill.¹²³ This is a significant deficiency, and I believe it is likely
10 contributing to the substantial overcharging of all residential customers in PECO's service territory
11 – including confirmed low income customers not currently participating in CAP. Even if a supplier
12 does optionally choose to provide the price per kWh, the information appears on the second page
13 of PECO's bill and in different sections of the bill¹²⁴ – further obscuring the ability for CAP
14 customers to reasonably monitor the price that they are paying for electricity.

15 While the Commission is well equipped to adjudicate complaints brought by a consumer
16 against a supplier, in the absence of such complaints, it is not well equipped to implement and/or
17 monitor compliance with CAP Shopping rules, as it lacks access to the customer data necessary to
18 perform that type of oversight and active monitoring. Given the nature of the harms associated
19 with CAP Shopping, and the technical nature of the proposed CAP Shopping rules, many CAP
20 customers may never realize – on their own – that they are paying more than the PTC; that this
21 overpayment impacts the speed with which they approach exhaustion of their maximum CAP

¹²³ CAUSE-PA to PECO I-38; see also CAUSE-PA to PECO I-3, TURN to PECO I-17.

¹²⁴ CAUSE-PA to PECO I-36(a) (Attachment).

1 credits; that it results in additional costs to other residential ratepayers; or that there are rules in
2 place to protect them from excessive costs through CAP.

3 **Q: PECO notes in its filing that CAP Shopping Plans have been approved in other utility**
4 **service territories. Does this justify PECO's proposal?**

5 A: No. First, it needs to be noted that in both Duquesne and PECO service territories, CAP
6 customers have never shopped. These CAP and other residential customers who support CAP have
7 fared far better than in CAP shopping territories. PPL Electric and the four FirstEnergy Companies
8 each have a currently approved CAP shopping plan, though the two plans take a different approach.

9 PPL Electric operates a CAP-SOP, which – like the standard SOP – permits CAP customers
10 to enter a 12-month contract for service at 7% off the then-applicable PTC.¹²⁵ After four years of
11 operating its CAP-SOP program, PPL Electric is now proposing to end CAP shopping in its service
12 territory – noting that financial harms associated with CAP shopping have persisted, and that
13 suppliers have not engaged in the program.¹²⁶ Even with the shopping restrictions, CAP customers
14 have continued to pay – on net – millions of dollars more for electricity each year in PPL's service
15 territory.¹²⁷ This fact is particularly troubling, given the current lack of any participating suppliers
16 in PPL's CAP-SOP. In short, this means that the overcharging is caused entirely by holdover
17 contracts and suppliers' failure to comply with PPL's CAP shopping restrictions. PPL reported the
18 following CAP shopping data in its latest DSP filing:

¹²⁵ Petition of PPL Electric Utilities Corporation for Approval of a Default Service Program and Procurement Plan for the Period June 1, 2021 through May 31, 2025, Direct Testimony of James M. Rouland, Docket No. 2020-3019356, at 79 (filed March 25, 2020); see also id. Direct Testimony of Melinda Stumpf, 14.

¹²⁶ Petition of PPL Electric Utilities Corporation for Approval of a Default Service Program and Procurement Plan for the Period June 1, 2021 through May 31, 2025, Direct Testimony of Melinda Stumpf, Docket No. 2020-3019356, at 12 (filed March 25, 2020). PPL notes that it has received several complaints from CAP customers that their suppliers did not return them to default service at the end of their contract term as required by the CAP-SOP.

¹²⁷ Id. at 12.

1 **CAP Shopping in PPL Electric Service Territory – Net Costs and Savings¹²⁸**

	Incremental Costs Above PTC	Incremental Savings Below PTC	Net Incremental Cost/(Savings)
2013	\$3,102,101.99	(\$577,626.58)	\$2,524,475.41
2014	\$7,075,886.90	(\$1,260,702.83)	\$5,815,184.07
2015	\$4,143,051.93	(\$1,824,797.73)	\$2,318,254.20
2016	\$7,754,048.98	(\$299,675.37)	\$7,454,373.60
2017	\$5,733,675.86	(\$925,870.45)	\$4,807,805.41
2018	\$4,801,337.09	(\$519,755.99)	\$4,281,581.10
2019	\$3,163,412.20	(\$255,326.71)	\$2,908,085.49
2020	\$265,270.32	(\$43,797.44)	\$221,472.88
Total	\$36,038,785.27	(\$5,707,553.10)	\$30,331,232.16

2 As with PECO’s proposal, PPL Electric neither enforced nor policed suppliers’ adherence to its
3 CAP SOP rules.¹²⁹ The result – in terms of dollars and cents – is striking, and further underscores
4 my conclusion that suppliers, absent strong and consistent enforcement by the utility and the
5 Commission, have simply not complied with CAP shopping rules. Because of the level of
6 enforcement needed to prevent suppliers from overcharging CAP customers, and in light of
7 PECO’s claimed inability and unwillingness to do so,¹³⁰ the only reasonable resolution capable of
8 preventing substantial financial harm to CAP customer and other residential ratepayers is to
9 maintain the status quo and prohibit CAP shopping in its entirety.

10 FirstEnergy’s CAP shopping program is more similar to PECO’s proposal, in that it limits
11 CAP customers to offers that are and remain at or below the applicable price to compare.¹³¹ But
12 FirstEnergy’s CAP shopping program was only recently approved and implemented, and has not
13 yet been subject to formal review to determine whether the CAP shopping restrictions were

¹²⁸ Id.

¹²⁹ Id. at 14.

¹³⁰ See PECO St. 3 at 11.

¹³¹ Consolidated Petitions of Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company for Approval of a Default Service Program for the Period Beginning June 1, 2019 through May 31, 2021, Final Order, Docket Nos. P-2017-2637855, -2637857, 2637858, -2637866 (order entered Feb. 28, 2019).

1 effective at protecting CAP customers and other residential ratepayers from unnecessary and
2 excessive costs.¹³² Moreover, FirstEnergy’s program requires suppliers to use rate-ready billing,
3 which requires suppliers to disclose the price per kWh that it charges consumers for electricity.¹³³
4 PECO’s proposal is to use bill-ready billing, which does not require suppliers to disclose the price
5 per kWh on the customer’s bill.¹³⁴ As noted above, the lack of per unit pricing information on the
6 customer bill further obscures the ability of the consumer – and the utility – to monitor pricing to
7 determine compliance with CAP shopping restrictions.

8 In light of the persistent harm in PPL service territory – as well as the lack of experience
9 with a similar program in FirstEnergy’s service territory – it would be imprudent and cost-
10 ineffective for PECO to spend millions in ratepayer dollars to develop, deploy, and subsequently
11 maintain its proposed CAP shopping plan.

12 **Q: Is there any evidence to suggest that CAP customers want to shop for competitive**
13 **electric supply?**

14 **A:** No. In fact, there is evidence to the contrary. Since 2015, only 548 PECO CAP customers
15 – or roughly 0.5% of PECO’s CAP customers¹³⁵ – have attempted to shop for competitive electric
16 supply.¹³⁶ Over the last five years, PECO was unable to identify a single informal or formal
17 complaint regarding its restriction on CAP shopping.¹³⁷ PECO’s proposal to spend more than
18 \$1.4M to implement CAP shopping,¹³⁸ coupled with the inherent risk of harm associated with CAP

¹³² Id.

¹³³ Id. at 12.

¹³⁴ CAUSE-PA to PECO I-38; see also CAUSE-PA to PECO I-3; TURN to PECO I-17.

¹³⁵ In 2018, PECO had 117,162. 548 CAP customers equates to 0.47%. 2018 Universal Service Report at 51.

¹³⁶ CAUSE-PA to PECO I-28(a) (Attachment)

¹³⁷ CAUSE-PA to PECO I-5.

¹³⁸ CAUSE-PA to PECO I-25.

1 shopping to CAP customers and other residential ratepayers described above, is unjustified in light
2 of the clear lack of actual interest in the program.

3 **Q: How does PECO propose to educate CAP customers about CAP shopping?**

4 A: It is not clear how PECO plans to educate CAP customers because its CAP shopping plan
5 lacks any detailed plans or proposed outreach documents.¹³⁹ The entirety of PECO’s education
6 plan is contained in just 19 lines of testimony – with absolutely no supportive documents, sample
7 outreach materials, or other materials to facilitate review.¹⁴⁰ Given the gravity of this issue, and
8 the distinct risk of harm, it is critical that PECO offer more than just assurances regarding its
9 planned outreach and education effort.

10 Over the last 5 years, and millions of dollars in ratepayer-funded education efforts,
11 residential consumers continue to fare poorly in the competitive market as a whole. Indeed, as I
12 explained above, residential shopping customers paid roughly \$773M more than the default service
13 price over a five-year period. Notably, this \$773M in excessive pricing was amassed since the
14 2014 Polar Vortex, when unprecedented spikes in the competitive market caused the Commission
15 to reform its switching regulations and enhance education efforts. PECO and the Commission
16 have promised effective competitive shopping education for years, but education alone has proven
17 to be ineffective to protect residential customers from excessive costs. Given this long history of
18 educational efforts, and the persistent increase in over-charging within the residential competitive
19 market over the long term, I do not see how even the most carefully crafted education effort will
20 prevent statutorily protected economically vulnerable CAP customers from falling into the same
21 traps by which other residential customers have persistently fallen victim despite existing
22 education efforts.

¹³⁹ CAUSE-PA to PECO I-26.

¹⁴⁰ PECO St. 3 at 12-13.

1 **Q: Please restate your recommendations regarding PECO's CAP Shopping Plan.**

2 A: As I noted above, I believe PECO's CAP shopping plan should be rejected in its entirety.
3 Should PECO decide in the future to propose another CAP shopping proposal, it should first be
4 required to conduct a thorough assessment of shopping within its service territory, and should
5 specifically examine the disparate impact in low income and minority communities – as well as
6 the impact of excessive supplier pricing on arrearage forgiveness costs, of which there has never
7 been a comprehensive assessment.

8 **Q: If PECO's CAP shopping plan were to be approved, do you have any**
9 **recommendations for how PECO could improve the plan?**

10 A: As my testimony indicates, there is yet to be developed a CAP shopping plan which does
11 not result in harm to CAP participants, other ratepayers, or both. I do not believe that PECO can
12 eliminate all of the harms inherent in CAP shopping. I remain resolute in my recommendation
13 that PECO's CAP shopping proposal must be rejected in its entirety to prevent substantial
14 economic harm to CAP customers and residential ratepayers. Yet, if PECO's plan is not rejected
15 – despite what I consider to be overwhelming data – then I believe significant safeguards must be
16 required to help mitigate those harms before any plan is implemented. PECO should be mandated
17 to attempt to mitigate those harms by: (1) requiring suppliers to offer rate-ready billing so that the
18 amount charged per kWh appears on the bill, (2) automatically rejecting non-compliant offers for
19 CAP customers, (3) actively monitoring supplier pricing, and returning all CAP customers with
20 noncompliant offers to default service; and (4) ensuring that CAP customers with noncompliant
21 contracts upon enrollment in CAP are promptly returned to default service at the end of the contract
22 term. Moreover, consistent with the recommendations below, in section VI, I believe that PECO
23 must redesign its CAP bills to ensure that shopping information – including customer's current

1 shopping price and the price to compare – are easily identified, presented in identical format, and
2 prominently displayed to permit CAP customers to actively review the rate they are paying for
3 service. Prominent warnings should appear on CAP customer bills to remind them of the CAP
4 shopping rules, with information about how a CAP customer can report and resolve supplier
5 overcharging in violation with the CAP shopping rules.

6 Importantly, I do not believe that residential customers or CAP customers should pay for
7 the costs of implementation, or any ongoing costs associated with CAP shopping. Any costs
8 associated with CAP shopping should be recovered from suppliers who wish to participate in the
9 program.

10 VI. Residential Bill Revisions

11 **Q: You noted at the outset of your testimony that you believe PECO should be required**
12 **to make changes to its residential bill. Please explain.**

13 A: As I mentioned above, PECO only allows for bill-ready billing.¹⁴¹ As a result, PECO's
14 residential customer bill only includes the price that a supplier charges per kWh if the supplier
15 chooses to disclose this information in the supplier portion of the bill.¹⁴² If a supplier chooses not
16 to disclose this information, or displays the information in a different format,¹⁴³ a shopping
17 customer has no way to compare the price they are paying with the price to compare.

18 Moreover, the price to compare for residential customers is buried in the small print of the
19 general message center box on the second page of the bill, making it difficult for most residential

¹⁴¹ CAUSE-PA to PECO I-38.

¹⁴² Id.

¹⁴³ Suppliers sometimes present charges in cents (e.g. 10 ¢/kWh), as opposed to dollars and cents (\$0.10/kWh). They also sometimes present charges per KW, as opposed to kWh. These may seem like minor variances, but in fact can cause significant confusion for consumers that are not familiar with utility pricing or units of energy.

1 consumers to identify and understand.¹⁴⁴ In my experience, consumers generally look to their bill
2 for the total amount due – and do not spend time scrutinizing the fine print on their monthly bill.

3 **Q: What changes do you believe PECO should make to its residential bill?**

4 A: I believe PECO should require suppliers to provide the per kWh price on each residential
5 bill. That price, and the price to compare, should appear in a stand-alone box on the front of the
6 bill in identical format so that customers can easily identify the amount they are paying and
7 compare it to the price to compare. I suggest PECO use colors or other indicators to flag when a
8 consumer’s current price exceeds the price to compare, and indicate the amount by which they
9 have either saved or overpaid. PECO should work with stakeholders through its Universal Service
10 Advisory Committee to provide advice and input on the bill improvements to ensure that shopping
11 information is clear, transparent, and easily understandable to consumers.

12 **Q: Would your suggestions undermine the ability of suppliers to offer additional non-
13 energy benefits and services to consumers which may justify the additional costs?**

14 A: Absolutely not. This information will simply ensure transparency in the marketplace.
15 Consumers who have knowingly elected to pay more for electricity to access other non-energy
16 benefits will likely continue to do so. For example, consumers that elect to purchase 100%
17 renewable energy are likely to continue purchasing 100% renewable energy – even when the price
18 differential is clearly displayed on their monthly bill. My recommendation will simply protect
19 consumers who are *unknowingly* paying more than the price to compare.

¹⁴⁴ CAUSE-PA to PECO I-36(a) (Attachment).

1 **VII. Summary of Conclusions and Recommendations**

2 **Q: Please summarize your conclusions and recommendations.**

3 A: Throughout the course of my testimony, I provided an overview of residential customer
4 shopping, and discussed the impact of PECO’s Time of Use rate proposal, its Standard Offer
5 Program proposal, and its CAP Shopping proposal. I also briefly discussed deficiencies in
6 PECO’s residential customer bill that make it difficult for consumers to easily compare the rate
7 they pay to the applicable price to compare. The following is a high level overview of the
8 conclusions and recommendations I made regarding each topic.

9 **Residential Customer Shopping Overview**

- 10 • Since 2015, PECO’s residential shopping customers have paid roughly \$733M more, on
11 net, than the default service price to compare.
- 12 • Evidence suggests that the most substantial financial harms in the competitive market
13 have been concentrated in low income and minority communities.
- 14 • The average rate for residential shopping customers has grown increasingly divergent
15 from energy market patterns in the default service price, revealing that pricing for
16 competitive supply is not market based.
- 17 • Since 2015, confirmed low income customers in PECO’s service territory have paid a net
18 average of nearly \$10M more than they otherwise would have paid if they remained on
19 default service.
- 20 • In 2019, confirmed low income customers in PECO’s service territory paid a net average
21 of \$192.43/year – or \$16.04/month – over the default service price to compare.
- 22 • Strong evidence in PECO’s service territory – and in other states – suggests that there
23 may be racial equity issues in the competitive electric market that requires further
24 attention from the Commission.

25 **Time of Use Rate Proposal**

- 26 • Time of Use rates have the potential to negatively impact CAP benefits, decreasing the
27 effectiveness of CAP at delivering an affordable bill and increasing the cost of CAP to
28 other ratepayers.

- 1 • Many low income households are unable to reasonably shift usage during off peak hours,
2 as they most often do not have discretionary energy usage that could reasonably be
3 curtailed.
- 4 • Other vulnerable consumers, including seniors, individuals with disabilities, and families
5 with young children (all of whom are generally more likely to be low income or income
6 constrained), often have inflexible usage patterns and are otherwise unable to reasonably
7 shift their energy usage.
- 8 • Research has revealed a link between TOU rates and poor health outcomes in low income
9 and minority communities attributable to usage deprivation.
- 10 • **Recommendations:**
 - 11 ○ Implement additional protections for all low income customers, as well as those
12 with known medical usage.
 - 13 ○ Track the income, age, race/ethnicity, and disability status of TOU rate
14 participants
 - 15 ○ Conduct a third party evaluation of TOU rates to be completed and submitted as
16 part of PECO's next default service plan proceeding.

17 **Standard Offer Program**

- 18 • PECO has not conducted any assessment of the price that Standard Offer Program
19 participants pay during or after the program period.
- 20 • Evidence from other utilities suggests that participants in the Standard Offer Program are
21 not actively engaged in the market, and are likely to pay significantly more than the price
22 to compare at the end of the SOP contract period.
- 23 • **Recommendations:**
 - 24 ○ Return customers to default service if they do not make an affirmative decision to
25 stay with their current supplier or to select a new supplier at the end of the 12
26 month SOP contract.
 - 27 ○ Conduct outreach to SOP customers about their shopping decision throughout the
28 12-month SOP contract, especially in the month leading up to the expiration of
29 the SOP contract, to educate them about their options and provide information
30 about how to compare offers.

1 **CAP Shopping Plan**

- 2 • PECO has a substantial number of low income customers in its service territory. In 2018,
3 it had 146,100 confirmed low income customers and 389,621 estimated low income
4 customers – representing far and away the greatest low income population in the state
5 compared to other electric distribution companies.
- 6 • Energy insecurity threatens stable and continued housing, employment, and education;
7 has substantial and long-term impacts on mental and physical health; creates serious risks
8 to the household and the larger community; and negatively impacts the greater economy.
- 9 • Even with assistance, low income households are often still unable to afford the cost of
10 energy, and often forego other critical necessities – or keep their home at unsafe
11 temperatures – as a result of energy unaffordability.
- 12 • PECO is planning to redesign its CAP from a Fixed Credit Option program to a
13 Percentage of Income Program.
- 14 • Education efforts alone have proven to be ineffective to protect CAP participants and
15 other residential customers from excessive costs associated with CAP shopping.
- 16 • Regardless of the structure or design of CAP, CAP shopping that exceeds the Price to
17 Compare will have one or more of the following results: (1) CAP customers will be
18 charged higher rates, and/or will prematurely exceed their maximum allotted CAP
19 credits; (2) residential ratepayers will pay more for the cost of CAP; or (3) both CAP
20 customers and other residential ratepayers will pay increased costs.
- 21 • Evidence from other service territories that have permitted CAP shopping, with
22 reasonable restrictions, has shown that suppliers are incapable of or otherwise unwilling
23 to effectively self-police their compliance with CAP shopping rules.
- 24 • PECO’s proposal to spend more than \$1.4M to implement CAP shopping is unjustified in
25 light of the clear lack of interest in such a program, coupled with the inherent risk of
26 harm associated with CAP shopping.
- 27 • **Recommendations:**
 - 28 ○ Reject PECO’s CAP Shopping Plan in its entirety.
 - 29 ○ Require PECO, should it determine to proceed with an alternative CAP shopping
30 plan in the future, to first conduct a thorough assessment of shopping within its
31 service territory, and specifically examine the disparate impact in low income and

1 minority communities – as well as the impact of excessive supplier pricing on
2 arrearage forgiveness costs.

3 *Alternative Recommendations:*

- 4 ○ If PECO’s proposal is permitted to be implemented, notwithstanding substantial
5 record evidence that approval is not in the public interest, PECO should be
6 required to:
- 7 ▪ Require suppliers to offer rate ready billing
 - 8 ▪ Automatically reject switching requests for non-compliant offers for
9 existing CAP customers
 - 10 ▪ Actively monitor supplier pricing for existing CAP customers, and return
11 all CAP customers with noncompliant offers to default service
 - 12 ▪ Ensure CAP customers with noncompliant contracts upon enrollment in
13 CAP are promptly returned to default service at the end of the contract
14 term
 - 15 ▪ Redesign the CAP bill to ensure that the customer’s shopping information
16 is easily identified and prominently displayed to permit active review.
 - 17 ▪ Include prominent warnings on CAP customer bills to remind them of
18 CAP shopping rules, and to provide information about how a CAP
19 customer can report and resolve overcharging by a supplier in violation of
20 the CAP shopping rules.
 - 21 ▪ Conduct a thorough assessment of shopping within its service territory,
22 and specifically examine the disparate impact in low income and minority
23 communities – as well as the impact of excessive supplier pricing on
24 arrears forgiveness costs.

25 **Residential Customer Bills**

- 26 • PECO’s current residential customer bills do not clearly, consistently, and transparently
27 depict the price that a shopping customer pays for electricity, nor do they clearly indicate
28 the price to compare.
- 29 • **Recommendation:**
- 30 ○ Require suppliers to provide per kWh price on each residential bill.

- 1 ○ Display the current shopping price and the price to compare in a prominent
- 2 location on the front page of the bill.
- 3 ○ Use colors or other prominent indicators to warn consumers when their current
- 4 shopping price is higher than the price to compare.

5 **Q: Does this conclude your direct testimony?**

6 A: Yes.

CAUSE-PA EXHIBIT 1
Residential Shopping v. Residential Default Service

CAUSE-PA EXHIBIT 1

RESIDENTIAL SHOPPING VS. RESIDENTIAL DEFAULT SERVICE

2015-2020

Residential Shopping Customers					Residential Default Service				
Date	Shopping Usage (kWh)	Shopping Billed	Avg \$/kWh	Amount Over Avg \$/kWh Non-Shopping	Total Over Default	Non-Shopping Usage (kWh)	Non-Shopping Billed	Avg \$/kWh	PTC
Jan-15	498,137,113	\$51,926,342	0.1042	0.02251	\$ 11,214,191	763,513,238	\$62,401,025	0.08173	\$0.0818
Feb-15	482,731,034	\$49,934,108	0.1034	0.02200	\$ 10,620,255	762,250,382	\$62,078,046	0.08144	\$0.0818
Mar-15	458,326,680	\$47,041,899	0.1026	0.02505	\$ 11,482,646	697,084,323	\$54,083,253	0.07758	\$0.0777
Apr-15	333,160,398	\$34,319,280	0.1030	0.02548	\$ 8,489,596	506,314,503	\$39,254,196	0.07753	\$0.0777
May-15	288,541,559	\$29,489,840	0.1022	0.02475	\$ 7,140,354	455,581,664	\$35,287,866	0.07746	\$0.0777
Jun-15	385,306,152	\$39,231,086	0.1018	0.02495	\$ 9,612,216	610,444,218	\$46,925,458	0.07687	\$0.7700
Jul-15	473,759,086	\$48,351,710	0.1021	0.02515	\$ 11,914,971	726,507,233	\$55,875,561	0.07691	\$0.7700
Aug-15	507,136,593	\$51,604,676	0.1018	0.02474	\$ 12,547,251	774,304,463	\$59,633,516	0.07702	\$0.7700
Sep-15	477,697,045	\$48,002,742	0.1005	0.02067	\$ 9,872,715	756,068,436	\$60,349,777	0.07982	\$0.0799
Oct-15	335,858,994	\$33,799,217	0.1006	0.02089	\$ 7,016,199	506,272,196	\$40,372,589	0.07974	\$0.0799
Nov-15	284,140,510	\$28,360,327	0.0998	0.02025	\$ 5,754,330	437,726,262	\$34,825,159	0.07956	\$0.0799
Dec-15	362,227,758	\$35,941,876	0.0992	0.02155	\$ 7,806,839	568,336,738	\$44,143,981	0.07767	\$0.0778
2015					\$ 113,471,564				
Jan-16	444,467,897	\$44,276,856	0.0996	0.02196	\$ 9,759,677	691,281,459	\$53,684,610	0.07766	\$0.0778
Feb-16	435,323,952	\$42,628,298	0.0979	0.02044	\$ 8,899,146	665,942,361	\$51,597,600	0.07748	\$0.0778
Mar-16	364,265,891	\$35,289,633	0.0969	0.02319	\$ 8,447,123	548,929,588	\$40,450,255	0.07369	\$0.0738
Apr-16	297,668,006	\$28,754,177	0.0966	0.02295	\$ 6,830,671	456,347,914	\$33,610,418	0.07365	\$0.0738
May-16	282,635,058	\$27,131,366	0.0960	0.02287	\$ 6,464,143	425,667,315	\$31,126,221	0.07312	\$0.0738
Jun-16	380,280,871	\$36,375,829	0.0957	0.02755	\$ 10,475,295	586,688,175	\$39,958,721	0.06811	\$0.0683
Jul-16	490,652,171	\$46,310,519	0.0944	0.02621	\$ 12,859,059	757,308,907	\$51,631,461	0.06818	\$0.0683
Aug-16	574,276,570	\$54,488,866	0.0949	0.02645	\$ 15,188,266	873,822,716	\$59,800,031	0.06843	\$0.0683
Sep-16	546,737,921	\$51,433,912	0.0941	0.02311	\$ 12,637,550	819,548,367	\$58,154,911	0.07096	\$0.0711
Oct-16	353,188,434	\$33,079,111	0.0937	0.02275	\$ 8,035,227	515,395,891	\$36,545,690	0.07091	\$0.0711
Nov-16	299,783,491	\$27,967,821	0.0933	0.02262	\$ 6,782,205	451,792,153	\$31,928,026	0.07067	\$0.0711
Dec-16	403,059,412	\$37,384,633	0.0928	0.02401	\$ 9,675,641	606,398,206	\$41,687,857	0.06875	\$0.0688
2016					\$ 116,054,003				
Jan-17	498,316,471	\$46,126,306	0.0926	0.02378	\$ 11,849,621	754,752,387	\$51,915,623	0.06878	\$0.0688
Feb-17	406,649,953	\$37,884,802	0.0932	0.02462	\$ 10,010,102	609,641,272	\$41,789,179	0.06855	\$0.0688
Mar-17	371,731,368	\$34,629,808	0.0932	0.02756	\$ 10,243,827	556,018,676	\$36,475,428	0.06560	\$0.0658

Apr-17	331,694,906	\$31,033,232	0.0936	0.02799	\$ 9,282,678	492,092,324	\$32,268,451	0.06557	\$0.0658
May-17	286,857,323	\$26,968,868	0.0940	0.02861	\$ 8,207,817	432,091,208	\$28,259,642	0.06540	\$0.0658
Jun-17	358,600,764	\$33,819,573	0.0943	0.03018	\$ 10,822,139	541,786,344	\$34,745,312	0.06413	\$0.0642
Jul-17	499,160,546	\$47,292,705	0.0947	0.03070	\$ 15,326,317	791,163,249	\$50,666,327	0.06404	\$0.0642
Aug-17	486,174,407	\$46,117,743	0.0949	0.03080	\$ 14,974,718	753,709,261	\$48,280,589	0.06406	\$0.0642
Sep-17	386,360,703	\$36,537,890	0.0946	0.03033	\$ 11,717,194	587,070,647	\$37,714,763	0.06424	\$0.0644
Oct-17	350,450,890	\$33,515,783	0.0956	0.03140	\$ 11,004,157	557,484,236	\$35,810,657	0.06424	\$0.0644
Nov-17	293,071,549	\$27,975,841	0.0955	0.03115	\$ 9,130,298	477,553,780	\$30,708,407	0.06430	\$0.0644
Dec-17	397,553,463	\$37,766,557	0.0950	0.02999	\$ 11,921,045	640,000,549	\$41,607,340	0.06501	\$0.0652
2017					\$ 134,489,911				
Jan-18	543,649,928	\$51,491,314	0.0947	0.02963	\$ 16,107,203	903,112,967	\$58,780,197	0.06509	\$0.0652
Feb-18	421,852,372	\$40,305,652	0.0955	0.03056	\$ 12,893,768	688,855,713	\$44,761,709	0.06498	\$0.0652
Mar-18	349,745,378	\$33,554,524	0.0959	0.03210	\$ 11,227,723	600,056,810	\$38,306,008	0.06384	\$0.0640
Apr-18	340,990,477	\$32,010,256	0.0939	0.03009	\$ 10,260,441	567,659,386	\$36,207,717	0.06378	\$0.0640
May-18	289,857,205	\$29,625,237	0.1022	0.03827	\$ 11,092,294	485,231,457	\$31,024,817	0.06394	\$0.0640
Jun-18	349,014,743	\$34,404,997	0.0986	0.03261	\$ 11,379,791	596,453,760	\$39,349,256	0.06597	\$0.0662
Jul-18	475,073,574	\$46,708,342	0.0983	0.03231	\$ 15,349,871	825,973,105	\$54,520,510	0.06601	\$0.0662
Aug-18	488,318,729	\$48,240,989	0.0988	0.03305	\$ 16,140,417	860,050,878	\$56,537,101	0.06574	\$0.0662
Sep-18	484,046,272	\$47,603,734	0.0983	0.03577	\$ 17,311,974	840,119,624	\$52,574,936	0.06258	\$0.0628
Oct-18	333,564,688	\$33,099,285	0.0992	0.03664	\$ 12,221,690	585,049,618	\$36,617,871	0.06259	\$0.0628
Nov-18	293,246,308	\$29,114,819	0.0993	0.03674	\$ 10,774,651	546,813,830	\$34,198,751	0.06254	\$0.0628
Dec-18	390,539,328	\$38,728,984	0.0992	0.03676	\$ 14,355,760	723,999,658	\$45,184,197	0.06241	\$0.0624
2018					\$ 159,115,583				
Jan-19	427,157,682	\$43,418,593	0.1016	0.03933	\$ 16,801,378	812,076,570	\$50,602,429	0.06231	\$0.0624
Feb-19	409,457,250	\$41,604,430	0.1016	0.03909	\$ 16,004,844	796,906,477	\$49,823,213	0.06252	\$0.0624
Mar-19	354,491,497	\$35,972,425	0.1015	0.03640	\$ 12,903,673	689,041,448	\$44,839,796	0.06508	\$0.0653
Apr-19	276,398,536	\$27,913,502	0.1010	0.03603	\$ 9,958,333	540,966,730	\$35,141,826	0.06496	\$0.0653
May-19	238,234,910	\$24,289,237	0.1020	0.03730	\$ 8,885,933	469,843,318	\$30,378,165	0.06466	\$0.0653
Jun-19	313,578,024	\$31,662,364	0.1010	0.03915	\$ 12,275,465	616,899,529	\$38,139,690	0.06182	\$0.0621
Jul-19	443,878,090	\$44,378,294	0.1000	0.03807	\$ 16,900,651	891,084,892	\$55,161,346	0.06190	\$0.0621
Aug-19	495,583,618	\$49,254,282	0.0994	0.03741	\$ 18,540,450	959,732,284	\$59,479,481	0.06198	\$0.0621
Sep-19	392,380,681	\$38,881,717	0.0991	0.03668	\$ 14,393,067	780,930,186	\$48,738,194	0.06241	\$0.0626
Oct-19	298,562,741	\$29,643,220	0.0993	0.03693	\$ 11,025,031	587,342,412	\$36,626,311	0.06236	\$0.0626
Nov-19	251,524,036	\$25,160,408	0.1000	0.03781	\$ 9,510,247	518,476,398	\$32,260,292	0.06222	\$0.0626
Dec-19	357,408,769	\$35,000,536	0.0979	0.03697	\$ 13,215,032	741,982,782	\$45,226,840	0.06095	\$0.0611
2019					\$ 160,414,105				
Jan-20	398,554,727	\$39,112,502	0.0981	0.03708	\$ 14,778,442	830,348,056	\$50,697,529	0.06106	\$0.0611
Feb-20	343,151,687	\$33,650,124	0.0981	0.03720	\$ 12,765,833	711,926,836	\$43,328,031	0.06086	\$0.0611

Mar-20	296,375,994	\$29,062,427	0.0981	0.03858	\$ 11,434,033	628,793,845	\$37,400,552	0.05948	\$0.0597
Apr-20	276,773,531	\$27,129,222	0.0980	0.03857	\$ 10,674,467	580,508,802	\$34,512,441	0.05945	\$0.0597
					\$ 49,652,775				
					Total				
					\$ 733,197,940				

*The information in this Exhibit was derived from data in CAUSE-PA to PECO I-1(a) (Attachment), which provided the billing and usage data, and PECO Exhibit JAB-10, which provided PECO's historical price to compare (PTC).

CAUSE-PA EXHIBIT 2

Confirmed Low Income Shopping v. Confirmed Low Income Default Service (Non-CAP)

CAUSE-PA EXHIBIT 2
CONFIRMED LOW INCOME SHOPPING VS. CONFIRMED LOW INCOME DEFAULT SERVICE (NON-CAP)
2015-2020

Date	CLI Shopping (Non-CAP)						CLI Non-Shopping (Non-CAP)				
	Shopping Usage (kWh)	CLI Shopping Billed	Avg \$/kWh	Amt. Over Avg \$/kWh Over Default	Total Over Default	Total # CLI Shopping	Avg. Annual Over Default	CLI Non-Shopping Usage (kWh)	CLI Non-Shopping Billed	Avg \$/kWh	
2015	77,042,403	\$ 8,041,256	\$ 0.104	\$ 0.025	\$ 1,926,060.08	17,137	\$ 112.39	178,978,238	\$ 14,113,929	\$ 0.079	
2016	62,211,543	\$ 6,237,182	\$ 0.100	\$ 0.028	\$ 1,741,923.20	14,977	\$ 116.31	141,367,922	\$ 10,247,203	\$ 0.072	
2017	57,521,115	\$ 5,419,557	\$ 0.094	\$ 0.028	\$ 1,610,591.22	13,579	\$ 118.61	128,635,215	\$ 8,476,669	\$ 0.066	
2018	55,812,511	\$ 5,486,535	\$ 0.098	\$ 0.035	\$ 1,953,437.89	12,194	\$ 160.20	142,496,682	\$ 9,204,657	\$ 0.065	
2019	50,467,092	\$ 5,297,492	\$ 0.105	\$ 0.042	\$ 2,119,617.86	11,015	\$ 192.43	133,348,881	\$ 8,391,377	\$ 0.063	
*2020	13,364,917	\$ 1,356,437	\$ 0.101	\$ 0.040	\$ 534,596.68	5,019	\$ 106.51	33,733,288	\$ 2,042,546	\$ 0.061	

TOTAL \$9,886,226.93

* 2020 data includes January through April 2020

*The information in this Exhibit was derived from data in CAUSE-PA to PECO II-3(a) (Attachment), which provided the annual billing and usage data for confirmed low income customers from 2015 to April 2020. The figures exclude billing and usage data for low income customers enrolled in the Customer Assistance Program, as these customers are currently protected from competitive market pricing.

CAUSE-PA EXHIBIT 3
Confirmed Low Income Non-CAP Shopping by Zip Code

CAUSE-PA EXHIBIT 3

CONFIRMED LOW INCOME NON-CAP SHOPPING CUSTOMERS BY ZIP CODE

2016-2020

Zip Code	2020	2019	2018	2017	2016	% Poverty Rate	% Child Poverty	% White	% Black	% Hispanic
19134	104	433	502	460	537	41%	57%	35%	16%	46%
19124	97	432	442	516	623	34.30%	47%	14%	37%	41%
19140	86	404	475	548	563	42%	54%	3%	53%	42%
19132	69	336	374	366	345	39.40%	50%	3%	91%	3%
19013	68	328	301	379	389	33.90%	46%	16%	69%	12%
19143	65	392	400	464	463	30.60%	42%	12%	79%	4%
19144	61	256	286	294	311	29.80%	38%	16%	75%	4%
19139	60	340	393	399	384	36.50%	51%	6%	87%	3%
19120	59	310	427	402	477	29.10%	37%	6%	50%	31%
19401	52	183	170	199	239	18.90%	25%	37%	31%	23%
19082	50	230	280	259	310	19.50%	25%	21%	48%	7%
19121	48	235	268	240	252	48.70%	63%	13%	75%	6%
19142	47	248	240	231	290	33.10%	41%	6%	84%	3%
19149	42	180	203	250	274	22.10%	31%	34%	24%	22%
19135	40	162	198	186	237	21.40%	30%	45%	24%	23%
19141	38	210	199	226	235	28%	39%	4%	84%	4%
19133	36	243	258	243	267	51.70%	62%	4%	35%	59%
19023	34	175	210	176	220	22.40%	32%	26%	67%	4%
19104	34	154	156	202	190	45.40%	52%	35%	42%	5%
19136	30	115	118	136	155	18.40%	28%	64%	15%	14%
19145	28	135	155	173	210	21.40%	32%	48%	30%	6%
19148	28	90	111	147	178	22.30%	42%	56%	5%	14%
19151	28	110	161	166	209	18.30%	28%	6%	87%	4%
19138	26	202	222	200	221	22.10%	29%	3%	92%	2%
19050	26	111	112	125	138	10.50%	14%	23%	66%	3%
19464	25	130	134	167	192	12.30%	19%	74%	14%	5%
19131	24	219	229	221	212	33%	43%	11%	80%	3%

19111	23	130	170	174	223	17.60%	26%	44%	23%	20%
19146	22	97	144	162	158	17.50%	24%	45%	43%	5%
19320	21	156	163	170	199	11.40%	17%	65%	20%	9%
19007	16	47	67	83	105	16.60%	26%	63%	16%	15%
19079	15	52	60	68	70	16.40%	27%	16%	76%	6%
19152	14	45	70	66	100	14.40%	19%	53%	15%	13%
19026	13	40	48	53	82	7.80%	9%	74%	15%	5%
19020	13	51	94	101	110	11.40%	17%	66%	8%	10%
19057	12	22	26	30	50	10.80%	15%	81%	8%	9%
19032	11	21	24	30	40	8.20%	10%	50%	35%	11%
19154	11	44	43	62	71	8.20%	12%	78%	8%	8%
19119	11	71	73	84	70	10.40%	10%	31%	58%	3%
19116	10	28	41	48	56	13.70%	16%	67%	6%	6%
19128	10	33	34	43	42	9.90%	5%	77%	12%	4%
19018	10	50	59	60	79	9.50%	10%	72%	19%	2%
19015	10	42	45	55	50	13.50%	21%	68%	26%	3%
19114	9	38	53	70	64	10%	15%	76%	10%	9%
19061	9	60	52	69	67	11%	16%	83%	9%	3%
19115	9	29	36	51	60	12.20%	14%	68%	9%	8%
19067	9	38	52	67	70	3.70%	4%	81%	7%	5%
19126	9	68	76	93	85	25.30%	37%	5%	82%	5%
19090	8	20	30	24	19	8%	11%	70%	16%	5%
19078	8	13	16	25	19	5.80%	5%	93%	1%	3%
19153	7	33	35	69	50	22.20%	38%	12%	73%	7%
19129	7	11	15	27	16	15.60%	16%	52%	36%	4%
19150	6	74	72	91	106	12.60%	18%	2%	94%	1%
19122	6	57	65	86	86	33.80%	47%	28%	36%	28%
19044	6	7	16	10	9	2.40%	4%	78%	6%	5%
19382	6	17	24	28	33	10.70%	4%	86%	4%	3%
19063	6	11	14	19	16	3.50%	2%	86%	5%	3%
19038	6	19	20	22	33	5%	3%	77%	13%	4%
19022	6	13	24	23	35	23.80%	33%	58%	28%	5%
19348	5	7	17	10	23	6%	13%	69%	4%	21%
19021	5	18	26	27	42	11.70%	15%	80%	6%	8%

19123	5	30	38	22	34	19.40%	31%	48%	29%	10%
19125	5	31	44	64	72	17.50%	27%	75%	4%	13%
19054	5	13	17	20	18	4.70%	3%	84%	6%	5%
19055	5	15	16	24	30	4.50%	2%	87%	4%	6%
19056	5	11	13	19	23	5.20%	8%	78%	8%	6%
19468	5	23	26	25	32	6.80%	10%	86%	5%	2%
18901	5	5	14	9	12	5.60%	5%	90%	2%	4%
19363	4	25	18	28	32	8.70%	12%	77%	4%	16%
19403	4	15	29	23	37	5.10%	6%	76%	9%	4%
19405	4	13	17	15	18	11.20%	17%	75%	7%	12%
19070	4	3	7	13	10	5.20%	5%	80%	10%	2%
19147	4	50	41	42	48	11.20%	12%	66%	9%	9%
18974	4	28	25	42	48	5.30%	7%	85%	3%	7%
19001	4	15	15	20	17	5.10%	4%	71%	15%	6%
19137	4	18	26	22	37	18.70%	24%	88%	2%	9%
19390	3	6	5	13	12	8.70%	13%	73%	2%	23%
19438	3	9	17	14	26	3.30%	3%	88%	3%	3%
19064	3	4	10	12	8	2.30%	1%	92%	1%	1%
19335	3	28	24	39	32	4%	5%	83%	4%	5%
19311	3	6	8	10	5	7.60%	14%	59%	4%	33%
19029	3	4	11	10	14	16.20%	16%	97%	1%	1%
19094	3	12	15	19	21	13.90%	24%	84%	9%	4%
18966	3	11	12	12	24	3.50%	3%	95%	1%	1%
19426	3	6	14	15	24	3.40%	2%	79%	8%	3%
19365	3	6	9	15	19	7.40%	8%	85%	4%	6%
19446	3	10	16	19	33	5.10%	5%	75%	5%	4%
19380	3	10	16	19	22	5.40%	4%	84%	4%	5%
19043	3	5	6	5	6	10.70%	8%	95%	2%	0%
19047	3	15	22	21	24	5.40%	5%	84%	4%	5%
19475	3	11	20	25	33	9.80%	15%	88%	5%	3%
19003	2	11	8	14	18	7.80%	4%	75%	11%	6%
19008	2	6	7	9	13	3.10%	4%	85%	3%	1%
19454	2	6	8	12	17	4.90%	5%	73%	5%	2%
19130	2	25	36	33	28	12.60%	20%	65%	18%	6%

19355	2	9	11	9	7	4.30%	6%	81%	4%	3%
19030	2	8	16	10	16	6.30%	6%	83%	3%	5%
19006	2	2	6	13	16	4.60%	4%	82%	2%	2%
19033	2	6	9	10	14	4.60%	4%	86%	4%	7%
19096	2		3	3	4	4.20%	5%	76%	4%	4%
19036	2	16	31	24	29	11.90%	20%	85%	10%	2%
19341	2	5	6	6	8	4.60%	2%	73%	4%	4%
19083	2	10	13	19	20	2.60%	2%	88%	4%	2%
19002	2	11	14	15	23	5.90%	8%	80%	6%	4%
19087	2	7	12	6	12	4.20%	5%	80%	5%	4%
19004	2	3	8	4	6	5.70%	5%	81%	4%	3%
19040	2	9	9	14	19	4.30%	4%	87%	2%	6%
19428	2	13	19	22	24	7.20%	5%	86%	5%	3%
19014	2	6	9	23	21	6.20%	5%	87%	7%	1%
19460	2	8	23	33	36	6.50%	8%	81%	5%	7%
19095	2	3	4	5	4	10.90%	3%	51%	33%	5%
19107	2	7	12	7	24	23.30%	18%	55%	8%	5%
19317	1		1	2	2	4.80%	5%	78%	4%	2%
19072	1	3	4	2	2	3.50%	3%	84%	4%	4%
19330	1	1	2	2	7	6%	6%	89%	2%	6%
19074	1	6	10	8	11	6.20%	12%	88%	2%	2%
19422	1	7	5	11	10	2.80%	2%	76%	6%	3%
18938	1	2	5	5	7	4.30%	5%	92%	0%	3%
18976	1	8	14	6	11	4.60%	5%	84%	2%	7%
19076	1	13	8	15	18	10.60%	11%	86%	8%	0%
19027	1	10	18	17	21	8.60%	7%	49%	34%	5%
19362	1	1	4	8	13	5.80%	12%	87%	2%	11%
19406	1	2	10	7	12	4.20%	4%	66%	6%	5%
19046	1	5	7	17	19	5.60%	7%	85%	6%	4%
18074	1	1		1	1	5.10%	8%	97%	0%	1%
19010	1	4	10	3	2	10.10%	6%	76%	7%	4%
17314	1	1	6	4	13	14.20%	20%	95%	2%	1%
19012	1	6	10	3	11	6.90%	14%	49%	31%	7%
19473	1	11	7	8	11	5.70%	8%	88%	3%	5%

19118	1	3	2	3	3	6.60%	5%	65%	19%	7%
19127	1	5	5	4	11	22.90%	17%	81%	9%	5%
19053	1	23	11	22	35	4.80%	5%	87%	3%	3%
19086	1	3	4	4	5	4.20%	7%	82%	3%	2%
19301	1	3	2		4	4.90%	9%	83%	3%	4%
17302	1		4	3	7	6.50%	7%	95%	2%	1%
18054	1	3	4		2	5.10%	4%	91%	0%	4%
19443			1	1						
19375		1		1				100%	0%	0%
19478			1							
18914		2	7	5	6	4.40%	5%	88%	2%	3%
19421		1								
18915		2	1			6.80%	26%	89%	0%	0%
19462		3	2	5	7	4.30%	6%	76%	8%	5%
18916		2	4		4					
19367				1	1					
18917		2	7	1	6	10.10%	10%	82%	3%	11%
18929		3	2	4	5	1.60%	3%	93%	0%	1%
18923			1			1.10%	2%	94%	0%	2%
19009					1	10.50%	20%	84%	5%	5%
19041		1	1	3	2	2.90%	1%	87%	2%	3%
18958				1						
19085			1		2	5.60%	6%	83%	5%	4%
19081		5	4	4	3	3.40%	2%	86%	5%	2%
17309			1			2.90%	1%	84%	11%	0%
19492		3	1	1		12.50%	0%	99%	1%	0%
18969		1				10.50%	18%	87%	3%	5%
19373		1	1		1	3.20%	0%	73%	19%	4%
18925				1	3	2.60%	0%	88%	1%	1%
19066					1	2.60%	0%	90%	3%	2%
18971				1	1					
18957			1							
18934			3	2	1					
19425			3	2	5	2.60%	2%	79%	1%	3%

18940	7	4	7	5	4%	3%	86%	2%	2%
19440		1			4.80%	3%	69%	6%	6%
19052			1	1					
18084		1	1	1					
19102				5	14.30%	0%	73%	4%	5%
19457			2	2		0%	70%	0%	0%
19103		2	5	9	8.80%	2%	72%	6%	6%
19465	6	7	9	8	5.20%	6%	90%	3%	3%
19310	1	2		2	8.50%	8%	86%	5%	7%
17527			2		9.90%	16%	93%	1%	3%
19520				1	4.40%	7%	97%	1%	1%
18912				1		0%	100%	0%	0%
19312	2	5	4	6	3%	3%	82%	2%	1%
18931				1					
19316			1	3	3.80%	0%	100%	0%	0%
19369		1							
18977	1			2	2.70%	2%	91%	1%	2%
19374		2		4	32.90%	56%	26%	0%	74%
19318				2					
18950		1				0%	73%	16%	12%
18980		1			1.40%	0%	92%	1%	3%
19031	2	4	6	4	3.80%	0%	88%	4%	3%
18944		1	1	1	4.80%	5%	93%	1%	3%
18954	2	1		1	1.70%	2%	91%	1%	3%
19331				1					
19073	2	2	5	5	5.80%	5%	88%	1%	2%
19333	1		4	3	4.50%	0%	75%	4%	3%
19034		1	1		1.70%	0%	90%	3%	3%
19025	1		3	1	1.80%	1%	81%	3%	1%
19075	2	3	5	8	3.20%	2%	81%	8%	5%
18946		1		1					
19077		1	1						
19342	2	2	5	3	2%	1%	85%	5%	1%
19442		1		1		0%	0%	0%	0%

19343	1	2	3	3	3.10%	2%	90%	2%	4%
19444	1	2	2	7	4.80%	5%	90%	2%	3%
19344	2	4	5	6	9.40%	18%	94%	2%	2%
19453	1	2		2	12.90%	5%	87%	1%	7%
19060	1		2	1	2.40%	0%	82%	2%	1%
19456				2		0%	71%	13%	13%
19350	3	7	5	7	4%	7%	86%	1%	7%
18902	2		5	1	4.30%	6%	89%	1%	4%
19351	1	1	1						
18910	1								
19352	3	1	1	4	5.80%	11%	78%	13%	7%
18936	1					0%	0%	0%	0%
18947	1				4.70%	9%	93%	2%	5%
19474	3	1			8.60%	0%	100%	0%	0%
19357				1					
19477				1		0%	83%	17%	0%
19358	2		1	2	17%	27%	67%	16%	15%
19490		1							
19360	1								
18949		1		1					
18073		1			7.20%	13%	90%	3%	3%
19106	2	3	3	5	7.50%	0%	77%	8%	6%
Grand Total	1,832	8,637	9,908	10,681	12,001				

***The information in this Exhibit was derived from data in TURN to PECO I-7(a) (Attachment), which provided the shopping numbers for confirmed low income customers by zip code, along with census data by zip code from <https://censusreporter.org/> - which is based on the most recent US Census American Communities Study.**

CAUSE-PA STATEMENT 1
APPENDIX A
RESUME OF HARRY S. GELLER

RESUME OF HARRY S. GELLER

EDUCATIONAL BACKGROUND:

Harpur College, State University of New York at Binghamton, B.A. 1966

Washington College of Law, American University, J.D. 1969

New York University Law School, courses in Urban Affairs and Poverty Law, as part of
Volunteers in Service to America (VISTA) Program 1969-1971

EMPLOYMENT:

1988 – 2015 Executive Director, Pennsylvania Utility Law Project (PULP), a project of the civil non-profit Pennsylvania Legal Aid Network. PULP is dedicated to providing technical support, information sharing, and representation to low-income individuals and organizations, assisting and advocating for the low income in utility and energy matters. Responsibilities include project oversight, case consultation, co-counseling, and participation on task forces, work groups and advisory panels, community education and training in utility and energy matters affecting the low-income.

While at PULP, served in the following capacities:

- Chairman, Low-Income Home Energy Assistance Program (LIHEAP) Advisory Committee to the Secretary, Pennsylvania Department of Human Services
- Member, Pennsylvania Public Utility Commission, Consumer Advisory Council
- Coordinator, Pennsylvania Legal Services Utility/Energy Work Groups
- Member, Weatherization Policy Advisory Committee to the Department of Community and Economic Development
- Member, PECO Universal Service Advisory Committee and LIURP Subcommittee

1974-1987 Staff Attorney, Managing Attorney and ultimately, Executive Director of Legal Services, Incorporated (LSI), a civil legal services program serving Adams, Cumberland, Franklin and Fulton Counties. Through a restructuring with other legal services programs, LSI became part of what is now known as MidPenn Legal Services and Franklin County Legal Services.

1971-1972 Staff Attorney, New York City Legal Aid Society, Criminal Court and Supreme Court Branches, New York County.

1969-1971 Volunteer in Service to America (VISTA) assigned to the New York University Law School Project on Urban Affairs and Poverty Law.

BAR ADMISSIONS

New York State

Commonwealth of Pennsylvania

United States District Court, Middle District of Pennsylvania

Cases in which Harry S. Geller has participated as a witness before the Pennsylvania Public Utility Commission since July 1, 2015

- Pennsylvania Public Utility Commission v. Philadelphia Gas Works, R-2020-3017206
- Petition of PPL Electric Utilities Corporation for Approval of a Default Service Program for the Period of June 1, 2021 through May 31, 2025, Docket No. P-2020-3019356.
- Petition of PECO Energy Company for Approval of Its Default Service Program for the Period from June 1, 2021 through May 31, 2025, Docket No. P-2020-3019290.
- Petition of Duquesne Light Company For Approval of Default Service Plan For The Period June 1, 2021 Through May 31, 2025, Docket No. P-2020-3019522.
- Joint Application of Aqua America, Inc., Aqua Pennsylvania, Inc., Aqua Pennsylvania Wastewater, Inc., Peoples Natural Gas Company LLC and Peoples Gas Company LLC for all of the Authority and Necessary Certificates of Public Convenience to Approve a Change in Control of Peoples Natural Gas Company LLC, and Peoples Gas Company LLC by way of the Purchase of all of LDC Funding LLC's Membership Interests by Aqua America, Inc., Docket Nos. A-2018-3006061, A-2018-3006062, A-2018-3006063.
- Pennsylvania Public Utility Commission v. Aqua Pennsylvania, Inc. et al. Docket Nos. R-2018-3003558 et seq.
- Pennsylvania Public Utility Commission v. Duquesne Light Company, Docket No. R-2018-3000124.
- Pennsylvania Public Utility Commission v. PECO Energy Company- Electric Division, Docket No. R-2018-3000164.
- Joint Petition of Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company for Approval of their Default Service Programs for the period commencing June 1, 2019 through May 31, 2023, Docket Nos. P-2017-2637855, P-2017-2637857, P-2017-2637858; P-2017-2637866.
- Pennsylvania Public Utility Commission et al. v. Philadelphia Gas Works, Docket No. R-2017-2586783.
- PECO Energy Company's Pilot Plan for an Advance Payments Program and Petition for Temporary Waiver of Portions of the Commission's Regulations with Respect to that Plan, Docket No. P-2016-2573023.
- Petition of PECO Energy Company for Approval of a Default Service Program for the Period of June 1, 2017 through May 31, 2019, Docket No. P-2016-2534980.
- Petition of PPL Electric Utilities Corporation for Approval of a Default Service Program and Procurement Plan for the Period of June 1, 2017 through May 31, 2021, Docket No. P-2016-2526627.
- Petition of Duquesne Light Company for Approval of a Default Service Program for the Period of June 1, 2017 through May 31, 2021, Docket No. P-2016-2543140.
- Pennsylvania Public Utility Commission et al. v. Columbia Gas of Pennsylvania, Inc., Docket No. R-2016-2529660.
- Joint Petition of Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company for Approval of their Default Service Programs for the period commencing June 1, 2017 through May 31, 2019, Docket Nos. P-2015-2511333, P-2015-25113351, P-2015-2511355; P-2015-2511356.
- Petition of PPL Electric Utilities Corporation for Approval of its Energy Efficiency and Conservation Plan, Docket No. M-2015-2515642.

CAUSE-PA STATEMENT 1
APPENDIX B
CITED RESPONSES TO INTERROGATORIES

Appendix B
Cited Responses to Interrogatories

Interrogatories of the Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA to PECO I-1(a) (Attachment)
CAUSE-PA to PECO I-3
CAUSE-PA to PECO I-4(a) (Attachment)
CAUSE-PA to PECO I-5
CAUSE-PA to PECO I-11
CAUSE-PA to PECO I-12(a) (Attachment)
CAUSE-PA to PECO I-13(a) (Attachment)
CAUSE-PA to PECO I-14
CAUSE-PA to PECO I-25
CAUSE-PA to PECO I-26
CAUSE-PA to PECO I-28(a) (Attachment)
CAUSE-PA to PECO I-36(a) (Attachment)
CAUSE-PA to PECO I-38
CAUSE-PA to PECO II-3(a) (Attachment)
CAUSE-PA to PECO II-4

Interrogatories of the Tenant Union Representative Network and Action Alliance for Senior Citizens of Greater Philadelphia

TURN to PECO I-7(a) (Attachment)
TURN to PECO I-12(a) (Attachment)
TURN to PECO I-17
TURN to PECO I-18
TURN to PECO I-19

Interrogatories of the Office of Consumer Advocate

OCA to PECO I-5
OCA to PECO I-8
OCA to PECO I-10
OCA to PECO II-18(b) (Attachment)
OCA to PECO II-19
OCA to PECO II-20

Interrogatories of the Electric Suppliers Coalition

ESC to PECO I-8

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/04/2020

CAUSE-PA-I-1

Please provide the following for January 2015 through April 2020, disaggregated by month:

- (a) The total usage of residential, non-CAP shopping customers.
- (b) The total usage of residential, non-CAP non-shopping customers.
- (c) The total amount billed for generation supply charges for non-CAP residential shopping customers.
- (d) The total amount billed for generation supply charges for non-CAP residential non-shopping customers.

RESPONSE:

Please see Attachment CAUSE-PA-I-1(a) for the data requested in parts (a) – (d).

Responsible Witness: Carol Reilly

CAUSE-PA STATEMENT 1, APPENDIX B

Date	Usage Residential, non-CAP (kWh)		Billings for Generation Supply	
	Shopping (a)	Non-Shopping (b)	Charges for Residential, Non-CAP	
			Shopping (c)	Non-Shopping (d)
Jan-15	498,137,113	763,513,238	\$51,926,342	\$62,401,025
Feb-15	482,731,034	762,250,382	\$49,934,108	\$62,078,046
Mar-15	458,326,680	697,084,323	\$47,041,899	\$54,083,253
Apr-15	333,160,398	506,314,503	\$34,319,280	\$39,254,196
May-15	288,541,559	455,581,664	\$29,489,840	\$35,287,866
Jun-15	385,306,152	610,444,218	\$39,231,086	\$46,925,458
Jul-15	473,759,086	726,507,233	\$48,351,710	\$55,875,561
Aug-15	507,136,593	774,304,463	\$51,604,676	\$59,633,516
Sep-15	477,697,045	756,068,436	\$48,002,742	\$60,349,777
Oct-15	335,858,994	506,272,196	\$33,799,217	\$40,372,589
Nov-15	284,140,510	437,726,262	\$28,360,327	\$34,825,159
Dec-15	362,227,758	568,336,738	\$35,941,876	\$44,143,981
Jan-16	444,467,897	691,281,459	\$44,276,856	\$53,684,610
Feb-16	435,323,952	665,942,361	\$42,628,298	\$51,597,600
Mar-16	364,265,891	548,929,588	\$35,289,633	\$40,450,255
Apr-16	297,668,006	456,347,914	\$28,754,177	\$33,610,418
May-16	282,635,058	425,667,315	\$27,131,366	\$31,126,221
Jun-16	380,280,871	586,688,175	\$36,375,829	\$39,958,721
Jul-16	490,652,171	757,308,907	\$46,310,519	\$51,631,461
Aug-16	574,276,570	873,822,716	\$54,488,866	\$59,800,031
Sep-16	546,737,921	819,548,367	\$51,433,912	\$58,154,911
Oct-16	353,188,434	515,395,891	\$33,079,111	\$36,545,690
Nov-16	299,783,491	451,792,153	\$27,967,821	\$31,928,026
Dec-16	403,059,412	606,398,206	\$37,384,633	\$41,687,857
Jan-17	498,316,471	754,752,387	\$46,126,306	\$51,915,623
Feb-17	406,649,953	609,641,272	\$37,884,802	\$41,789,179
Mar-17	371,731,368	556,018,676	\$34,629,808	\$36,475,428
Apr-17	331,694,906	492,092,324	\$31,033,232	\$32,268,451
May-17	286,857,323	432,091,208	\$26,968,868	\$28,259,642
Jun-17	358,600,764	541,786,344	\$33,819,573	\$34,745,312
Jul-17	499,160,546	791,163,249	\$47,292,705	\$50,666,327
Aug-17	486,174,407	753,709,261	\$46,117,743	\$48,280,589
Sep-17	386,360,703	587,070,647	\$36,537,890	\$37,714,763
Oct-17	350,450,890	557,484,236	\$33,515,783	\$35,810,657
Nov-17	293,071,549	477,553,780	\$27,975,841	\$30,708,407
Dec-17	397,553,463	640,000,549	\$37,766,557	\$41,607,340
Jan-18	543,649,928	903,112,967	\$51,491,314	\$58,780,197
Feb-18	421,852,372	688,855,713	\$40,305,652	\$44,761,709
Mar-18	349,745,378	600,056,810	\$33,554,524	\$38,306,008
Apr-18	340,990,477	567,659,386	\$32,010,256	\$36,207,717
May-18	289,857,205	485,231,457	\$29,625,237	\$31,024,817
Jun-18	349,014,743	596,453,760	\$34,404,997	\$39,349,256
Jul-18	475,073,574	825,973,105	\$46,708,342	\$54,520,510

CAUSE-PA STATEMENT 1, APPENDIX B

Date	Usage Residential, non-CAP (kWh)		Billings for Generation Supply Charges for Residential, Non-CAP	
	Shopping (a)	Non-Shopping (b)	Shopping (c)	Non-Shopping (d)
Aug-18	488,318,729	860,050,878	\$48,240,989	\$56,537,101
Sep-18	484,046,272	840,119,624	\$47,603,734	\$52,574,936
Oct-18	333,564,688	585,049,618	\$33,099,285	\$36,617,871
Nov-18	293,246,308	546,813,830	\$29,114,819	\$34,198,751
Dec-18	390,539,328	723,999,658	\$38,728,984	\$45,184,197
Jan-19	427,157,682	812,076,570	\$43,418,593	\$50,602,429
Feb-19	409,457,250	796,906,477	\$41,604,430	\$49,823,213
Mar-19	354,491,497	689,041,448	\$35,972,425	\$44,839,796
Apr-19	276,398,536	540,966,730	\$27,913,502	\$35,141,826
May-19	238,234,910	469,843,318	\$24,289,237	\$30,378,165
Jun-19	313,578,024	616,899,529	\$31,662,364	\$38,139,690
Jul-19	443,878,090	891,084,892	\$44,378,294	\$55,161,346
Aug-19	495,583,618	959,732,284	\$49,254,282	\$59,479,481
Sep-19	392,380,681	780,930,186	\$38,881,717	\$48,738,194
Oct-19	298,562,741	587,342,412	\$29,643,220	\$36,626,311
Nov-19	251,524,036	518,476,398	\$25,160,408	\$32,260,292
Dec-19	357,408,769	741,982,782	\$35,000,536	\$45,226,840
Jan-20	398,554,727	830,348,056	\$39,112,502	\$50,697,529
Feb-20	343,151,687	711,926,836	\$33,650,124	\$43,328,031
Mar-20	296,375,994	628,793,845	\$29,062,427	\$37,400,552
Apr-20	276,773,531	580,508,802	\$27,129,222	\$34,512,441

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/04/2020

CAUSE-PA-I-3

Does PECO offer “rate ready billing” for any residential suppliers?

RESPONSE:

PECO does not offer “rate ready billing” to EGSs for any customer class. Please see the Company’s response to TURN-I-17 for a description of “bill ready billing.”

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company
To Interrogatories of the
The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania
CAUSE-PA Set I
Response Date: 06/04/2020

CAUSE-PA-I-4

For each month from January 2015 through April 2020, disaggregated by month, please provide:

- (a) the number of CAP customers who have reached their maximum CAP credit
- (b) for customers identified in (a), please specify the number of customers who are currently in arrears to PECO.

RESPONSE:

The maximum credit is determined on an annual basis, not a monthly basis. PECO does not have these data disaggregated on a monthly basis. Please see Attachment CAUSE-PA-I-4(a) for the data requested disaggregated on an annual basis.

Responsible Witness: Carol Reilly

a) The number of CAP customers who have reached t

Year	Count of Bill Account Nbr
2017	836
2018	1343
2019	535
2020	1
Grand Total	2715

b) For customers identified in (a), please specify the n

Balance As Of 4/30/2020 0:00

Year	Count of Bill Account Nbr
2017	202
2018	548
2019	263
Grand Total	1013

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/04/2020

CAUSE-PA-I-5

From 2015 to date in 2020, has a PECO CAP customer ever filed an informal or formal complaint against PECO regarding its restriction on CAP shopping?

RESPONSE:

PECO is not aware of any informal or formal complaints regarding its restriction on CAP shopping.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/04/2020

CAUSE-PA-I-11

Please explain how PECO defines the term “confirmed low income customer” and identify all of the categories of customers included in the term. Please also identify the length of time that a customer retains the designation “confirmed low income customer.”

RESPONSE:

PECO defines “confirmed low income customer” as a customer with a verified household income between 0% and 150% of the Federal Poverty Level in the two-year period prior to the month being analyzed.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/04/2020

CAUSE-PA-I-12

From 2015 to date in 2020, disaggregated by year, please provide the following:

- (a) The number of confirmed low income customers.
- (b) The number of confirmed low income customers (exclusive of CAP customers) who remained on default service for the entire year.
- (c) The number of confirmed low income customers (exclusive of CAP customers) who received generation supply for an electric generation supplier at some point during the calendar year.

RESPONSE:

Please see Attachment CAUSE-PA-I-12(a) for the data requested.

Responsible Witness: Carol Reilly

Year	Confirmed Low Income (a)	Confirmed Low Income excl CAP Customers with full year default service (b)	Confirmed Low Income excl CAP with Electric generation Supplier (c)
2015	233,456	95,443	17,955
2016	211,114	90,296	15,647
2017	174,653	69,243	10,878
2018	142,251	49,161	6,319
2019	119,654	30,060	6,102
2020	111,857	31,328	6,068

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/04/2020

CAUSE-PA-I-13

From 2015 to date in 2020, disaggregated by year and by month, please provide a chart comparing the actual billed supplier revenue with the revenue that would have been charged if those same customers had received service at the applicable price to compare. Please provide this data in a live Excel spreadsheet and pdf formats.

RESPONSE:

Please see Attachment CAUSE-PA-I-13(a) for the data requested. Please note that the data provided of "Supplier ¢ per kWh" is derived by dividing aggregate revenues and billings by aggregate usage for residential, small commercial and industrial ("C&I"), and large C&I customers, respectively. PECO does not have access to EGS rates for individual customers sufficient to make such a comparison at the customer level.

Responsible Witness: Carol Reilly

Residential	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015 Supplier Revenue (\$M)	\$ 51.9	\$ 49.9	\$ 47.0	\$ 34.3	\$ 29.5	\$ 39.2	\$ 48.4	\$ 51.6	\$ 48.0	\$ 33.8	\$ 28.4	\$ 35.9
Supplier Revenue @ PECO Rate (\$M)	\$ 45.2	\$ 42.5	\$ 39.5	\$ 28.7	\$ 24.0	\$ 31.4	\$ 38.5	\$ 42.3	\$ 40.2	\$ 28.3	\$ 23.9	\$ 30.1
2016 Supplier Revenue (\$M)	\$ 44.3	\$ 41.2	\$ 35.3	\$ 28.8	\$ 27.1	\$ 36.4	\$ 46.3	\$ 54.5	\$ 51.4	\$ 33.1	\$ 28.0	\$ 37.4
Supplier Revenue @ PECO Rate (\$M)	\$ 36.9	\$ 35.4	\$ 28.7	\$ 23.7	\$ 21.3	\$ 28.1	\$ 36.5	\$ 43.7	\$ 42.1	\$ 27.2	\$ 22.7	\$ 29.9
2017 Supplier Revenue (\$M)	\$ 44.2	\$ 36.5	\$ 34.6	\$ 29.9	\$ 27.0	\$ 33.8	\$ 47.3	\$ 46.1	\$ 36.5	\$ 33.5	\$ 28.0	\$ 37.8
Supplier Revenue @ PECO Rate (\$M)	\$ 37.1	\$ 29.6	\$ 26.4	\$ 23.5	\$ 20.2	\$ 25.2	\$ 35.3	\$ 34.4	\$ 27.4	\$ 24.6	\$ 20.9	\$ 28.7
2018 Supplier Revenue (\$M)	\$ 51.5	\$ 40.3	\$ 33.6	\$ 32.0	\$ 29.6	\$ 34.4	\$ 46.7	\$ 48.2	\$ 47.6	\$ 33.1	\$ 29.1	\$ 38.7
Supplier Revenue @ PECO Rate (\$M)	\$ 38.9	\$ 30.1	\$ 24.6	\$ 24.0	\$ 20.6	\$ 25.2	\$ 33.3	\$ 34.6	\$ 31.6	\$ 22.6	\$ 19.9	\$ 26.4
2019 Supplier Revenue (\$M)	\$ 43.4	\$ 41.6	\$ 36.0	\$ 27.9	\$ 24.3	\$ 31.7	\$ 44.4	\$ 49.3	\$ 38.9	\$ 29.6	\$ 25.2	\$ 35.0
Supplier Revenue @ PECO Rate (\$M)	\$ 29.1	\$ 28.5	\$ 25.0	\$ 19.5	\$ 16.3	\$ 21.0	\$ 29.9	\$ 33.5	\$ 26.5	\$ 20.2	\$ 17.0	\$ 23.7
2020 Supplier Revenue (\$M)	\$ 39.1	\$ 33.7	\$ 29.1	\$ 27.1								
Supplier Revenue @ PECO Rate (\$M)	\$ 26.8	\$ 22.9	\$ 19.3	\$ 18.1								

SC&I	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015 Supplier Revenue (\$M)	\$ 33.5	\$ 33.4	\$ 34.1	\$ 29.0	\$ 27.1	\$ 30.8	\$ 33.9	\$ 34.5	\$ 34.0	\$ 29.4	\$ 26.9	\$ 28.5
Supplier Revenue @ PECO Rate (\$M)	\$ 35.4	\$ 35.3	\$ 31.4	\$ 27.3	\$ 26.2	\$ 29.4	\$ 30.9	\$ 32.7	\$ 33.2	\$ 29.0	\$ 26.5	\$ 28.6
2016 Supplier Revenue (\$M)	\$ 32.0	\$ 30.1	\$ 29.0	\$ 25.4	\$ 26.8	\$ 28.7	\$ 34.3	\$ 36.8	\$ 35.7	\$ 29.8	\$ 26.6	\$ 29.5
Supplier Revenue @ PECO Rate (\$M)	\$ 32.2	\$ 31.3	\$ 28.7	\$ 25.7	\$ 24.9	\$ 23.0	\$ 28.4	\$ 29.1	\$ 28.2	\$ 25.0	\$ 22.1	\$ 21.4
2017 Supplier Revenue (\$M)	\$ 32.2	\$ 28.1	\$ 28.0	\$ 24.9	\$ 24.5	\$ 27.6	\$ 31.9	\$ 30.6	\$ 27.4	\$ 27.4	\$ 24.4	\$ 27.7
Supplier Revenue @ PECO Rate (\$M)	\$ 27.8	\$ 24.0	\$ 21.9	\$ 21.1	\$ 19.8	\$ 22.9	\$ 25.5	\$ 24.0	\$ 22.3	\$ 21.9	\$ 20.1	\$ 23.2
2018 Supplier Revenue (\$M)	\$ 32.5	\$ 29.5	\$ 24.4	\$ 24.1	\$ 23.8	\$ 26.0	\$ 30.4	\$ 30.5	\$ 31.7	\$ 25.2	\$ 23.2	\$ 28.3
Supplier Revenue @ PECO Rate (\$M)	\$ 34.9	\$ 23.8	\$ 20.4	\$ 21.8	\$ 20.4	\$ 23.8	\$ 26.5	\$ 26.3	\$ 27.0	\$ 21.3	\$ 20.4	\$ 25.0
2019 Supplier Revenue (\$M)	\$ 29.1	\$ 26.2	\$ 27.5	\$ 24.0	\$ 22.0	\$ 25.2	\$ 27.8	\$ 29.4	\$ 27.9	\$ 23.8	\$ 21.3	\$ 25.4
Supplier Revenue @ PECO Rate (\$M)	\$ 25.3	\$ 23.6	\$ 26.6	\$ 21.5	\$ 19.1	\$ 18.0	\$ 23.4	\$ 25.0	\$ 22.6	\$ 20.6	\$ 18.7	\$ 21.5
2020 Supplier Revenue (\$M)	\$ 26.3	\$ 24.8	\$ 21.8	\$ 17.8								
Supplier Revenue @ PECO Rate (\$M)	\$ 22.6	\$ 21.8	\$ 16.7	\$ 14.6								

LC&I	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2015 Supplier Revenue (\$M)	\$ 33.5	\$ 34.5	\$ 34.7	\$ 33.0	\$ 31.5	\$ 34.7	\$ 36.7	\$ 33.0	\$ 37.3	\$ 37.3	\$ 30.6	\$ 30.2
Supplier Revenue @ PECO Rate (\$M)	\$ 28.6	\$ 46.6	\$ 54.5	\$ 28.6	\$ 25.2	\$ 41.3	\$ 19.7	\$ 27.9	\$ 33.3	\$ 30.4	\$ 26.3	\$ 22.3
2016 Supplier Revenue (\$M)	\$ 35.3	\$ 29.2	\$ 30.1	\$ 27.4	\$ 30.8	\$ 29.4	\$ 34.6	\$ 39.2	\$ 36.7	\$ 32.5	\$ 29.3	\$ 32.7
Supplier Revenue @ PECO Rate (\$M)	\$ 37.7	\$ 27.7	\$ 21.8	\$ 23.6	\$ 25.5	\$ 15.9	\$ 28.9	\$ 33.7	\$ 25.0	\$ 22.9	\$ 26.1	\$ 16.9
2017 Supplier Revenue (\$M)	\$ 30.3	\$ 28.9	\$ 30.7	\$ 26.5	\$ 28.3	\$ 30.0	\$ 33.3	\$ 29.4	\$ 30.8	\$ 31.0	\$ 28.5	\$ 30.1
Supplier Revenue @ PECO Rate (\$M)	\$ 31.8	\$ 25.8	\$ 23.2	\$ 22.5	\$ 24.2	\$ 25.2	\$ 28.7	\$ 16.6	\$ 26.6	\$ 23.1	\$ 25.1	\$ 21.3
2018 Supplier Revenue (\$M)	\$ 31.6	\$ 31.8	\$ 24.3	\$ 26.2	\$ 23.6	\$ 25.9	\$ 34.2	\$ 31.1	\$ 34.4	\$ 25.5	\$ 24.6	\$ 32.0
Supplier Revenue @ PECO Rate (\$M)	\$ 57.5	\$ 25.1	\$ 19.6	\$ 24.3	\$ 22.8	\$ 28.6	\$ 30.1	\$ 30.4	\$ 27.5	\$ 24.9	\$ 23.7	\$ 31.7
2019 Supplier Revenue (\$M)	\$ 27.9	\$ 24.9	\$ 26.9	\$ 27.7	\$ 23.3	\$ 25.5	\$ 27.0	\$ 27.7	\$ 28.9	\$ 26.3	\$ 22.5	\$ 30.0
Supplier Revenue @ PECO Rate (\$M)	\$ 25.6	\$ 27.5	\$ 26.0	\$ 27.5	\$ 20.5	\$ 15.1	\$ 21.0	\$ 24.7	\$ 17.6	\$ 18.4	\$ 18.5	\$ 17.6
2020 Supplier Revenue (\$M)	\$ 26.9	\$ 26.4	\$ 23.8	\$ 20.0								
Supplier Revenue @ PECO Rate (\$M)	\$ 25.5	\$ 21.2	\$ 13.8	\$ 12.4								

Residential Electric

2015	<u>Usage:</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
a	MwH Sold by PECO	907,972	885,921	770,550	534,118	634,454	783,870	900,063	897,571	739,271	509,376	561,267	666,799
b	MwH Sold by Others	498,183	480,732	456,458	330,805	287,166	383,220	470,137	505,335	475,067	334,300	284,873	360,744
	<u>Billings:</u>												
c	PECO Energy + Transmission (\$M)	\$ 82.4	\$ 78.3	\$ 66.7	\$ 46.3	\$ 52.9	\$ 64.2	\$ 73.6	\$ 75.1	\$ 62.6	\$ 43.1	\$ 47.1	\$ 55.6
d	Supplier Billings (\$M)	\$ 51.9	\$ 49.9	\$ 47.0	\$ 34.3	\$ 29.5	\$ 39.2	\$ 48.4	\$ 51.6	\$ 48.0	\$ 33.8	\$ 28.4	\$ 35.9
	<u>Estimate of Imputed Avg Rate</u>												
e	PECO ¢ per kwh (c/a/10)	9.07	8.83	8.65	8.67	8.34	8.19	8.18	8.37	8.47	8.47	8.40	8.34
f	Supplier ¢ per kwh (d/b/10)	10.42	10.39	10.31	10.37	10.27	10.24	10.28	10.21	10.10	10.11	9.96	9.96
g	Supplier Revenue \$M (d)	\$ 51.9	\$ 49.9	\$ 47.0	\$ 34.3	\$ 29.5	\$ 39.2	\$ 48.4	\$ 51.6	\$ 48.0	\$ 33.8	\$ 28.4	\$ 35.9
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 45.2	\$ 42.5	\$ 39.5	\$ 28.7	\$ 24.0	\$ 31.4	\$ 38.5	\$ 42.3	\$ 40.2	\$ 28.3	\$ 23.9	\$ 30.1
2016	<u>Usage:</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
a	MwH Sold by PECO	857,596	735,073	605,991	555,318	541,608	768,225	1,030,900	1,019,356	719,761	515,545	581,778	802,686
b	MwH Sold by Others	442,698	433,581	361,985	298,299	281,262	378,088	487,858	570,838	543,948	351,638	298,434	400,293
	<u>Billings:</u>												
c	PECO Energy + Transmission (\$M)	\$ 71.4	\$ 60.0	\$ 48.1	\$ 44.1	\$ 41.0	\$ 57.1	\$ 77.1	\$ 78.0	\$ 55.8	\$ 39.8	\$ 44.2	\$ 60.0
d	Supplier Billings (\$M)	\$ 44.3	\$ 41.2	\$ 35.3	\$ 28.8	\$ 27.1	\$ 36.4	\$ 46.3	\$ 54.5	\$ 51.4	\$ 33.1	\$ 28.0	\$ 37.4
	<u>Estimate of Imputed Avg Rate</u>												
e	PECO ¢ per kwh (c/a/10)	8.33	8.17	7.94	7.94	7.57	7.43	7.48	7.65	7.75	7.72	7.60	7.47
f	Supplier ¢ per kwh (d/b/10)	10.00	9.50	9.75	9.64	9.65	9.62	9.49	9.55	9.46	9.41	9.37	9.34
g	Supplier Revenue \$M (d)	\$ 44.3	\$ 41.2	\$ 35.3	\$ 28.8	\$ 27.1	\$ 36.4	\$ 46.3	\$ 54.5	\$ 51.4	\$ 33.1	\$ 28.0	\$ 37.4
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 36.9	\$ 35.4	\$ 28.7	\$ 23.7	\$ 21.3	\$ 28.1	\$ 36.5	\$ 43.7	\$ 42.1	\$ 27.2	\$ 22.7	\$ 29.9
2017	<u>Usage:</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
a	MwH Sold by PECO	776,553	669,933	703,118	498,607	523,502	756,622	945,878	796,792	656,548	559,699	600,153	843,566
b	MwH Sold by Others	498,247	405,101	370,376	329,304	286,419	357,482	496,197	483,076	384,563	347,905	291,788	396,876
	<u>Billings:</u>												
c	PECO Energy + Transmission (\$M)	\$ 57.8	\$ 49.0	\$ 50.2	\$ 35.6	\$ 36.9	\$ 53.4	\$ 67.3	\$ 56.7	\$ 46.7	\$ 39.7	\$ 42.9	\$ 61.0
d	Supplier Billings (\$M)	\$ 44.2	\$ 36.5	\$ 34.6	\$ 29.9	\$ 27.0	\$ 33.8	\$ 47.3	\$ 46.1	\$ 36.5	\$ 33.5	\$ 28.0	\$ 37.8
	<u>Estimate of Imputed Avg Rate</u>												
e	PECO ¢ per kwh (c/a/10)	7.44	7.31	7.13	7.14	7.05	7.06	7.11	7.11	7.12	7.08	7.16	7.23
f	Supplier ¢ per kwh (d/b/10)	8.88	9.01	9.35	9.08	9.42	9.46	9.53	9.55	9.50	9.63	9.59	9.52
g	Supplier Revenue \$M (d)	\$ 44.2	\$ 36.5	\$ 34.6	\$ 29.9	\$ 27.0	\$ 33.8	\$ 47.3	\$ 46.1	\$ 36.5	\$ 33.5	\$ 28.0	\$ 37.8
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 37.1	\$ 29.6	\$ 26.4	\$ 23.5	\$ 20.2	\$ 25.2	\$ 35.3	\$ 34.4	\$ 27.4	\$ 24.6	\$ 20.9	\$ 28.7
2018	<u>Usage:</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
a	MwH Sold by PECO	971,058	677,696	745,388	575,438	588,578	761,478	1,026,618	1,014,804	716,987	685,067	752,042	772,775
b	MwH Sold by Others	541,534	420,218	348,316	339,456	287,325	347,915	472,302	486,472	483,706	333,152	293,723	388,868
	<u>Billings:</u>												

Residential Electric

c	PECO Energy + Transmission (\$M)	\$ 69.7	\$ 48.5	\$ 52.7	\$ 40.7	\$ 42.2	\$ 55.1	\$ 72.4	\$ 72.2	\$ 46.9	\$ 46.5	\$ 51.1	\$ 52.6
d	Supplier Billings (\$M)	\$ 51.5	\$ 40.3	\$ 33.6	\$ 32.0	\$ 29.6	\$ 34.4	\$ 46.7	\$ 48.2	\$ 47.6	\$ 33.1	\$ 29.1	\$ 38.7
Estimate of Imputed Avg Rate													
e	PECO ¢ per kwh (c/a/10)	7.18	7.15	7.07	7.07	7.17	7.24	7.06	7.12	6.54	6.79	6.79	6.80
f	Supplier ¢ per kwh (d/b/10)	9.50	9.59	9.63	9.43	10.31	9.89	9.89	9.92	9.84	9.94	9.91	9.96
g	Supplier Revenue \$M (d)	\$ 51.5	\$ 40.3	\$ 33.6	\$ 32.0	\$ 29.6	\$ 34.4	\$ 46.7	\$ 48.2	\$ 47.6	\$ 33.1	\$ 29.1	\$ 38.7
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 38.9	\$ 30.1	\$ 24.6	\$ 24.0	\$ 20.6	\$ 25.2	\$ 33.3	\$ 34.6	\$ 31.6	\$ 22.6	\$ 19.9	\$ 26.4

2019

Usage:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
a	MwH Sold by PECO	957,639	840,682	708,737	533,503	619,881	783,804	1,154,982	946,400	718,503	571,699	718,281	860,480
b	MwH Sold by Others	426,392	407,819	353,009	275,043	237,064	310,768	442,283	492,613	389,398	296,275	252,337	355,743
Billings:													
c	PECO Energy + Transmission (\$M)	\$ 65.3	\$ 58.7	\$ 50.2	\$ 37.8	\$ 42.6	\$ 52.9	\$ 78.0	\$ 64.3	\$ 48.9	\$ 38.9	\$ 48.5	\$ 57.4
d	Supplier Billings (\$M)	\$ 43.4	\$ 41.6	\$ 36.0	\$ 27.9	\$ 24.3	\$ 31.7	\$ 44.4	\$ 49.3	\$ 38.9	\$ 29.6	\$ 25.2	\$ 35.0
Estimate of Imputed Avg Rate													
e	PECO ¢ per kwh (c/a/10)	6.82	6.98	7.08	7.08	6.87	6.75	6.75	6.80	6.81	6.80	6.75	6.68
f	Supplier ¢ per kwh (d/b/10)	10.18	10.20	10.19	10.15	10.25	10.19	10.03	10.00	9.99	10.01	9.97	9.84
g	Supplier Revenue \$M (d)	\$ 43.4	\$ 41.6	\$ 36.0	\$ 27.9	\$ 24.3	\$ 31.7	\$ 44.4	\$ 49.3	\$ 38.9	\$ 29.6	\$ 25.2	\$ 35.0
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 29.1	\$ 28.5	\$ 25.0	\$ 19.5	\$ 16.3	\$ 21.0	\$ 29.9	\$ 33.5	\$ 26.5	\$ 20.2	\$ 17.0	\$ 23.7

2020

Usage:		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
a	MwH Sold by PECO	872,306	751,830	674,537	634,599								
b	MwH Sold by Others	398,060	340,722	296,126	275,713								
Billings:													
c	PECO Energy + Transmission (\$M)	\$ 58.8	\$ 50.5	\$ 44.0	\$ 41.7								
d	Supplier Billings (\$M)	\$ 39.1	\$ 33.7	\$ 29.1	\$ 27.1								
Estimate of Imputed Avg Rate													
e	PECO ¢ per kwh (c/a/10)	6.74	6.71	6.52	6.57								
f	Supplier ¢ per kwh (d/b/10)	9.83	9.88	9.81	9.84								
g	Supplier Revenue \$M (d)	\$ 39.1	\$ 33.7	\$ 29.1	\$ 27.1								
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 26.8	\$ 22.9	\$ 19.3	\$ 18.1								

SC&I Electric													
2015	Usage:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
a	MwH Sold by PECO	233,349	202,232	200,576	162,242	175,060	186,171	208,879	209,714	192,460	152,042	151,897	182,058
b	MwH Sold by Others	378,206	377,294	364,643	312,496	309,224	349,639	379,046	390,089	387,284	337,208	308,304	329,266
	Billings:												
c	PECO Energy + Transmission (\$M)	\$ 21.8	\$ 18.9	\$ 17.3	\$ 14.2	\$ 14.9	\$ 15.7	\$ 17.0	\$ 17.6	\$ 16.5	\$ 13.1	\$ 13.1	\$ 15.8
d	Supplier Billings (\$M)	\$ 33.5	\$ 33.4	\$ 34.1	\$ 29.0	\$ 27.1	\$ 30.8	\$ 33.9	\$ 34.5	\$ 34.0	\$ 29.4	\$ 26.9	\$ 28.5
	Estimate of Imputed Avg Rate												
e	PECO ¢ per kwh (c/a/10)	9.36	9.34	8.62	8.75	8.49	8.41	8.16	8.40	8.58	8.59	8.61	8.69
f	Supplier ¢ per kwh (d/b/10)	8.87	8.86	9.37	9.27	8.78	8.80	8.95	8.83	8.79	8.72	8.71	8.67
g	Supplier Revenue \$M (d)	\$ 33.5	\$ 33.4	\$ 34.1	\$ 29.0	\$ 27.1	\$ 30.8	\$ 33.9	\$ 34.5	\$ 34.0	\$ 29.4	\$ 26.9	\$ 28.5
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 35.4	\$ 35.3	\$ 31.4	\$ 27.3	\$ 26.2	\$ 29.4	\$ 30.9	\$ 32.7	\$ 33.2	\$ 29.0	\$ 26.5	\$ 28.6
2016	Usage:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
a	MwH Sold by PECO	204,942	181,817	172,700	156,389	147,937	177,800	203,674	205,043	177,060	142,338	146,076	179,549
b	MwH Sold by Others	368,397	365,715	338,378	302,613	319,199	340,283	401,994	432,627	423,309	354,288	319,520	351,631
	Billings:												
c	PECO Energy + Transmission (\$M)	\$ 17.9	\$ 15.6	\$ 14.6	\$ 13.3	\$ 11.6	\$ 12.0	\$ 14.4	\$ 13.8	\$ 11.8	\$ 10.0	\$ 10.1	\$ 10.9
d	Supplier Billings (\$M)	\$ 32.0	\$ 30.1	\$ 29.0	\$ 25.4	\$ 26.8	\$ 28.7	\$ 34.3	\$ 36.8	\$ 35.7	\$ 29.8	\$ 26.6	\$ 29.5
	Estimate of Imputed Avg Rate												
e	PECO ¢ per kwh (c/a/10)	8.74	8.57	8.47	8.51	7.81	6.76	7.07	6.73	6.67	7.05	6.91	6.09
f	Supplier ¢ per kwh (d/b/10)	8.68	8.22	8.58	8.38	8.41	8.43	8.53	8.50	8.42	8.40	8.34	8.40
g	Supplier Revenue \$M (d)	\$ 32.0	\$ 30.1	\$ 29.0	\$ 25.4	\$ 26.8	\$ 28.7	\$ 34.3	\$ 36.8	\$ 35.7	\$ 29.8	\$ 26.6	\$ 29.5
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 32.2	\$ 31.3	\$ 28.7	\$ 25.7	\$ 24.9	\$ 23.0	\$ 28.4	\$ 29.1	\$ 28.2	\$ 25.0	\$ 22.1	\$ 21.4
2017	Usage:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
a	MwH Sold by PECO	186,611	153,422	185,755	146,419	153,003	185,155	207,510	244,514	110,281	179,067	153,423	192,599
b	MwH Sold by Others	406,918	360,819	343,994	327,342	303,759	345,619	395,977	382,027	352,764	345,739	311,020	356,943
	Billings:												
c	PECO Energy + Transmission (\$M)	\$ 12.7	\$ 10.2	\$ 11.8	\$ 9.4	\$ 10.0	\$ 12.2	\$ 13.4	\$ 15.3	\$ 7.0	\$ 11.3	\$ 9.9	\$ 12.5
d	Supplier Billings (\$M)	\$ 32.2	\$ 28.1	\$ 28.0	\$ 24.9	\$ 24.5	\$ 27.6	\$ 31.9	\$ 30.6	\$ 27.4	\$ 27.4	\$ 24.4	\$ 27.7
	Estimate of Imputed Avg Rate												
e	PECO ¢ per kwh (c/a/10)	6.82	6.66	6.35	6.45	6.51	6.61	6.44	6.27	6.32	6.33	6.46	6.49
f	Supplier ¢ per kwh (d/b/10)	7.91	7.80	8.15	7.61	8.08	7.99	8.05	8.00	7.77	7.91	7.84	7.75
g	Supplier Revenue \$M (d)	\$ 32.2	\$ 28.1	\$ 28.0	\$ 24.9	\$ 24.5	\$ 27.6	\$ 31.9	\$ 30.6	\$ 27.4	\$ 27.4	\$ 24.4	\$ 27.7
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 27.8	\$ 24.0	\$ 21.9	\$ 21.1	\$ 19.8	\$ 22.9	\$ 25.5	\$ 24.0	\$ 22.3	\$ 21.9	\$ 20.1	\$ 23.2
2018	Usage:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

SC&I Electric

a	MwH Sold by PECO	222,879	182,151	183,503	163,221	171,442	184,954	216,527	218,444	191,109	187,097	181,836	178,532
b	MwH Sold by Others	415,504	371,903	322,153	329,808	306,602	351,042	391,369	398,696	422,390	332,651	306,266	373,842

Billings:

c	PECO Energy + Transmission (\$M)	\$ 18.7	\$ 11.7	\$ 11.6	\$ 10.8	\$ 11.4	\$ 12.5	\$ 14.7	\$ 14.4	\$ 12.2	\$ 12.0	\$ 12.1	\$ 11.9
d	Supplier Billings (\$M)	\$ 32.5	\$ 29.5	\$ 24.4	\$ 24.1	\$ 23.8	\$ 26.0	\$ 30.4	\$ 30.5	\$ 31.7	\$ 25.2	\$ 23.2	\$ 28.3

Estimate of Imputed Avg Rate

e	PECO ¢ per kwh (c/a/10)	8.40	6.40	6.32	6.60	6.67	6.78	6.77	6.61	6.39	6.40	6.65	6.68
f	Supplier ¢ per kwh (d/b/10)	7.82	7.92	7.59	7.31	7.76	7.39	7.76	7.64	7.51	7.59	7.57	7.58

g	Supplier Revenue \$M (d)	\$ 32.5	\$ 29.5	\$ 24.4	\$ 24.1	\$ 23.8	\$ 26.0	\$ 30.4	\$ 30.5	\$ 31.7	\$ 25.2	\$ 23.2	\$ 28.3
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 34.9	\$ 23.8	\$ 20.4	\$ 21.8	\$ 20.4	\$ 23.8	\$ 26.5	\$ 26.3	\$ 27.0	\$ 21.3	\$ 20.4	\$ 25.0

2019

	Usage:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
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a	MwH Sold by PECO	206,834	207,640	173,463	170,575	170,299	195,043	228,642	217,571	189,956	167,216	169,365	211,921
b	MwH Sold by Others	391,436	349,777	407,788	321,082	297,023	305,114	382,853	405,820	387,844	337,785	299,982	360,014

Billings:

c	PECO Energy + Transmission (\$M)	\$ 13.4	\$ 14.0	\$ 11.3	\$ 11.4	\$ 11.0	\$ 11.5	\$ 14.0	\$ 13.4	\$ 11.1	\$ 10.2	\$ 10.5	\$ 12.6
d	Supplier Billings (\$M)	\$ 29.1	\$ 26.2	\$ 27.5	\$ 24.0	\$ 22.0	\$ 25.2	\$ 27.8	\$ 29.4	\$ 27.9	\$ 23.8	\$ 21.3	\$ 25.4

Estimate of Imputed Avg Rate

e	PECO ¢ per kwh (c/a/10)	6.46	6.74	6.52	6.69	6.44	5.89	6.12	6.16	5.82	6.08	6.23	5.96
f	Supplier ¢ per kwh (d/b/10)	7.43	7.48	6.74	7.47	7.40	8.26	7.26	7.24	7.19	7.05	7.10	7.06

g	Supplier Revenue \$M (d)	\$ 29.1	\$ 26.2	\$ 27.5	\$ 24.0	\$ 22.0	\$ 25.2	\$ 27.8	\$ 29.4	\$ 27.9	\$ 23.8	\$ 21.3	\$ 25.4
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 25.3	\$ 23.6	\$ 26.6	\$ 21.5	\$ 19.1	\$ 18.0	\$ 23.4	\$ 25.0	\$ 22.6	\$ 20.6	\$ 18.7	\$ 21.5

2020

	Usage:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
--	---------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

a	MwH Sold by PECO	211,325	187,481	181,781	137,729								
b	MwH Sold by Others	375,335	354,311	311,384	257,076								

Billings:

c	PECO Energy + Transmission (\$M)	\$ 12.7	\$ 11.5	\$ 9.8	\$ 7.8								
d	Supplier Billings (\$M)	\$ 26.3	\$ 24.8	\$ 21.8	\$ 17.8								

Estimate of Imputed Avg Rate

e	PECO ¢ per kwh (c/a/10)	6.03	6.15	5.38	5.68								
f	Supplier ¢ per kwh (d/b/10)	7.02	7.00	7.01	6.92								

g	Supplier Revenue \$M (d)	\$ 26.3	\$ 24.8	\$ 21.8	\$ 17.8								
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 22.6	\$ 21.8	\$ 16.7	\$ 14.6								

LC&I Electric

2015	<u>Usage:</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
a	MwH Sold by PECO	56,277	51,543	40,981	42,171	37,844	42,647	52,033	52,736	35,310	46,523	33,105	46,318
b	MwH Sold by Others	479,436	477,721	474,078	457,122	436,003	489,573	518,685	453,321	521,223	526,620	428,505	422,851
	<u>Billings:</u>												
c	PECO Energy + Transmission (\$M)	\$ 3.4	\$ 5.0	\$ 4.7	\$ 2.6	\$ 2.2	\$ 3.6	\$ 2.0	\$ 3.3	\$ 2.3	\$ 2.7	\$ 2.0	\$ 2.4
d	Supplier Billings (\$M)	\$ 33.5	\$ 34.5	\$ 34.7	\$ 33.0	\$ 31.5	\$ 34.7	\$ 36.7	\$ 33.0	\$ 37.3	\$ 37.3	\$ 30.6	\$ 30.2
	<u>Estimate of Imputed Avg Rate</u>												
e	PECO ¢ per kwh (c/a/10)	5.96	9.75	11.50	6.26	5.78	8.45	3.80	6.16	6.39	5.76	6.14	5.29
f	Supplier ¢ per kwh (d/b/10)	6.98	7.22	7.32	7.22	7.22	7.09	7.08	7.27	7.15	7.09	7.13	7.14
g	Supplier Revenue \$M (d)	\$ 33.5	\$ 34.5	\$ 34.7	\$ 33.0	\$ 31.5	\$ 34.7	\$ 36.7	\$ 33.0	\$ 37.3	\$ 37.3	\$ 30.6	\$ 30.2
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 28.6	\$ 46.6	\$ 54.5	\$ 28.6	\$ 25.2	\$ 41.3	\$ 19.7	\$ 27.9	\$ 33.3	\$ 30.4	\$ 26.3	\$ 22.3
	<u>Usage:</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
a	MwH Sold by PECO	46,742	44,508	32,932	28,822	36,917	46,786	35,681	37,010	29,015	27,937	28,426	60,467
b	MwH Sold by Others	494,149	472,360	438,535	397,099	453,348	430,031	499,667	564,944	532,656	473,791	426,431	470,836
	<u>Billings:</u>												
c	PECO Energy + Transmission (\$M)	\$ 3.6	\$ 2.6	\$ 1.6	\$ 1.7	\$ 2.1	\$ 1.7	\$ 2.1	\$ 2.2	\$ 1.4	\$ 1.3	\$ 1.7	\$ 2.2
d	Supplier Billings (\$M)	\$ 35.3	\$ 29.2	\$ 30.1	\$ 27.4	\$ 30.8	\$ 29.4	\$ 34.6	\$ 39.2	\$ 36.7	\$ 32.5	\$ 29.3	\$ 32.7
	<u>Estimate of Imputed Avg Rate</u>												
e	PECO ¢ per kwh (c/a/10)	7.64	5.86	4.98	5.94	5.64	3.70	5.79	5.97	4.70	4.83	6.11	3.60
f	Supplier ¢ per kwh (d/b/10)	7.14	6.19	6.86	6.89	6.80	6.85	6.92	6.94	6.88	6.87	6.87	6.95
g	Supplier Revenue \$M (d)	\$ 35.3	\$ 29.2	\$ 30.1	\$ 27.4	\$ 30.8	\$ 29.4	\$ 34.6	\$ 39.2	\$ 36.7	\$ 32.5	\$ 29.3	\$ 32.7
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 37.7	\$ 27.7	\$ 21.8	\$ 23.6	\$ 25.5	\$ 15.9	\$ 28.9	\$ 33.7	\$ 25.0	\$ 22.9	\$ 26.1	\$ 16.9
	<u>Usage:</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
a	MwH Sold by PECO	23,646	34,877	35,277	28,720	34,366	37,385	46,302	36,882	36,521	38,362	33,209	49,714
b	MwH Sold by Others	539,301	466,811	473,304	487,204	440,967	467,084	525,586	454,217	493,213	495,292	468,119	491,775
	<u>Billings:</u>												
c	PECO Energy + Transmission (\$M)	\$ 1.4	\$ 1.9	\$ 1.7	\$ 1.3	\$ 1.9	\$ 2.0	\$ 2.5	\$ 1.3	\$ 2.0	\$ 1.8	\$ 1.8	\$ 2.2
d	Supplier Billings (\$M)	\$ 30.3	\$ 28.9	\$ 30.7	\$ 26.5	\$ 28.3	\$ 30.0	\$ 33.3	\$ 29.4	\$ 30.8	\$ 31.0	\$ 28.5	\$ 30.1
	<u>Estimate of Imputed Avg Rate</u>												
e	PECO ¢ per kwh (c/a/10)	5.89	5.53	4.91	4.62	5.49	5.39	5.45	3.65	5.40	4.67	5.35	4.34
f	Supplier ¢ per kwh (d/b/10)	5.62	6.18	6.48	5.43	6.42	6.42	6.34	6.48	6.24	6.25	6.09	6.12
g	Supplier Revenue \$M (d)	\$ 30.3	\$ 28.9	\$ 30.7	\$ 26.5	\$ 28.3	\$ 30.0	\$ 33.3	\$ 29.4	\$ 30.8	\$ 31.0	\$ 28.5	\$ 30.1
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 31.8	\$ 25.8	\$ 23.2	\$ 22.5	\$ 24.2	\$ 25.2	\$ 28.7	\$ 16.6	\$ 26.6	\$ 23.1	\$ 25.1	\$ 21.3
	<u>Usage:</u>	<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>

2018

Appendix B 17

LC&I Electric

a	MwH Sold by PECO	56,739	35,770	43,114	36,429	28,042	31,674	33,674	35,537	33,390	33,100	23,547	41,519
b	MwH Sold by Others	500,201	487,513	397,503	438,110	391,027	476,434	503,215	492,373	562,929	419,332	401,175	515,842

Billings:

c	PECO Energy + Transmission (\$M)	\$ 6.5	\$ 1.8	\$ 2.1	\$ 2.0	\$ 1.6	\$ 1.9	\$ 2.0	\$ 2.2	\$ 1.6	\$ 2.0	\$ 1.4	\$ 2.5
d	Supplier Billings (\$M)	\$ 31.6	\$ 31.8	\$ 24.3	\$ 26.2	\$ 23.6	\$ 25.9	\$ 34.2	\$ 31.1	\$ 34.4	\$ 25.5	\$ 24.6	\$ 32.0

Estimate of Imputed Avg Rate

e	PECO ¢ per kwh (c/a/10)	11.50	5.16	4.93	5.56	5.83	6.00	5.98	6.18	4.88	5.95	5.91	6.14
f	Supplier ¢ per kwh (d/b/10)	6.31	6.52	6.12	5.99	6.05	5.43	6.80	6.31	6.11	6.09	6.14	6.21

g	Supplier Revenue \$M (d)	\$ 31.6	\$ 31.8	\$ 24.3	\$ 26.2	\$ 23.6	\$ 25.9	\$ 34.2	\$ 31.1	\$ 34.4	\$ 25.5	\$ 24.6	\$ 32.0
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 57.5	\$ 25.1	\$ 19.6	\$ 24.3	\$ 22.8	\$ 28.6	\$ 30.1	\$ 30.4	\$ 27.5	\$ 24.9	\$ 23.7	\$ 31.7

2019**Usage:**

		<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
a	MwH Sold by PECO	33,311	31,661	47,687	30,505	37,020	62,841	51,287	44,564	52,319	49,357	47,702	64,325
b	MwH Sold by Others	460,157	418,306	447,079	457,958	386,402	430,345	475,554	467,732	505,330	466,455	399,330	517,412

Billings:

c	PECO Energy + Transmission (\$M)	\$ 1.9	\$ 2.1	\$ 2.8	\$ 1.8	\$ 2.0	\$ 2.2	\$ 2.3	\$ 2.4	\$ 1.8	\$ 1.9	\$ 2.2	\$ 2.2
d	Supplier Billings (\$M)	\$ 27.9	\$ 24.9	\$ 26.9	\$ 27.7	\$ 23.3	\$ 25.5	\$ 27.0	\$ 27.7	\$ 28.9	\$ 26.3	\$ 22.5	\$ 30.0

Estimate of Imputed Avg Rate

e	PECO ¢ per kwh (c/a/10)	5.56	6.56	5.82	6.01	5.29	3.52	4.42	5.28	3.49	3.94	4.63	3.40
f	Supplier ¢ per kwh (d/b/10)	6.07	5.94	6.03	6.05	6.04	5.94	5.68	5.91	5.72	5.63	5.63	5.80

g	Supplier Revenue \$M (d)	\$ 27.9	\$ 24.9	\$ 26.9	\$ 27.7	\$ 23.3	\$ 25.5	\$ 27.0	\$ 27.7	\$ 28.9	\$ 26.3	\$ 22.5	\$ 30.0
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 25.6	\$ 27.5	\$ 26.0	\$ 27.5	\$ 20.5	\$ 15.1	\$ 21.0	\$ 24.7	\$ 17.6	\$ 18.4	\$ 18.5	\$ 17.6

2020**Usage:**

		<u>Jan</u>	<u>Feb</u>	<u>Mar</u>	<u>Apr</u>	<u>May</u>	<u>Jun</u>	<u>Jul</u>	<u>Aug</u>	<u>Sep</u>	<u>Oct</u>	<u>Nov</u>	<u>Dec</u>
a	MwH Sold by PECO	36,012	50,959	47,341	31,256								
b	MwH Sold by Others	471,259	470,125	424,566	362,374								

Billings:

c	PECO Energy + Transmission (\$M)	\$ 2.0	\$ 2.3	\$ 1.5	\$ 1.1								
d	Supplier Billings (\$M)	\$ 26.9	\$ 26.4	\$ 23.8	\$ 20.0								

Estimate of Imputed Avg Rate

e	PECO ¢ per kwh (c/a/10)	5.42	4.52	3.25	3.42								
f	Supplier ¢ per kwh (d/b/10)	5.70	5.61	5.61	5.52								

g	Supplier Revenue \$M (d)	\$ 26.9	\$ 26.4	\$ 23.8	\$ 20.0								
h	Supplier Revenue @ PECO Rate \$M (b*e*10)	\$ 25.5	\$ 21.2	\$ 13.8	\$ 12.4								

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/04/2020

CAUSE-PA-I-14

Please provide a list of any and all unregulated non-basic energy products or services that PECO allows to be placed on a customer's utility bill, including the cost and/or range of costs for each product or service each month.

RESPONSE:

PECO does not allow any unregulated non-basic energy products or services to be placed on a customer's utility bill.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

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To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/01/2020

CAUSE-PA-I-25

See PECO St. 2 at 24-25 and JAB-6. Please identify whether the estimated \$1.2M implementation costs for PECO's CAP Shopping proposal include any ongoing implementation costs. If not, please provide an estimate of the costs to administer CAP Shopping on an ongoing basis, after the program is implemented.

RESPONSE:

The estimated \$1.2M implementation cost for PECO's CAP Shopping proposal does not include any ongoing implementation costs. PECO has not estimated those costs, which will be based on the final design of the CAP Shopping Plan approved by the Commission in this proceeding.

Responsible Witness: Joseph A. Bisti

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/01/2020

CAUSE-PA-I-26

Please provide a copy of PECO's CAP Shopping education plan, along with any related documents. If no plan is available, please explain why not and identify PECO's process for developing and executing an education plan.

RESPONSE:

PECO's proposed customer education initiatives for the CAP Shopping Plan are described in PECO Statement 3, page 12, line 6. A detailed plan and related documents will be developed after the Commission enters its final Order in this proceeding and PECO receives notices of intent to participate as a CAP supplier from at least five EGSs.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

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PECO Energy Company

Petition of PECO Energy Company for Approval of
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Response of PECO Energy Company
To Interrogatories of the
The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania
CAUSE-PA Set I
Response Date: 06/01/2020

CAUSE-PA-I-28

See PECO's response to TURN I-3. Please identify the number of CAP rejection letters sent to consumers from January 2015 to April 2020, disaggregated by year.

RESPONSE:

Please find the number of letters sent when a customer who receives electric generation service from an electric generation supplier tries to enroll in CAP in Attachment CAUSE-PA-I-28(a).

Responsible Witness: Carol Reilly

Volume of CAP Letter - Customer with active Supplier tries to enroll in CAP

	Jan	Feb	Mar	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Total
2015	1	2	15	4	10	11	7	12	17	5	3	3	90
2016	0	6	6	7	6	15	29	7	1	10	19	4	110
2017	4	29	62	20	35	24	12	14	13	14	2	5	234
2018	6	1	1	2	1	0	0	1	0	0	5	10	27
2019	18	9	7	13	4	1	3	0	0	1	0	7	63
2020	12	7	4	1									24
Total	41	54	95	47	56	51	51	34	31	30	29	29	548

Pennsylvania Public Utility Commission

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Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set I

Response Date: 06/01/2020

CAUSE-PA-I-36

Does PECO identify the rate that a residential shopping customer is currently paying for electricity on its monthly bill, as compared to the currently applicable Price to Compare? Please provide a copy of a sample residential customer bill.

RESPONSE:

Yes. Please see Attachment CAUSE-PA-I-36(a) for a sample residential customer bill.

Responsible Witness: Carol Reilly



An Exelon Company
Page 1 of 2

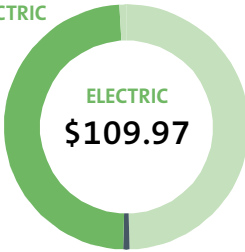
Name: PECO RESIDENTIAL CUSTOMER
Account Number: 10000-10001
Phone Number: 555-123-4567
Service Address: 123 Main St, Any Town

Emergency and Repair

! 800-841-4141

This is the number to call to report power outages, gas leaks or odors, and safety hazards related to PECO Equipment.

PECO ELECTRIC DELIVERY



TAXES & FEES

ELECTRIC SUPPLY
Electric Supplier ABC
2301 Market St.
SUITE 01
PHILADELPHIA PA 19101
555-456-7890
WWW.ELECSUPPLIERABC.COM

Billing Summary

Bill Date **06/23/2017**
Thank you for your payment of \$113.26 on 06/13/2017

Current Period Charges

Electric **\$109.97**

Total New Charges \$109.97

Total Amount Due on 07/17/2017 \$109.97

General Information

Next scheduled meter reading: 07/26/2017

1-800-494-4000

If you have any questions or concerns, please call 800-494-4000 before the due date. Si tiene alguna pregunta, favor de llamar al numero 1-800-494-4000 antes de la fecha de vencimiento.

peco.com/service

Customer Self Service - Manage Your Account 24/7
Start, stop and move your service

Online: peco.com

In Person: **2301 Market St., Philadelphia, PA 19103**

By Phone: **1-800-494-4000**

Return only this portion with your check made payable to PECO. Please write your account number on your check.



An Exelon Company
2301 Market Street
Philadelphia, PA 19103-1380

Pay Today!

peco.com/ebill

Go paperless: receive and pay your bill online.

- Enroll in Automatic Payment. *Complete form on reverse side.*
- Pledge a donation to MEAF. *Complete form on reverse side.*

Account # 10000-10001

877-432-9384

Pay by phone, a convenience fee will apply (\$2.35 fee)

Please pay this amount by 07/17/2017 \$109.97

Payment Amount \$

0000003 01 SP 0.460 **SNGLP H1 1 0168 17772 -C22-B1-P00000-1123 5 78

PECO RESIDENTIAL CUSTOMER
123 MAIN ST
ANY TOWN, PA 17772



PECO - Payment Processing
PO Box 37629
Philadelphia, PA 19101-0629

0168-21-0000003-0001-0000001



An Exelon Company
 Page 1 of 2

Account Number: 10000-10001

Meter Information

Read Dates	Meter Number	Load Type	Reading Type	Meter Reading		Difference	Multiplier X	Total Usage
				Previous	Present			
05/23-06/22	124719458	General Service	Tot kWh	24677 Actual	25367 Actual	690	1	690
05/23-06/22	133006129	General Service	Total Ccf	3054 Actual	3068 Actual	14	1.14	16

Total kWh Used: 690
 Total Ccf Used: 16



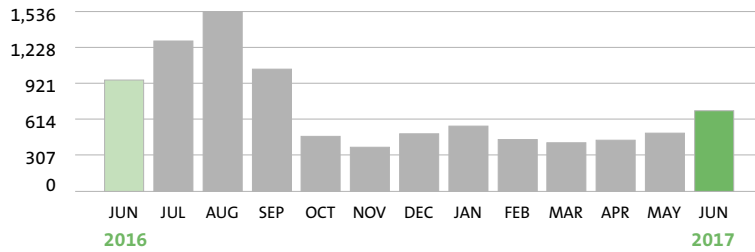
Electric Residential Service

Service Period 05/23/2017 to 06/22/2017 - 30 days

PECO ELECTRIC DELIVERY	\$54.16
Customer Charge	8.45
Distribution Charges	690 kWh X 0.06624 = 45.71
ELECTRIC SUPPLY	\$55.82
Supplier Logo Placed Here	
Electric Supplier ABC Charges (555-456-7890)	
SUPPLIER MESSAGE	55.82
Sales Tax	0.00
TAXES & FEES	-\$0.01
State Tax Adjustment	-0.01
Total Current Charges	\$109.97

Your Usage Profile
 ANNUAL ELECTRIC USAGE

peco.com/smartideas
 Save energy and money



Period	Usage	Avg Daily Usage	Days	Avg Daily Temp
Current Month	690	23.0	30	71
Last Month	499	17.2	29	63
Last Year	955	31.8	30	73

Avg kWh per Month: 690
 Total Annual kWh Usage: 8,280

Message Center

From PECO:

New charges contain estimated total state taxes of \$4.30, including \$6.48 for State Gross Receipts Tax.

Your estimated electric price to compare is \$0.0711 per kWh. This may change in March, June, September and December. For more information and supplier offers visit PAPowerSwitch.com and oca.state.pa.us.

From Electric Supplier ABC:

Electric Supplier message displays here.

Shopping Information Box

When shopping for a competitive electric supplier, please provide the following:

Account Number: 10000-10001

Electric Rate: Electric Residential Service

If you are purchasing the energy you use from a competitive supplier, it is important to understand the terms of your contract and expiration date.



Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company
To Interrogatories of the
The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania
CAUSE-PA Set I
Response Date: 06/01/2020

CAUSE-PA-I-38

See PECO's response to TURN I-17: "PECO has a 'bill ready' billing platform and does not receive EGS pricing information (i.e. EGS rate in cents per kWh) at any time that would show whether EGS rates are higher or lower than the PTC." Please explain how PECO complies with 52 Pa. Code § 54.4(b)(3)(i)(A) ("Generation charges shall be presented in a standard pricing unit for electricity in actual dollars or cents per kWh, actual average dollars or cents per kWh, kW or other Commission-approved standard pricing unit.")

RESPONSE:

PECO's default service charges are presented on the customer's bill in dollars per kWh in accordance with the Commission's regulations at 52 Pa. Code § 54.4(b)(3)(i)(A). For EGSs, PECO's current Electronic Data Interchange ("EDI") 810 protocol includes a free text comment field where EGSs have the option, but not obligation, to describe their generation charges as defined in the PUC Electronic Data Exchange Working Group standards (e.g., in dollars or cents per kWh). If an EGS completes this field as part of an EDI 810 transaction, PECO will place the description on the bill as shown in Attachment CAUSE-PA-I-36(a).

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

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PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania
CAUSE-PA Set II

Response Date: 06/18/2020

CAUSE-PA-II-3

See Attachment CAUSE-PA I-1(a). Please amend this chart to also include the following:

- (1) the number of non-CAP confirmed low income customers for each month;
- (2) the number of non-CAP confirmed low income shopping customers for each month; and
- (3) the number of non-CAP confirmed low income non-shopping customers for each month.

Please provide the full revised chart in both PDF and live Excel spreadsheet formats.

RESPONSE:

Based upon the data request as amended, please see Attachment CAUSE-PA-II-3(a).

PECO has been asked several discovery questions that inquire about the number of non-CAP confirmed low-income customers, and about which of those non-CAP confirmed low-income customers have shopped. These questions include TURN I-7, TURN II-5, CAUSE-PA I-12, and this question, CAUSE PA II-3. Each of the questions was worded somewhat differently; consequently, in attempting to answer each question, PECO approached the data slightly differently in an attempt to answer each of the specific questions. We have reviewed each of the answers to those questions in preparing the response to this request.

Responsible Witness: Carol Reilly

The table below contains Accounts, Generation Charges and Usage (kWh) for Customers with a verified Financial Poverty Level between 0 and 150 in the 2 year period prior to and including the analysis year end or year-to-date month. Tariff Rates were used as filters to obtain the Shopping and Non Shopping breakouts.

	April YTD 2020	2019	2018	2017	2016	2015
-number of non-CAP confirmed low income shopping customers	5,019	11,015	12,194	13,576	14,977	17,137
-number of non-CAP confirmed low income non-shopping customer	12,711	30,371	34,659	37,711	43,060	49,813
-total amount billed for generation supply charges for non-CAP confirmed low income shopping customers	\$1,356,437	\$5,297,492	\$5,486,535	\$5,419,557	\$6,237,182	\$8,041,256
-total amount billed for generation supply charges for non-CAP confirmed low income non-shopping customers	\$2,042,546	\$8,391,377	\$9,204,657	\$8,476,669	\$10,247,203	\$14,113,929
-total usage for non-CAP confirmed low income shopping customers (kWh)	13,364,917	50,467,092	55,812,511	57,521,115	64,211,543	77,042,403
-total usage for non-CAP confirmed low income non-shopping customers (kWh)	33,733,288	133,348,881	142,496,682	128,635,215	141,367,922	178,978,238

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

The Coalition for Affordable Utility Services and Energy Efficiency in Pennsylvania

CAUSE-PA Set II

Response Date: 06/12/2020

CAUSE-PA-II-4

Please confirm or deny whether PECO intends to file a Petition or otherwise seek Commission approval to re-design its Customer Assistance Program to calculate benefits based on a customer's Percentage of Income as opposed to its current Fixed Credit Option program design. If so, please indicate the timeframe for such action.

RESPONSE:

PECO confirms it intends to file a Petition to seek Commission approval to re-design its Customer Assistance Program to calculate benefits based on a customer's Percentage of Income as opposed to its current Fixed Credit Option program design. PECO plans to file the Petition by June 30, 2020.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company
To Interrogatories of the
Tenant Union Representative Network
TURN Set I

Response Date: 05/18/2020

TURN-I-7

For each calendar year, 2016 through current year to date, please provide a table setting forth, by zip code, how many confirmed non-CAP low income customers selected electric supply from an EGS.

RESPONSE:

Please see Attachment TURN-I-7(a).

Responsible Witness: Carol Reilly

Verified Low Income (FPL = 01-150)						
Income Verified Within The Year						
Sum of Bill Account Count	Column Labels					
Row Labels	2020	2019	2018	2017	2016	
19134	104	433	502	460	537	
19124	97	432	442	516	623	
19140	86	404	475	548	563	
19132	69	336	374	366	345	
19013	68	328	301	379	389	
19143	65	392	400	464	463	
19144	61	256	286	294	311	
19139	60	340	393	399	384	
19120	59	310	427	402	477	
19401	52	183	170	199	239	
19082	50	230	280	259	310	
19121	48	235	268	240	252	
19142	47	248	240	231	290	
19149	42	180	203	250	274	
19135	40	162	198	186	237	
19141	38	210	199	226	235	
19133	36	243	258	243	267	
19023	34	175	210	176	220	
19104	34	154	156	202	190	
19136	30	115	118	136	155	
19145	28	135	155	173	210	
19148	28	90	111	147	178	
19151	28	110	161	166	209	
19138	26	202	222	200	221	
19050	26	111	112	125	138	
19464	25	130	134	167	192	
19131	24	219	229	221	212	
19111	23	130	170	174	223	
19146	22	97	144	162	158	
19320	21	156	163	170	199	
19007	16	47	67	83	105	
19079	15	52	60	68	70	
19152	14	45	70	66	100	
19026	13	40	48	53	82	
19020	13	51	94	101	110	
19057	12	22	26	30	50	
19032	11	21	24	30	40	
19154	11	44	43	62	71	
19119	11	71	73	84	70	
19116	10	28	41	48	56	
19128	10	33	34	43	42	
19018	10	50	59	60	79	
19015	10	42	45	55	50	

19114	9	38	53	70	64
19061	9	60	52	69	67
19115	9	29	36	51	60
19067	9	38	52	67	70
19126	9	68	76	93	85
19090	8	20	30	24	19
19078	8	13	16	25	19
19153	7	33	35	69	50
19129	7	11	15	27	16
19150	6	74	72	91	106
19122	6	57	65	86	86
19044	6	7	16	10	9
19382	6	17	24	28	33
19063	6	11	14	19	16
19038	6	19	20	22	33
19022	6	13	24	23	35
19348	5	7	17	10	23
19021	5	18	26	27	42
19123	5	30	38	22	34
19125	5	31	44	64	72
19054	5	13	17	20	18
19055	5	15	16	24	30
19056	5	11	13	19	23
19468	5	23	26	25	32
18901	5	5	14	9	12
19363	4	25	18	28	32
19403	4	15	29	23	37
19405	4	13	17	15	18
19070	4	3	7	13	10
19147	4	50	41	42	48
18974	4	28	25	42	48
19001	4	15	15	20	17
19137	4	18	26	22	37
19390	3	6	5	13	12
19438	3	9	17	14	26
19064	3	4	10	12	8
19335	3	28	24	39	32
19311	3	6	8	10	5
19029	3	4	11	10	14
19094	3	12	15	19	21
18966	3	11	12	12	24
19426	3	6	14	15	24
19365	3	6	9	15	19
19446	3	10	16	19	33
19380	3	10	16	19	22
19043	3	5	6	5	6
19047	3	15	22	21	24

19475	3	11	20	25	33
19003	2	11	8	14	18
19008	2	6	7	9	13
19454	2	6	8	12	17
19130	2	25	36	33	28
19355	2	9	11	9	7
19030	2	8	16	10	16
19006	2	2	6	13	16
19033	2	6	9	10	14
19096	2		3	3	4
19036	2	16	31	24	29
19341	2	5	6	6	8
19083	2	10	13	19	20
19002	2	11	14	15	23
19087	2	7	12	6	12
19004	2	3	8	4	6
19040	2	9	9	14	19
19428	2	13	19	22	24
19014	2	6	9	23	21
19460	2	8	23	33	36
19095	2	3	4	5	4
19107	2	7	12	7	24
19317	1		1	2	2
19072	1	3	4	2	2
19330	1	1	2	2	7
19074	1	6	10	8	11
19422	1	7	5	11	10
18938	1	2	5	5	7
18976	1	8	14	6	11
19076	1	13	8	15	18
19027	1	10	18	17	21
19362	1	1	4	8	13
19406	1	2	10	7	12
19046	1	5	7	17	19
18074	1	1		1	1
19010	1	4	10	3	2
17314	1	1	6	4	13
19012	1	6	10	3	11
19473	1	11	7	8	11
19118	1	3	2	3	3
19127	1	5	5	4	11
19053	1	23	11	22	35
19086	1	3	4	4	5
19301	1	3	2		4
17302	1		4	3	7
18054	1	3	4		2
19443			1	1	

19375	1		1	
19478		1		
18914	2	7	5	6
19421	1			
18915	2	1		
19462	3	2	5	7
18916	2	4		4
19367			1	1
18917	2	7	1	6
18929	3	2	4	5
18923		1		
19009				1
19041	1	1	3	2
18958			1	
19085		1		2
19081	5	4	4	3
17309		1		
19492	3	1	1	
18969	1			
19373	1	1		1
18925			1	3
19066				1
18971			1	1
18957		1		
18934		3	2	1
19425		3	2	5
18940	7	4	7	5
19440		1		
19052			1	1
18084		1	1	1
19102				5
19457			2	2
19103		2	5	9
19465	6	7	9	8
19310	1	2		2
17527			2	
19520				1
18912				1
19312	2	5	4	6
18931				1
19316			1	3
19369		1		
18977	1			2
19374		2		4
19318				2
18950		1		
18980		1		

19031	2	4	6	4
18944		1	1	1
18954	2	1		1
19331				1
19073	2	2	5	5
19333	1		4	3
19034		1	1	
19025	1		3	1
19075	2	3	5	8
18946		1		1
19077		1	1	
19342	2	2	5	3
19442		1		1
19343	1	2	3	3
19444	1	2	2	7
19344	2	4	5	6
19453	1	2		2
19060	1		2	1
19456				2
19350	3	7	5	7
18902	2		5	1
19351	1	1	1	
18910	1			
19352	3	1	1	4
18936	1			
18947	1			
19474	3	1		
19357				1
19477				1
19358	2		1	2
19490		1		
19360	1			
18949		1		1
18073		1		
19106	2	3	3	5
Grand Total	1,832	8,637	9,908	10,681
			12,001	

CAUSE-PA STATEMENT 1, APPENDIX B
Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company
To Interrogatories of the
Tenant Union Representative Network
TURN Set I

Response Date: 05/18/2020

TURN-I-12

Reference Q&A 21 of PECO St. 2 (Bisti). Is PECO aware of any third-party analyses of the impact of TOU rates on low income customers? If so, please provide copies of those analyses.

RESPONSE:

Please refer to Attachments TURN-I-12(a) thru TURN-I-12(d).

Please also refer to Attachment TURN-I-12(e), specifically Q&A 29 on Page 20 and associated Exhibit AF-20 on Page 38.

Responsible Witness: Joseph A. Bisti

ARTICLES

<https://doi.org/10.1038/s41560-019-0507-y>nature
energy

Health and financial impacts of demand-side response measures differ across sociodemographic groups

Lee V. White^{1,2,3*} and Nicole D. Sintov¹

Demand-side response (DSR) measures, which facilitate the integration of high shares of intermittent renewable generation into electric grids, are gaining prominence. DSR measures, such as time-of-use (TOU) rates, charge higher rates during high-demand 'on-peak' times. These rates may disproportionately impact the energy bills and health of vulnerable households, defined as those who face greater energy needs combined with greater social and financial pressures. Here we examine 7,487 households that took part in a randomized control TOU pilot in the southwestern United States. We found that assignment to TOU rather than control disproportionately increases bills for households with elderly and disabled occupants, and predicts worse health outcomes for households with disabled and ethnic minority occupants than those for non-vulnerable counterparts. These results suggest that vulnerable groups should be considered separately in DSR rate design, and future pilots should seek to determine which designs most effectively avoid exacerbating existing energy injustices or creating new ones.

To mitigate climate change, electricity grids need to integrate large shares of renewable generation. Some renewables, such as solar, are variable and cannot be generated according to market needs, which creates challenges in matching supply with demand. Demand-side response (DSR) measures are gaining prominence as a way to align demand with non-dispatchable supply. The residential sector accounts for 30–40% of electricity consumption across the Organisation for Economic Co-operation and Development countries, which makes it a prime target for DSR¹. Decision makers, such as the California Public Utilities Commission, are enacting policies that require default enrolment in DSR programmes², which can yield participation rates that exceed 80% (ref. ³); other entities may follow⁴. Thus, DSR is poised to soon reach millions of households, which highlights the need to understand whether the costs and benefits of DSR are distributed evenly across sociodemographic groups.

DSR measures typically use price signals to attempt to shift demand away from high-demand 'on-peak' times. Static time-of-use (TOU) rates are a common DSR measure that aim to shift electricity use away from on-peak times using a fixed rate schedule with more expensive on-peak times. For households that already struggle with electricity bills, this can be detrimental^{5–8}. Households suffering from energy poverty are forced to make trade-offs between paying for electricity bills versus other necessities, such as food and medicine^{9,10}. TOU and other forms of DSR may worsen this trade-off pressure, often termed 'the heat or eat dilemma'.

The term 'energy poverty' broadly refers to a confluence of factors that result in the inability to maintain a dwelling at a comfortable and healthy temperature, failure of which is associated with increased mortality and morbidity, and having to make decisions between paying for electricity or other necessities such as food^{11,12}. Energy poverty is often considered synonymous with 'fuel poverty'¹³, and assesses the same sets of concerns addressed by some definitions of energy insecurity¹⁴.

Energy poverty can be considered a state of being in which households face an inability to meet both energy and other costs necessary to live a decent life⁵. In contrast, energy vulnerability is dynamic, with energy-vulnerable households characterized as those that "face a combination of more intense and non-negotiable energy needs as well as a lack of social and/or financial capital"¹⁵. Energy-vulnerable households have a limited capacity to adapt to changing circumstances, such as TOU assignment⁸.

Further, energy-vulnerable groups face energy injustices: procedural injustice in limited access to information, policy participation and legal rights; distributional injustice in inequalities in income, energy prices and housing efficiency; and injustice in recognition, which is a lack of recognition of the differential needs of energy-vulnerable groups, and an unequal accordance of respect¹⁶. Walker and Day¹⁷ provide in-depth discussions of these topics. Below, we draw on energy poverty and energy justice literature to define vulnerability indicators.

Low-income households face pressure to curtail energy costs, often with negative impacts⁸. For instance, during winter months with high heating bills, low-income households curtail energy use to thermally uncomfortable levels⁶. Electricity shut-offs that result from utility debt can exacerbate both physical and mental health conditions⁷, and low incomes are linked to a higher likelihood of mortality during extreme heat events^{18–20}. Lower incomes are linked to distributional injustices, which include higher likelihood of living in inefficient buildings with poor insulation and less efficient appliances, which means these homes are more expensive to heat (or cool) than others^{21,22,23}.

Elderly people are at risk of recognition injustices. They require a narrower band of temperatures for health²⁴ and suffer exacerbated mortality during both extreme heat and extreme cold if unable to maintain the appropriate temperatures^{25–28}. As a case in point, heat waves in Italy and France in 2003 were associated with higher mortality rates for elderly individuals^{17,19}. Elderly people also experience

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Table 1 | Definition of vulnerability on each indicator used in the quantitative analyses

Low income	Enrolled in electric utility financial aid programme; some eligible households probably did not complete the enrolment process, so this indicator may be imperfect
Elderly	Someone over the age of 65 resides in the household
Young children	Someone under the age of 6 resides in the household
Disability	Someone in the household has a disability or serious medical condition that requires the 'home to be cool in the summer', or that requires them to 'use more energy for medical equipment'; although this does not cover the full range of reasons for which a person with a disability may need to use additional energy, available data preclude such a nuanced examination
Hispanic	Respondent identified as Hispanic. Respondents that identified as non-Hispanic white are considered non-vulnerable. Other households (for example, those that identified as Asian American) could not be considered non-vulnerable in terms of ethnicity/race. Thus, all analyses using the Hispanic vulnerability indicator use a subsample that comprises only Hispanic and non-Hispanic white participants, and the Hispanic indicator is not included as a control in other analyses
African American	Respondent identified as African American. All analyses using the African American vulnerability indicator use a subsample that comprises only African American and non-Hispanic white respondents, and the African American indicator is not included as a control in other analyses

Supplementary Table 1 gives descriptive statistics. The survey question text is provided in Methods.

greater difficulty paying for food during seasons with high heating or cooling needs, compared to the general population⁷.

Families with young children experience heightened pressures and thus are at risk of recognition injustices. Households with children bear additional costs associated with ensuring that children are well fed and healthy⁸, and thereby face greater competing (child-care) expenses and hence more challenges to meet their energy needs. Children living in energy poverty are more likely to face food scarcity and to have health and developmental issues, compared to those not in energy poverty⁹. Young children are also at higher risk of morbidity in extreme heat events^{23,26}.

People with disabilities face higher rates of energy poverty¹⁰. Compared to the general population, people with disabilities may need more energy to realize a range of essential capabilities¹⁰. Illness or disability can limit freedom of movement, which raises energy costs due to people being at home more¹¹. Although previous work has not found disability to predict mortality during heat events²³, financial pressure to curtail electricity use may contribute to poorer health outcomes. The energy needs of those with disabilities vary greatly depending on the individual and disability, but are likely to involve a higher energy use. Yet, the needs of individuals with disabilities are often systematically disregarded by decision makers (recognition and procedural injustices¹¹).

Finally, racial and ethnic minorities face procedural injustices in the form of discrimination in areas such as housing, employment and credit¹⁰, in addition to a lack of informed consent for energy projects, lack of representation in the decision-making and lack of access to information^{13,21}. Distributional injustices arise from these procedural injustices, and racial minorities are more likely to live in inefficient housing that necessitates higher energy bills to control indoor temperatures compared to the non-minority counterparts^{23,25}. Racial and ethnic minorities may also face greater health impacts tied to inability to cool homes; the likelihood of death during an extreme heat event in the United States is linked to sociodemographic vulnerability, defined partly by ethnic minority and Latino immigrant status^{15,20}.

Some argue that low-income households can save money on static TOU rates because their existing patterns place most of their use away from on-peak times²⁵. However, work that examined critical peak pricing found that, at baseline, low-income and elderly households tend to have a lower-than-average use during on-peak times, whereas households with chronically ill members tend to have a higher on-peak use²⁶. Beyond existing use patterns, demand flexibility is considered key for households to be able to take financial advantage of TOU²⁷. Vulnerable households may face constraints that limit the flexibility of electricity use timing, such as poorly insulated homes

that prevent the retention of comfortable temperatures if heating or cooling systems are turned off^{27,28,33,38}. Some DSR trials found that vulnerable (low-income, young children, elderly and/or chronically ill) households can load shift on par with or to a greater extent than non-vulnerable households^{29,30-31}. However, other work found that vulnerable (low-income and young children) households load shift less and/or have a higher demand during on-peak times and limited flexibility compared to non-vulnerable households^{29,32-34}. Overall, it is unclear how TOU rates will impact vulnerable households in terms of bill changes, and responses will probably differ by group. There is a risk that those with higher and less flexible energy needs, such as the elderly or those with a disability, will face bill increases.

Energy poverty has been associated with a range of negative health outcomes, particularly regarding respiratory health³⁵. Although much work examines the links between energy poverty and discomfort, illness and mortality in cold climates^{11,36-38}, less work has examined these links related to extreme heat. Prior work identified that greater thermal discomfort associated with energy poverty is tied to an increased likelihood of negative impacts on both physical and mental health among households in cold climates^{35,39}. The vulnerable groups that we focus on have been found to suffer worse outcomes during extreme heat events^{15, 16,23,26,34}; this may be linked to the inability to access sufficient cooling, but has not yet been examined in the context of energy poverty.

Here we evaluate the cost and health impacts of TOU among vulnerable (that is, low income, elderly, disability, young children and racial/ethnic minority; Table 1 gives the operational definitions) versus non-vulnerable households that took part in a randomized control TOU pilot in the southwestern United States. We found that, although all households on TOU face bill increases relative to controls, those vulnerable on the elderly and disability indicators face greater bill increases on TOU versus control than their non-vulnerable counterparts. Conversely, low-income and Hispanic households face relatively smaller bill increases on TOU versus control than their non-vulnerable counterparts. Households vulnerable on low-income and disability indicators face worse health outcomes regardless of the rate. Relative to their non-vulnerable counterparts, households vulnerable on disability and Hispanic indicators face an increased likelihood of negative health outcomes when assigned to TOU, and low-income households face increased discomfort. These results suggest the need to consider vulnerable groups separately, and the importance of a careful rate design.

Effect of TOU on electricity bills

All analyses were performed using STATA MP 14.2. The pilot included two TOU rates and a non-TOU control group. Compared

ARTICLES

NATURE ENERGY

Table 2 | Triple difference estimators examining mean monthly bills (US\$) for TOU1, by vulnerability group

	(1)	(2)	(3)	(4)	(5)	(6)
	Low income	Elderly	Young children	Disability	Hispanic	African American
TOU1×Vulnerable×Pilot	1.11 (2.53)	3.69 (2.72)	0.72 (3.89)	8.65* (3.38)	-3.79 (3.29)	-4.43 (5.94)
TOU1×Pilot	13.35*** (1.88)	12.59*** (1.71)	13.84*** (1.43)	12.42*** (1.48)	15.83*** (1.86)	15.83*** (1.86)
Vulnerable×Pilot	-5.18** (1.59)	0.36 (1.69)	1.15 (2.52)	1.25 (2.03)	2.69 (2.03)	1.76 (3.98)
Vulnerable×TOU1	-5.72 (5.28)	-2.40 (6.02)	3.33 (7.98)	3.94 (7.57)	0.02 (7.15)	2.02 (11.76)
TOU1	-3.81 (4.06)	-3.34 (3.73)	-4.53 (3.19)	-4.71 (3.23)	-2.76 (4.24)	-2.76 (4.24)
Pilot	6.18*** (1.18)	3.94*** (1.06)	3.92*** (0.88)	3.85*** (0.93)	3.32** (1.14)	3.32** (1.14)
Vulnerable	-52.72*** (3.40)	-3.69 (3.78)	5.14 (4.95)	5.11 (4.73)	-23.33*** (4.42)	-34.36*** (7.39)
R ²	0.08	0.00	0.00	0.01	0.01	0.01
n	9,738	9,738	9,738	9,738	7,364	5,862

Standard errors in parentheses. *P < 0.05; **P < 0.01; ***P < 0.001.

Table 3 | Triple difference estimators examining mean monthly bills (US\$) for TOU2, by vulnerability group

	(1)	(2)	(3)	(4)	(5)	(6)
	Low income	Elderly	Young children	Disability	Hispanic	African American
TOU2×Vulnerable×Pilot	-6.21* (2.46)	8.76*** (2.63)	5.31 (4.18)	7.49* (3.27)	-7.70* (3.12)	-6.27 (5.81)
TOU2×Pilot	26.45*** (1.92)	19.96*** (1.65)	22.98*** (1.36)	22.18*** (1.43)	27.92*** (1.84)	27.92*** (1.84)
Vulnerable×Pilot	-5.18** (1.59)	0.36 (1.69)	1.15 (2.52)	1.25 (2.03)	2.69 (2.03)	1.76 (3.98)
Vulnerable×TOU2	3.36 (4.83)	3.06 (5.34)	2.58 (7.17)	4.48 (6.63)	-3.51 (6.21)	6.99 (10.15)
TOU2	-8.03* (3.81)	-9.26** (3.44)	-8.22** (2.86)	-8.88** (2.93)	-6.51 (3.83)	-6.51 (3.83)
Pilot	6.18*** (1.18)	3.94*** (1.06)	3.92*** (0.88)	3.85*** (0.93)	3.32** (1.14)	3.32** (1.14)
Vulnerable	-52.72*** (3.40)	-3.69 (3.78)	5.14 (4.95)	5.11 (4.73)	-23.33*** (4.42)	-34.36*** (7.39)
R ²	0.08	0.01	0.01	0.01	0.02	0.02
n	10,966	10,966	10,966	10,966	8,414	6,700

Standard errors in parentheses. *P < 0.05; **P < 0.01; ***P < 0.001.

to TOU Rate 1 (TOU1), TOU Rate 2 (TOU2) had higher cents per kilowatt hour costs on-peak and fewer hours on-peak (Methods).

The pilot happened during summer in a hot climate in the southwestern United States; bills were expected to be driven by cooling needs. We used a difference-in-difference-in-differences (triple difference) approach to examine whether assignment to TOU results in greater electricity bill increases for vulnerable versus non-vulnerable households. Supplementary Table 2 presents the mean monthly bill amounts for all the study groups across the baseline and pilot periods. Each model compares the control to either TOU1 (Table 2) or TOU2 (Table 3). There are six models for each rate, one for each vulnerability indicator. The mean monthly summer bill amount is the dependent variable, and independent variables are the full set of interaction terms and main effects required for a triple difference model (Methods).

Both TOU rates resulted in bill increases for all participants ($P=0.000$; Fig. 1, Tables 2 and 3 and Supplementary Note 1). The triple difference term TOU×Vulnerable×Pilot in each model gives the estimated effect of the TOU assignment for vulnerable individuals during the pilot year (Methods). As expected, households vulnerable on the disability indicator assigned to TOU1 ($P=0.011$) or TOU2 ($P=0.022$) and households vulnerable on the elderly indicator assigned to TOU2 ($P=0.001$) saw greater baseline-to-pilot-year bill increases compared to non-vulnerable counterparts. Contrary to expectations, for households vulnerable on the low-income ($P=0.012$) and Hispanic indicators ($P=0.014$), assignment

to TOU2 versus control is associated with a smaller increase in bills relative to non-vulnerable households. Other groups (African American and young children) saw no difference in TOU assignment impacts versus their non-vulnerable counterparts. The remaining model terms primarily serve as controls, and are discussed in Supplementary Note 1.

On-peak energy use reduction

In Tables 2 and 3, R^2 is consistently <0.10, which suggests that factors not included in the model contribute to bill variation. Regional fixed effects analysis confirms that changes in on-peak use predict bill changes (Supplementary Note 2 and Supplementary Tables 1–3). In a separate triple difference analysis (parallel to the billing analysis (Methods)), we found that households vulnerable on the disability indicator saw a smaller decrease in on-peak use from baseline to pilot year when on TOU1 versus control, compared to their non-vulnerable counterparts; no differences were observed for other groups (Supplementary Tables 7 and 8; the mean on-peak use reported by group and time period is given in Supplementary Table 6). Additionally, examining reported behavioural efforts to curtail on-peak air conditioning (AC) use (Table 4), low-income, young children, Hispanic and African American households reported a greater curtailment compared to their non-vulnerable counterparts, whereas households with elderly members reported less curtailment; no differences were observed for households with versus without a disability (Wilcoxon rank sum tests (Methods)).

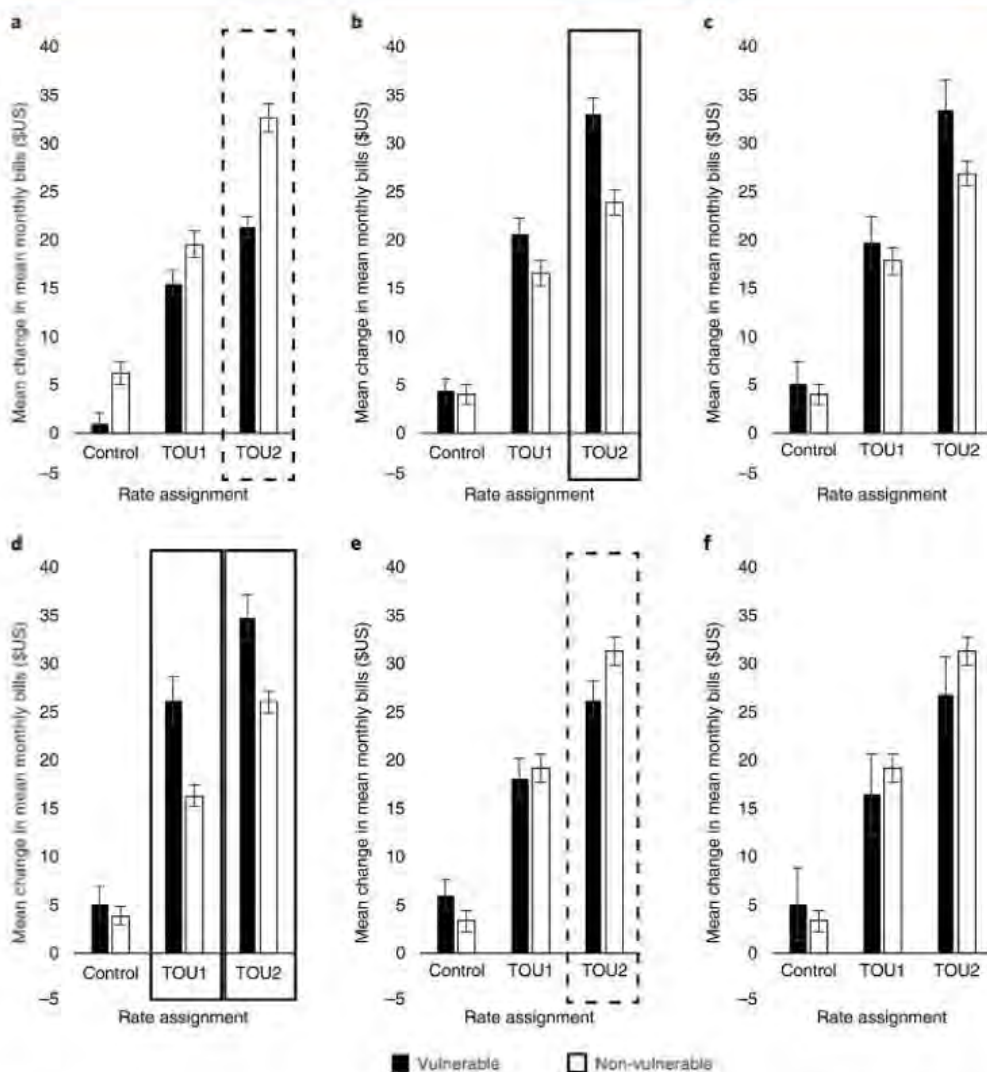


Fig. 1 | Mean change in mean monthly summer bills, by vulnerability group and rate assignment. Change in mean monthly summer bills (pilot minus baseline) for the control, TOU1 and TOU2 rate groups for each vulnerability indicator with standard error bars. **a**, Low income (control, $n = 2,865$; TOU1, $n = 2,004$; TOU2, $n = 2,618$). **b**, Elderly (control, $n = 2,865$; TOU1, $n = 2,004$; TOU2, $n = 2,618$). **c**, Young children (control, $n = 2,865$; TOU1, $n = 2,004$; TOU2, $n = 2,618$). **d**, Disability (control, $n = 2,865$; TOU1, $n = 2,004$; TOU2, $n = 2,618$). **e**, Hispanic (control, $n = 2,202$; TOU1, $n = 1,480$; TOU2, $n = 2,005$). **f**, African American (control, $n = 1,762$; TOU1, $n = 1,169$; TOU2, $n = 1,588$). Solid boxes denote a positive triple difference term that indicates a greater increase in bills for vulnerable versus non-vulnerable groups; dashed boxes denote a negative triple difference term that indicates a smaller increase in bills for vulnerable versus non-vulnerable groups (Tables 2 and 3).

Table 4 | Reported AC curtailment by vulnerable households versus non-vulnerable counterparts

	Vulnerability present (mean curtailment)	Vulnerability absent (mean curtailment)	z score	P	d^a
Low income	3.30	3.10	-4.85	0.000	0.16
Elderly	3.09	3.24	3.73	0.000	0.12
Young children	3.33	3.16	-2.80	0.005	0.13
Disability	3.12	3.20	1.72	0.086	0.06
Hispanic	3.29	3.02	-5.54	0.000	0.22
African American	3.45	3.02	-5.27	0.000	0.35

Main sample, $n = 4,129$; Hispanic subsample, $n = 3,108$; African American subsample, $n = 2,459$. Bold font shows the group that made greater efforts to curtail for each behaviour. ^aCohen's d effect size.

Health impacts of TOU assignment

We tested whether vulnerable versus non-vulnerable households report a higher likelihood of seeking medical attention for

heat-related reasons, using regional fixed effects regression grouped by climate zone (Methods and Supplementary Tables 9 and 10). The dependent variable is the likelihood of seeking

medical attention. Independent variables in all models are rate assignment and vulnerability indicators for low income, elderly, young children and disability. Hispanic and African American indicators appear only in models that use subsamples. Interaction terms Vulnerable \times TOU are introduced individually in subsequent models to test group-specific effects of TOU assignment. The frequency of reported discomfort (expected precursor to more severe problems), presence of AC (expected to impact indoor temperature), change in on-peak use (expected to impact indoor temperature) and home ownership (expected to impact indoor temperature via a greater control by homeowners over efficiency measures, such as insulation) are included as control variables in all models. A subset of the models is presented in Table 5, which comprises all the main effects models and models with significant vulnerability interaction terms at $P < 0.05$.

Main effects indicate that households vulnerable on low-income ($P = 0.000$), disability ($P = 0.000$) and Hispanic indicators ($0.001 < P < 0.011$) are more likely to seek medical attention for heat-related reasons (Table 5). TOU assignment alone does not predict the likelihood of seeking medical attention. A greater frequency of discomfort predicts a higher likelihood of needing medical attention for heat-related reasons in all models ($P = 0.000$), whereas home ownership predicts a lower likelihood of needing medical attention in models (1), (2), (3) and (4) ($0.011 < P < 0.032$) and a reduction in on-peak use predicts a higher likelihood of needing medical attention in models (7), (8) and (9) ($0.011 < P < 0.014$) (Table 5).

Considering the interaction terms, TOU versus control assignment significantly alters the likelihood of seeking medical attention among households with either young children ($P = 0.045$) or disabled members assigned to TOU1 ($P = 0.030$), and Hispanic households assigned to TOU2 ($P = 0.032$). For significant interaction terms, we performed post hoc tests with the conservative Scheffé's adjustment applied to significance testing of the contrast between pairwise comparisons (Table 6). Among families with young children, assignment to TOU1 versus control correlates with a lower likelihood of needing medical attention. For households vulnerable on the disability indicator, assignment to TOU1 is associated with a higher likelihood of seeking medical attention relative to non-vulnerable households on TOU1 (and non-vulnerable households assigned to control rate). Hispanic households assigned to TOU2 face higher a likelihood of needing medical attention than non-Hispanic white households on TOU2.

Discomfort in vulnerable versus non-vulnerable households

We tested whether vulnerable versus non-vulnerable households report more frequently experiencing discomfort due to homes being too hot, using regional fixed effects regression grouped by climate zone (Methods and Supplementary Tables 11 and 12). The dependent variable is the frequency of discomfort experienced while trying to save money on electricity. Independent variables are rate assignment, vulnerability indicators and Vulnerability \times TOU interaction terms. The models examine the interaction terms for each vulnerable group separately. The presence of AC, change in on-peak use and home ownership are included as control variables in all the models.

Regardless of the rate assignment, low-income ($P = 0.000$), disability ($P = 0.000$) and Hispanic indicators ($P = 0.024$, Hispanic for TOU1 models only) predict more frequent discomfort, whereas the elderly indicator ($P < 0.042$) predicts less frequent discomfort. Two interaction terms are significant: Low income \times TOU1 and African American \times TOU1. For these terms, we performed post hoc tests with Scheffé's adjustment (Table 7). Low-income households assigned to TOU face a higher discomfort than their non-vulnerable counterparts assigned to TOU (this is also true for the control group). No significant differences were observed for the African American \times TOU interaction term.

Discussion

The results suggest distributional, procedural and recognition injustices that differ across groups, which highlights the importance of considering specific subpopulations in the design and rollout of DSR programmes. The greater cost increases experienced by households vulnerable on the disability and elderly indicators assigned to TOU, relative to their non-vulnerable counterparts, suggest recognition injustices¹⁴. Cost increases faced by these households probably stem from inability to shift use times, as evidenced in our findings that households vulnerable on the disability indicator reduced on-peak use less than their non-vulnerable counterparts, and households vulnerable on both disability and elderly indicators reported less AC curtailment compared to their non-vulnerable counterparts. These groups may be constrained in load shifting due to being home-bound and having a greater reliance on energy for medical equipment, temperature control and completing daily tasks^{15,29,30}.

Households vulnerable on low-income and disability indicators face worse health and comfort outcomes than the outcomes faced by non-vulnerable counterparts, regardless of rate assignment, which probably stems from ongoing procedural and distributional injustices. However, TOU appears to widen the difference in health outcomes between those vulnerable on the disability indicator and their non-vulnerable counterparts, which suggests recognition injustices given that this group already struggles to keep homes cool under current distributional injustices.

TOU similarly correlates with worse health outcomes for Hispanic households, relative to their non-vulnerable counterparts. Hispanic households reported greater curtailment of AC compared to non-Hispanic white households, and it is possible that this contributed to negative health outcomes. Hispanic groups are more likely to experience heat distress in extreme heat events^{5,31}, which raises concerns that further distributional injustice could worsen the differentials in mortality rates. Future research should evaluate whether this outcome is linked to inefficient homes that limit the ability to keep cool³².

Our finding that TOU1 only shows a differential cost effect for those with disabilities, whereas TOU2 shows differential cost effects for those vulnerable on the low-income, elderly, disability and Hispanic indicators, suggests that the design of TOU rates is important in predicting outcomes for energy-vulnerable populations. Specifically, the length and kilowatt hour expense of on-peak times appear to play an important role in the group-differentiated financial impacts of TOU.

Given that DSR rates will probably be needed to integrate higher shares of non-dispatchable generation, it is important for pilots to continue trialling multiple rate designs and evaluating the impacts on vulnerable populations, with the goal of identifying rate designs in each locale that meet energy integration needs without worsening or creating energy injustices. The TOU rates examined here increased electricity bills for all groups. By definition, vulnerable groups are less able to bear cost increases than their non-vulnerable counterparts³, which suggests that switching to the TOU rates considered in this study probably increased hardships such as the 'heat or eat' dilemma. However, compared to their non-vulnerable counterparts, only two groups (disability and elderly) experienced greater cost increases, whereas two groups (low income and Hispanic) experienced lower cost increases.

TOU rate design should aim to be cost neutral, and studies of other TOU rates have found evidence that some rate designs can, indeed, achieve cost neutrality across the general population³⁰. If the TOU rate in our study had achieved cost neutrality across the general population, rather than causing increases across the board, it is possible that only some of the vulnerable groups examined (elderly and disability) would have been worse off, whereas some (low income and Hispanic) may have been better off. More extensive examination of potential rate designs is needed to understand if

CAUSE-PA STATEMENT 1, APPENDIX B

Table 5 | Regional fixed effects logit model grouped by climate zone, predicting likelihood of a household member needing medical attention

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Main effects, TOU1	Young children in interaction, TOU1	Disability in interaction, TOU1	Main effects (Hispanic), TOU1	Main effects (African American), TOU1	Main effects, TOU2	Main effects (Hispanic), TOU2	Hispanic in interaction, TOU2	Main effects (African American), TOU2
VulnerablexTOU		-0.71* (0.35)	0.60* (0.28)					0.38* (0.18)	
Assigned to TOU	-0.07 (0.14)	0.06 (0.19)	-0.38** (0.12)	0.02 (0.21)	0.05 (0.26)	-0.06 (0.10)	-0.02 (0.15)	-0.20 (0.15)	-0.29* (0.14)
Low income	0.57*** (0.14)	0.57*** (0.14)	0.59*** (0.14)	0.58*** (0.16)	0.69*** (0.17)	0.70*** (0.14)	0.82*** (0.18)	0.81*** (0.18)	0.99** (0.26)
Elderly	0.26 (0.16)	0.27 (0.16)	0.26 (0.16)	0.22 (0.19)	0.24 (0.23)	0.09 (0.09)	0.17 (0.09)	0.17 (0.09)	0.35 (0.22)
Young children	0.33 (0.19)	0.59** (0.21)	0.33 (0.18)	0.18 (0.24)	-0.12* (0.05)	0.47 (0.25)	0.36 (0.35)	0.37 (0.35)	0.11 (0.38)
Disability	1.58*** (0.16)	1.59*** (0.16)	1.36*** (0.15)	1.72*** (0.19)	1.69*** (0.18)	1.40*** (0.12)	1.42*** (0.19)	1.41*** (0.19)	1.17** (0.16)
Hispanic				0.36 (0.14)			0.49** (0.15)	0.32 (0.21)	
African American					0.42 (0.23)				0.30 (0.18)
Presence of AC	0.14 (0.21)	0.14 (0.21)	0.13 (0.22)	0.43* (0.22)	0.62 (0.76)	0.18 (0.39)	0.01 (0.55)	0.01 (0.56)	0.40 (0.60)
Frequency of discomfort trying to save money	0.80*** (0.05)	0.80*** (0.05)	0.80*** (0.05)	0.76*** (0.06)	0.82*** (0.05)	0.85*** (0.06)	0.92*** (0.05)	0.92*** (0.06)	0.88** (0.10)
Change in on-peak use (kWh, daily average)	0.06 (0.04)	0.06 (0.04)	0.06 (0.04)	0.05 (0.03)	0.08 (0.05)	0.07* (0.04)	0.11* (0.04)	0.11* (0.04)	0.15* (0.06)
Home owned	-0.35* (0.15)	-0.35* (0.15)	-0.33* (0.16)	-0.38* (0.15)	-0.36 (0.30)	-0.31 (0.22)	-0.25 (0.29)	-0.25 (0.28)	-0.30 (0.45)
Pseudo R ²	0.20	0.20	0.20	0.21	0.22	0.19	0.22	0.22	0.20
n	4,869	4,869	4,869	3,682	2,931	5,483	4,207	4,207	3,297

Standard errors in parentheses, clustered by climate zone. *p < 0.10, **p < 0.05, ***p < 0.01

Table 6 | Post hoc tests of Vulnerable×TOU interaction terms on the need for medical attention

	Control, vulnerable versus	TOU, non-vulnerable versus	TOU, vulnerable versus
Young children×TOU1			
Control, non-vulnerable	0.59* (0.21)	0.06 (0.19)	-0.6 (0.25)
Control, vulnerable		-0.53* (0.16)	-0.65* (0.21)
TOU, non-vulnerable			-0.12 (0.30)
Disability×TOU			
Control, non-vulnerable	1.38* (0.16)	-0.08 (0.11)	1.34* (0.20)
Control, vulnerable		-1.45* (0.10)	-0.03 (0.19)
TOU, non-vulnerable			1.43* (0.17)
Hispanic×TOU2			
Control, non-vulnerable	0.32 (0.21)	-0.10 (0.15)	0.50* (0.15)
Control, vulnerable		-0.52 (0.27)	0.18 (0.21)
TOU, non-vulnerable			0.70* (0.14)

Pairwise comparison, contrast. Standard error in parentheses. *Scheffé test significant at the 95% level.

Table 7 | Post hoc tests of Vulnerable×TOU interaction terms on discomfort

	Control, vulnerable versus	TOU, non-vulnerable versus	TOU, vulnerable versus
Low incomexTOU1			
Control, non-vulnerable	0.32* (0.48)	0.06 (0.02)	0.28* (0.05)
Control, vulnerable		-0.26* (0.04)	-0.03 (0.04)
TOU, non-vulnerable			0.23* (0.04)
African American×TOU			
Control, non-vulnerable	-0.17 (0.10)	-0.02 (0.03)	0.08 (0.12)
Control, vulnerable		0.15 (0.12)	0.26 (0.09)
TOU, non-vulnerable			0.11 (0.13)

Pairwise comparison, contrast. Standard error in parentheses. *Scheffé test significant at the 95% level.

this would be borne out in practice. Given that those vulnerable on disability and elderly indicators have a greater need for affordable energy compared to the general population, policy or rate design interventions should ensure that energy costs are low enough for these groups to maintain their health on TOU or other DSR rates and still be able to afford other necessities²⁴.

As opt-out DSR programmes spread, it is important that the costs of each DSR rate relative to those of other offered rates are clearly communicated and that the opt-out procedures be made clear to all, particularly vulnerable groups who are at risk of unfavourable outcomes on DSR. To aid households in evaluating benefits and burdens of competing rates, it is important to communicate cost information in a way that minimizes cognitive burden^{31,52}. Using heuristics to address common misperceptions may improve household understanding of energy use³¹. Given prior findings that households often base decisions regarding TOU enrolment on perceived financial savings, but misperceive the extent of actual financial savings³⁴, further testing of an ideal choice architecture and information presentation for DSR is critical to facilitate all households making informed decisions about their electricity rates.

More broadly, our findings regarding the worse health and comfort outcomes for households vulnerable on low-income and disability indicators regardless of rate assignment suggest that energy-vulnerable groups in hot climates globally should be the focus of future research. These findings also suggest a need for policy intervention to support more affordable cooling, regardless of

future DSR rollout. Cooling centres may help reduce discomfort, but often operate only during weekday business hours, so are disruptive to family routines and provide only part-time relief⁵³. Thus, we recommend other measures, such as improving building and appliance energy efficiency, and carefully designed rates. Efficiency improvement programmes can offer large cost savings and reduce emissions, as well as decrease discomfort^{36,37}. Future research should directly consider the extent to which housing energy efficiency limits the ability to control bills on DSR rates such as TOU, with a view to informing the design of complementary policies to address distributional injustices.

Our results should be viewed in the light of several limitations. First, our sample comprised individuals who opted into the pilot. Thus, our sample may be less risk averse than the general population^{36,39}, or may have a greater expectation of monetary savings on TOU⁵⁰. Second, the results may not generalize to all populations. Survey completers had higher mean baseline use and larger mean bill increases than partial completers. Control group members were more likely to complete the survey than those assigned to TOU1. Several vulnerable groups (low income, elderly, disability, Hispanic and African American) were less likely to complete the survey compared to non-vulnerable counterparts. Possibly survey completers had fewer time pressures, which suggests conservative estimates of the impact on vulnerable groups. Third, our indicator for low-income households relied on enrolment in a utility programme, and thus probably underestimates the low-income households

sampled and has an imperfect separation between vulnerable and non-vulnerable households; the associated coefficients should be interpreted with caution. Fourth, we examined vulnerability indicators in isolation, and hence the results do not capture differential impacts faced by those bearing a double burden, such as being both elderly and low income.

TOU raised the cost of energy for all households in our study, but some vulnerable households (elderly and disability) face greater bill increases on TOU compared to their non-vulnerable counterparts. Households vulnerable on low-income and disability indicators also face more discomfort and more heat-related medical issues regardless of rate assignment, which raises general concerns about the health impacts of energy poverty in hot climates. TOU widens the discomfort gap (low income) and increases the likelihood of seeking medical attention (disability and Hispanic) of some vulnerable groups relative to non-vulnerable counterparts on TOU. Rate design plays an important role in the impact of price-based DSR measures on vulnerable households, and future pilots should continue to examine multiple potential rate designs to determine which designs most effectively avoid exacerbating existing energy injustices or creating new ones.

Methods

Ethics statement. The University of Southern California's University Park Institutional Review Board reviewed and approved this research, and granted a waiver of informed consent.

Participants. Data are from households that participated in a pilot programme administered by a southwestern US electric utility. The utility sent invitations by direct mail and email soliciting opt in to the 2016 TOU pilot to roughly 197,000 households, 14% of which opted in. Some households that accepted the offer were not enrolled because they were ineligible (for example, were already participating in a special rate programme). The utility randomly assigned 21,534 households to either TOU1 ($n=4,709$), TOU2 ($n=6,365$), TOU3 ($n=3,746$) or the control group that opted in to TOU but was not placed on a TOU rate ($n=6,714$). Low-income households and those with elderly members were deliberately oversampled for TOU2. TOU3 was not fully rolled out by the start of the study period, due to additional complexities unique to the rate, and so could not be included in the present study; we consider only TOU1, TOU2 and the control group.

TOU pilot. Households assigned to a TOU rate were shifted to this new rate in June or July of 2016 and remained on these rates for a full year. The period of the pilot covered by this study occurred in the summer, specifically the months July–September 2016. Owing to the geographical region, the weather would have been warm to hot and mostly lacking precipitation for the majority of the sample.

After the rate assignment, participants received information letters. Those in the control group received a welcome letter informing them that they would remain on their current rate. TOU participants received a letter containing information on their TOU rate plan and bill protection (if customers paid more on TOU at the end of the 12-month pilot than they would have under their previous plan, the utility would credit back the difference after the pilot ended). They also received TOU time-period stickers, conservation-reminder stickers and door hangers with recommended seasonal thermostat settings.

TOU1 and TOU2 on-peak times covered different hours depending on weekend versus weekday. On-peak hours were in the evening. Cost per kilowatt hour varied depending on the rate and season. Summer rates per kilowatt hour for TOU1 were c23 for super off-peak, c27.61 for off-peak and c34.51 for on-peak. Summer rates per kilowatt hour for TOU2 were c17.33 for super off-peak, c29.3 for off-peak and c53.26 for on-peak. TOU1 had six hours on-peak from 14:00 to 20:00 for summer weekdays and no on-peak times at weekends. TOU2 had three hours on-peak from 17:00 to 20:00 for summer weekdays and no on-peak times at weekends.

Households could earn up to US\$200 as compensation for their participation, given as bill credits; US\$100 at enrolment and US\$50 after completing each of two surveys. The second survey, which we do not have data for due to the timing of our data request from the utility, was administered in the summer of 2017.

Survey. Customers were first surveyed between October and December 2016. At this point, TOU participants had 3–6 months' experience with TOU rates, solely or primarily in the summer. Survey response rates were 82% overall, out of the 18,747 households that remained in the pilot by December 2016 after being enrolled and not being dropped out of the pilot due to relocating, ineligibility or choosing to leave. For the full sample examined in this manuscript ($n=7,487$), 85% responded by email, 11% by mail and 4% by phone.

Electricity use data. Our participants experienced the TOU pilot during the summer months. Thus, the analyses use hourly electricity use data for each household only during the summer months (July, August and September) for the baseline years 2014 and 2015, and for the pilot year of 2016. Summer hourly consumption data were used to form the 'on-peak use' variable (kilowatt hours, daily mean).

In forming the 'on-peak use' variable, we took into account the different lengths of on-peak time, that is, TOU1 on-peak sums the use during the 6 h on-peak, and TOU2 on-peak sums the use during the 3 h on-peak. Control group households were all coded for both hypothetical TOU1 and TOU2 rate structures, and on-peak use was defined as use that happened during the hours designated as on-peak by that rate. In each analysis, the full control group is compared to either TOU1 or TOU2, using the corresponding on-peak hour coding for control groups to generate the change in on-peak use variable used for analysis. 'Change in on-peak use' between the baseline and TOU pilot years is taken as the TOU pilot daily on-peak mean use minus the mean baseline on-peak use. The following equation describes the change in on-peak use calculation: $\Delta U = [U_{2016} - (U_{2014} + U_{2015})/2]$, where U represents the mean daily on-peak use in kilowatt hours in each year.

Electricity bills. As for use, the billing data for each household were examined only for July, August and September for the baseline years 2014 and 2015, and for the pilot year 2016. Bill amounts used for the analysis were actual bills that customers received. That is, they reflect the true amount customers paid each month. All the households kept for analysis had billing data for at least two of the three summer months. Mean monthly bill size was taken as the mean of bills across July, August and September for a given year. A baseline bill variable was created by taking the mean of the 2014 and 2015 bills, and the pilot bill was the 2016 mean bill. A 'change in bills' variable was created by subtracting the baseline bills from the pilot bills using the equation: $\Delta B = [B_{2016} - (B_{2014} + B_{2015})/2]$, where B represents mean bill amounts in US dollars each year.

Climate zone. Climate zones are defined by a government agency, and are matched to each household based on the household's location. The government agency bases climate zone boundaries on the household energy use expected for heating and cooling, local temperature and local weather, among other factors. There are eight climate zones covered by households in our sample.

Survey and vulnerability measures. The survey assessed a number of demographic characteristics, which included respondent age and ethnicity/race, and household member disabilities. It also assessed homeownership status and educational attainment, the former of which is included in regression models due to the expectations that homeowners would more easily be able to upgrade appliances and building insulation to increase energy efficiency. Homeownership was coded as a dichotomous variable with 1 indicating homeownership and 0 indicating otherwise.

We defined vulnerability indicators as follows:

- **Low income.** Enrolment in an electric utility financial aid programme (that gives households discounts on electricity bills if income falls below certain limits based on the number of household members) serves as an indicator of low income, with those enrolled in a financial aid programme coded 1 and others coded 0. Enrolment status was provided by the utility.
- **Elderly.** The survey assessed respondent birth year with an open entry. It additionally asked: "How many people in each of the following age categories lived in your home this summer, not including yourself?"; with response categories including "Between 65 and 74 years old"; "Between 75 and 84 years old" and "85 years or older". Responses to this question and birth year were aggregated to determine whether anyone over 65 resided in the household. If someone over 65 years old lived in the household, that household was coded 1. Otherwise, it was coded 0.
- **Young children.** Respondents were asked "How many people in each of the following age categories lived in your home this summer, not including yourself?" with the youngest category being "Under 6 years old". Households that had at least one member under 6 years old were coded '1' for young children, otherwise households were coded 0.
- **Disability.** If someone answered yes to either "Does anyone in your household have a disability or serious medical condition that requires your home to be cool in the summer?" or "Does anyone in your household have a disability or serious medical condition that requires them to use more energy for medical equipment?", that household was coded 1. Otherwise, it was coded 0.
- **Hispanic.** Race and ethnicity were assessed using the question "Which categories describe you?"; in response to which households could mark as many options as they chose to out of the list provided. If a respondent identified as "Hispanic, Latino, or Spanish origin", their household was coded 1 for the Hispanic indicator. If a household marked "White" as a category that described them, and did not mark any other category (including, but not limited to, "Hispanic, Latino, or Spanish origin"), then they were coded as 0. That is, households were only coded 0 if they identified as white alone. Other households (for example, those that identified as African American, Asian American, American Indian and so on) could not be considered

non-vulnerable in terms of ethnicity/race, so were treated as missing. Thus, all analyses using the Hispanic vulnerability indicator use a subsample ($n=4,925$), and the Hispanic indicator is not included as a control in other analyses.

- African American. Coding follows the procedure described for the Hispanic indicator. If the respondent identified as "African American", their household was coded 1 for the African American indicator. If a household marked "White" as a category that described them, and did not mark any other category (including, but not limited to, "African American"), then they were coded as 0. All analyses using the African American vulnerability indicator use a subsample ($n=3,970$), and the African American indicator is not included as a control in other analyses.

AC curtailment and ownership. AC curtailment was assessed by asking respondents, "Since the beginning of this summer, how often, if at all, did you take the following actions to reduce your household's electricity use in the afternoons and evenings?—Turned off air conditioning" on a 5-point Likert scale where 1=Never and 5=Always, with an additional option of 6=Not applicable. We retained those who answered "Not applicable" within the sample, but coded these respondents as missing when conducting analyses that make use of the curtailment scale.

The survey assessed both the reported behavioural curtailment of AC and the presence of AC technology. Households were considered to have AC if they had central AC, window AC, evaporative coolers or heat pumps (which are capable of providing AC). Some households gave conflicting answers to their curtailment of AC and their ownership of AC technology; for example, some households rated their curtailment of AC rather than selecting "Not applicable", but indicated that they did not own AC technology. Households were coded 0 for AC ownership if they chose "Not applicable" for AC curtailment and also indicated they owned no AC technology, and were coded 1 for AC ownership if they rated their AC curtailment (that is, did not choose "Not applicable") and additionally indicated that they owned a form of AC technology. Households that gave conflicting answers were dropped ($n=850$).

Measures for discomfort and medical needs. Discomfort was assessed with responses to the question "Since June 2016, how often, if ever, were you or any members of your household uncomfortably hot inside your home because you were trying to save money on your electricity bill?" on a 5-point Likert scale with 1=Never and 5=Always.

The need for medical attention was assessed with responses to the question "Since June 2016, about how many times, if ever, did you or any members of your household need medical attention because it was too hot inside your home?" with respondents able to choose between options of "Never", "1", "2", ... to "more than 10". A dichotomous variable was created, with respondents coded 1 if they answered that they had needed medical attention at least once, and 0 otherwise.

Dropped participants. By December 2016, 2,787 households had dropped out of the pilot due to relocating, ineligibility or choosing to drop out, which left 18,747 households enrolled. Of these, 16,181 households responded to the survey. Before receipt by the authors, the utility removed respondents who answered 5.4% or less of the survey items. Respondents were also removed if they provided the same rating for all items across any of the three multi-item measures in the survey (for example, if a participant gave ratings of '4' to all the items in one multi-item question). Additionally, respondents were removed if they selected all the items in a 'select-all-that-apply' question in which some categories were mutually exclusive, for example, if when asked "What kept you from shifting use in the evening" respondents selected both "Nothing keeps me from shifting my use" and "My schedule doesn't allow me to reduce my usage".

This yielded a sample of $n=16,073$ households, with 5,198 in the control group, 3,522 on TOU1 and 4,593 on TOU2; the 2,760 households on TOU3 were not used, which left an initial sample of $n=13,313$ households. Additional households were then dropped for the reasons below.

First, households that were missing electricity use data on any days in July, August and September in 2014, 2015 or 2016 were dropped. A total of $n=1,339$ households were dropped due to incomplete use data; the missing values were predominantly clustered across several days or weeks at the beginning of the recorded period, which indicates that either no account was established for that address (that is, residents moved in during the study period) or the house did not have a smart meter at the beginning of the time period.

Second, billing outliers were removed. Customers with baseline or pilot period use below the 1st percentile or above the 99th percentile were dropped from the sample ($n=341$ households).

Third, households with incomplete survey data were dropped. Households were dropped if they had not answered the AC curtailment question, if they had not answered the question assessing the presence of AC, if they had not answered each vulnerability indicator (excepting the race/ethnicity indicators, which used subsamples), if they had not answered both the discomfort and the medical attention questions and if they had not included an answer to homeownership ($n=3,296$).

Finally, households that gave conflicting answers to their curtailment of AC and their ownership of AC technology were dropped ($n=850$). Our final sample comprised 7,487 respondents.

Dropout analyses. The utility with which we partnered provided data only for those who at least partially completed the survey, so we are unable to evaluate presurvey opt outs. We used a two-tailed t -test to understand whether there was a systematic difference regarding the change in bills from baseline to pilot year between households that completed the survey and those that did not complete the survey, restricting the sample only to those who had complete billing and use data ($n=11,633$); among those with incomplete billing and use data, this incompleteness was due to factors beyond the households' control, such as the installation of smart meters. We found that survey completers ($n=7,487$) saw larger bill increases (baseline to pilot, simple difference) than non-completers ($n=4,146$); $M_{\text{completer}}=16.09$, $M_{\text{non-completer}}=13.35$, $P=0.003$, $d=0.06$. We additionally used a two-tailed t -test to examine the systematic difference in change in on-peak use from baseline to pilot ($n=11,633$) for both TOU1 peak-time survey completers (TOU1 + control, $n=4,869$) versus non-completers (TOU1 + control, $n=2,688$) and TOU2 peak-time survey completers (TOU2 + control, $n=5,483$) versus non-completers (TOU2 + control, $n=3,107$), and found no difference between completers and non-completers in usage reduction ($M_{\text{completer,TOU1}}=-0.11$, $M_{\text{non-completer,TOU1}}=-0.11$, $P=0.91$, $d=0.002$; $M_{\text{completer,TOU2}}=-0.11$, $M_{\text{non-completer,TOU2}}=-0.09$, $P=0.56$, $d=0.01$). We finally examined differences in baseline use ($n=11,633$) between those who completed the survey ($n=7,487$) and those who did not ($n=4,146$), and found that completers had a higher daily baseline average use ($M_{\text{completer}}=24.98$, $M_{\text{non-completer}}=22.43$, $P=0.000$, $d=0.18$). In summary, those who completed the survey had higher baseline use and larger bill increases during the pilot than the non-completers. The effect size of the baseline difference in daily average use between the survey completers and non-completers is large, whereas the effect size difference in billing is small.

We further considered dropout across different conditions due to survey missing data: of 4,514 in the control group, 37% were non-completers, compared to 34% of the 3,043 on TOU1 and 36% of the 4,076 on TOU2. A simple logit model was used to estimate the correlation of group assignment with the likelihood of having incomplete data. We first considered all three rate types using dummy variables (with the control as baseline), and found that, compared to the control, TOU1 is associated with a higher likelihood of incomplete data ($P<0.034$), but TOU2 is not ($P<0.464$). We then considered only TOU1 versus TOU2, with TOU1 as the baseline, and found no difference in association with non-completion ($P<0.155$). Finally, we used a simple logit to consider whether vulnerability predicts non-completion of the survey. We found that low-income ($P<0.001$), elderly ($P<0.001$), disability ($P<0.001$), Hispanic ($P<0.001$) and African American ($P<0.011$) groups were all less likely to complete the survey compared to the respective non-vulnerable counterparts.

Difference-in-difference-in-differences analyses. The difference-in-difference-in-differences billing analyses are described by the equation:

$$B_{it} = \beta_0 + \beta_1 \text{TreatR1}_{it} + \beta_2 \text{Post}_t + \beta_3 \text{Vulnerable}_{it} + \beta_4 (\text{TreatR1}_{it} \times \text{Post}_t) + \beta_5 (\text{Vulnerable}_{it} \times \text{Post}_t) + \beta_6 (\text{Vulnerable}_{it} \times \text{TreatR1}_{it}) + \beta_7 (\text{Vulnerable}_{it} \times \text{TreatR1}_{it} \times \text{Post}_t) + \epsilon_{it}$$

where B_{it} is the mean monthly bill amount (US dollars), TreatR1_{it} is a dichotomous variable set to 1 if the household was on TOU1 and 0 if the household was in the control group, Post_t is a dichotomous variable set to 1 if the year was 2016 and 0 for the baseline indicator (the mean for the 2014 and 2015 mean monthly bills amount is taken to form the baseline indicator), Vulnerable_{it} is the indicator for vulnerability set to 1 if the household is vulnerable on a given indicator and 0 if it is not vulnerable on that indicator (see the descriptions above for the coding of vulnerable groups). These terms are included as controls for each individual indicator. Subscript s refers to a term that differs across subjects, but is constant over time for a given subject. Subscript t refers to a term that changes over time, but is constant across subjects at any given point in time. Terms with sub-script it vary across both subjects and time. $\text{TreatR1} \times \text{Post}$ controls for the effect on bills due to the assignment to the TOU rate during the pilot year, and takes a value of 1 for households that were on TOU in the pilot year and 0 for all others; $\text{Vulnerable} \times \text{Post}$ controls for differences experienced during the pilot year by vulnerable groups regardless of the rate assignment, and takes a value of 1 for vulnerable households during the pilot year and 0 for all others; $\text{Vulnerable} \times \text{TreatR1}$ controls for the differences of vulnerable groups assigned to the TOU condition regardless of whether the pilot had begun or not, and takes a value of 1 for vulnerable households assigned to a TOU rate and 0 for all others. The term of interest is $\text{Vulnerable} \times \text{TreatR1} \times \text{Post}$, which gives the effect of the TOU assignment during the pilot year on vulnerable groups; vulnerable households assigned to a TOU rate have a value of 1 for this term during the pilot year; all other groups, and other time periods, take a value of 0. Errors are clustered at the household level, ϵ_{it} refers to the idiosyncratic error term.

The same form is used to examine TOU2, with TreatR2_{it} (a dichotomous variable set to 1 if the household was on TOU2 and 0 if the household was in the control group) substituted for TreatR1_{it} . Likewise, this form is used to examine the on-peak usage differences between groups and time periods, with the dependent variable being on-peak use (kilowatt hour, mean) instead of the monthly bill amount.

Regional fixed effects regression. We used regional fixed effects analyses to consider the impacts of predictor variables on billing, discomfort and the need for medical attention. By using regional fixed effects grouped by climate zone, these models control for unobserved time-invariant differences between households, for those differences associated with living in different climate zones. That is, the predictions of respective dependent variables in each regional fixed effects analysis are estimated conditional on the climate zone, and each climate zone is associated with a unique intercept.

AC curtailment analysis. We used a subsample of $n=4,129$ households that were assigned to TOU (not control) and did not answer "Not applicable" when asked about AC curtailment (that is, we only considered households that have access to AC in their homes). Only households assigned to TOU were examined to restrict the comparison to households with the incentive to curtail during peak hours. For this subsample, we examined whether the vulnerable or non-vulnerable groups reported more frequent curtailment in the form of AC use. We used Wilcoxon rank sum tests (due to non-normal distributions) to test for differences in the reported frequency of evening AC curtailment among vulnerable versus non-vulnerable households. Table 4 reports the means, z scores with associated P tests and Cohen's d effect sizes (d). Effect sizes indicate the importance of mean differences; a large effect size is >0.8 , a medium one >0.5 and a small one >0.2 (ref.⁶). The results provide a richer description of how households responded to TOU rates, and are correlational rather than causal.

Online content. Any methods, additional references, Nature Research reporting summaries, source data, extended data, supplementary information, acknowledgements, peer review information; details of author contributions and competing interests; and statements of data and code availability are available at <https://doi.org/10.1038/s41560-019-0507-y>.

Reporting summary. Further information on research design is available in the Nature Research Reporting Summary linked to this article.

Data availability

The processed or aggregated data that support the plots within this paper and other findings of this study are available from the corresponding author upon reasonable request. Authors signed a non-disclosure agreement with the utility that provided the data analysed in this paper, and under this agreement are unable to make the raw data publicly available. Source data for Fig. 1 are provided with the paper.

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CAUSE-PA STATEMENT 1, APPENDIX B

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Author contributions

Both authors conceived the paper and designed the research. L.W. designed the analysis methods, performed the analyses and wrote and revised the paper. N.S. reviewed several drafts and made revisions.

Competing interests

The authors declare no competing interests.

Additional information

Supplementary information is available for this paper at <https://doi.org/10.1038/s41560-019-0507-y>.

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Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company
To Interrogatories of the
Tenant Union Representative Network
TURN Set I

Response Date: 05/18/2020

TURN-I-17

Reference Q&A 18 of PECO St. 3 (Reilly). Is it the witness's position that PECO does not receive EGS pricing information, at any point in time, that shows whether EGS charges exceed the PTC? If not, please indicate at what point in time PECO receives EGS pricing information that shows whether EGS charges exceed the PTC.

RESPONSE:

Yes. PECO has a "bill ready" billing platform and does not receive EGS pricing information (i.e., EGS rate in cents per kWh) at any time that would show whether EGS rates are higher or lower than the PTC. "Bill ready" billing means that PECO receives calculated results from the EGS for its charges for printing on the customer's consolidated bill and does not know the rates of the EGS used to calculate the dollar amount of its charges.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company
To Interrogatories of the
Tenant Union Representative Network
TURN Set I

Response Date: 05/18/2020

TURN-I-18

Reference Q&A 19 of PECO St. 3 (Reilly). Regarding the use of EGS charges to calculate the CAP fixed bill credit, is it correct that, all else remaining constant, a CAP participant who shops and is billed in excess of PECO's PTC would receive a higher fixed credit after 12 months? If not, please explain why not.

RESPONSE:

Yes, if a CAP participant was billed in excess of PECO's PTC, they would receive a higher fixed credit after 12 months.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company
To Interrogatories of the
Tenant Union Representative Network
TURN Set I

Response Date: 05/18/2020

TURN-I-19

Reference Q&A 19 of PECO St. 3 (Reilly). Please explain how PECO would calculate the CAP fixed bill credit if a CAP customer shops for only a portion of the first year.

RESPONSE:

The CAP credit will be calculated based on the customer's actual undiscounted bills over the last twelve months and will reflect EGS charges for the portion of the twelve-month period in which the CAP customer shops.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

Office of Consumer Advocate

OCA Set I

Response Date: 05/21/2020

OCA-I-5

Has PECO undertaken any analysis to compare the price customers in the Standard Offer Referral Program pay compare to the Price to Compare during the term of the Standard Offer contract fixed price offer? If so, provide the results of such an analysis. If not, why not?

RESPONSE:

No, PECO has conducted no such analysis. No such analysis has been required by the Commission.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

Office of Consumer Advocate

OCA Set I

Response Date: 05/21/2020

OCA-I-8

Has PECO undertaken any analysis of the frequency in which Standard Offer Referral program customers return to Default Service during or at the end of their 12-month fixed price contract with the EGS? If so, provide this information.

RESPONSE:

PECO has not undertaken any analysis of the frequency in which Standard Offer Referral program customers return to Default Service during or at the end of their 12-month fixed price contract with the EGS.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

Office of Consumer Advocate

OCA Set I

Response Date: 05/21/2020

OCA-I-10

Has PECO conducted any research and/or surveys of its customers concerning their understanding of or experience in the Standard Offer Referral Program? If so, provide the results of that research.

RESPONSE:

PECO has not conducted any research and/or surveys of its customers concerning their understanding of or experience in the Standard Offer Referral Program.

Responsible Witness: Carol Reilly

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

Office of Consumer Advocate

OCA Set II

Response Date: 05/22/2020

OCA-II-18

Referencing page 11, line 10 through page 12, line 7. Please provide a copy of any report(s) or memoranda that document the conduct and results of the TOU pilot program.

RESPONSE:

Please refer to Attachments OCA-II-18(a) and OCA-II-18(b) for the requested reports on PECO's Smart Time Pricing Pilot.

Responsible Witness: Joseph A. Bisti



REPORT

Dynamic Pricing

PECO Smart Time Pricing Pilot Final Report

April 27, 2015

Submitted by Nexant

Stephen George, Senior Vice President
Michael Sullivan, Senior Vice President
Josh Schellenberg, Managing Consultant
Alana Lemarchand, Consultant



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1 Executive Summary

In October 2013, PECO launched a time-of-use (TOU) pricing pilot called PECO Smart Time Pricing. The offer combined a TOU rate with a bill protection feature plus a no-fee cancellation provision. The TOU rate offered a reduced rate for electricity usage for most hours of the year and a higher rate during non-holiday, weekday afternoons from 2 PM to 6 PM. NRG Retail Solutions was selected by PECO through a competitive process to perform customer care, program implementation tasks, and become the electric generation supplier (EGS) for customers who enrolled in the program. The offer was made to nearly 121,000 residential customers and more than 3,500 small & medium business (SMB) customers. In total, 4,779 residential customers enrolled during a 5-month period, which produced a 3.9% enrollment rate by the end of February 2014. As for the SMB segment, 23 customers accepted the offer. Due to the small number of SMB participants, this report primarily focuses on residential PECO Smart Time Pricing customers.

The primary objectives of the pilot were to:

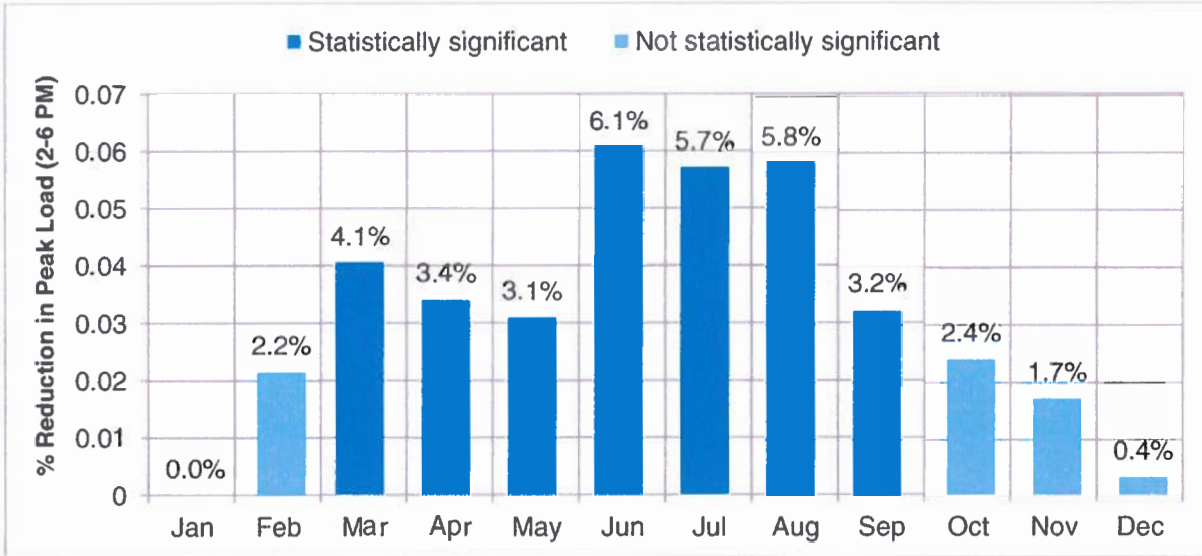
- Gauge customer interest in a TOU rate offered through a competitive supplier;
- Assess the reasons why customers chose to enroll or not enroll in PECO Smart Time Pricing; and
- Evaluate the impact of TOU prices on electricity consumption.

Nexant was retained as the measurement and evaluation (M&E) contractor that conducted the research associated with these pilot objectives. The first two objectives were addressed in the PECO Smart Time Pricing Pilot Enrollment Report that was prepared by Nexant and submitted on June 30, 2014. The final objective is addressed in this PECO Smart Time Pricing Final Report. In addition, based on the end-of-pilot surveys and focus groups summarized in Section 5, this report includes information on customer satisfaction with and impressions of PECO Smart Time Pricing.

1.1 Residential Load Impact Results

Figure 1-1 summarizes the average percent reduction in monthly peak load for the residential customers enrolled in PECO Smart Time Pricing. PECO Smart Time Pricing delivered a 6% average load reduction during non-holiday, weekday afternoons from 2 PM to 6 PM in June, July and August 2014. With around 4,300 participants during those months, this reduction corresponded with an aggregate impact of 367 kW to 459 kW (or around 0.1 kW per participant). During September and spring months (March through May), load reductions were about 3% to 4%. In fall and winter months in 2014, load impacts were lower and were not statistically significant, due in part to the lower enrollment associated with the pilot enrollment ramp up and ramp down during these time periods.

Figure 1-1: Percent Reduction in 2014 Monthly Peak Load (2-6 PM) as a Result of Residential PECO Smart Time Pricing



1.2 SMB Load Impact Results

For SMB customers, the results suggest that PECO Smart Time Pricing may have provided peak load reductions in most months, but given the small number of customers enrolled these results are not statistically significant. Because results for SMB customers were neither definitive nor meaningful they have not been included in this report.

1.3 Residential End-of-pilot Surveys and Focus Groups

Nexant conducted two end-of-pilot surveys in October 2014. The first was a participant survey among a randomly selected group of 2,500 customers out of a population of nearly 4,800 enrolled residential customers. The participant survey was designed to understand customer satisfaction with the pilot and self-reported behavior changes. The second survey, conducted among all 333 active PECO customers who disenrolled during the course of the pilot, was designed to understand customers' reasons for disenrolling from the program.

Nexant received 1,543 responses from participants, resulting in a 62% response rate for that survey. Ninety-five responses were received for the disenrollment survey, resulting in an overall response rate of 28%.

Among residential participant survey respondents, the key findings were:

- 98% were satisfied with PECO Smart Time Pricing or found it to be an equal or better value than their previous rate plan;
- 83% found PECO Smart Time Pricing to be convenient;
- 75% reported saving money on their bill; and

Executive Summary

- 73% reported taking some level of action to shift electric usage away from peak hours (most commonly use of large appliances), while only 3% reported not shifting usage.

Among disenrollment survey respondents, the following were key findings:

- 86% were satisfied with PECO Smart Time Pricing
- The most common reasons for disenrolling were: 1) did not save enough money, and 2) Found a better deal elsewhere
- 21% (20 customers) indicated via open-ended responses that they did not intend to disenroll, with several stating that they only became aware of their disenrollment by receiving the invitation to participate in the disenrollment survey. Most respondents describing these unintentional disenrollments indicated that they would have preferred to keep PECO Smart Time Pricing.¹

PECO also conducted focus groups to assess customers who were in one of three categories: 1) seniors (age 65+), 2) income less than \$34,000/year, and 3) households who had reported to have one member who was qualified under the Americans with Disabilities Act (“ADA”). The focus group questions were designed to understand customer perception and satisfaction regarding their experience with PECO STP. The key findings from members of all focus groups were:

- Participants were enthusiastic about PECO STP
- The ability to save money was among the top reasons for satisfaction with the program
- The bill protection guarantee was very encouraging and helped put customers at ease
- Customers expressed the desire to see more communication regarding their savings and progress during PECO STP²

The executive summary of the focus group report is available in the appendix of this report. The full report is available upon request.

1.4 Residential Impacts by Self-reported Load Shifting Actions

Next, the residential load impact results, cost analysis, and the survey responses were combined to assess the extent to which impacts vary by self-reported actions to shift electrical usage away from peak hours and potentially produce cost savings for the customer. Figure 1-2 and Figure 1-3 summarize these findings. Figure 1-2 shows the average July 2014 peak load and cost impacts (in blue and green, respectively) for participants reporting taking varying levels of action to shift their usage away from peak hours. For comparison, the table also includes the average impacts for all residential PECO Smart Time Pricing customers and the impacts from customers who reported taking no action to shift usage. Impacts for most of these groups are statistically significant, except for three groups with small sample sizes (indicated by lighter shades of blue and green: customers only reporting shifting use of small appliances, customers

¹ 20 of the 333 customers who were invited to participate in the disenrollment survey contacted either Nexant or PECO to ask why they were no longer enrolled in PECO Smart Time Pricing. Of these customers, 18 customers had switched to a competitive supplier, 1 customer was removed because of a meter mix-up, and 1 customer never returned attempts to contact them.

² See Appendix C for a description of the PECO Smart Time Pricing Communication Plan.

reporting shifting only the HVAC/thermostat settings, and those reported taking no action to shift usage).

The average peak load reduction per customer was 7% (0.14 kW) for customers who only shifted use of large appliances (e.g., washer and dryer, oven, stove). Average per customer impacts were twice as high, or 14% (0.28 kW), for customers who reported shifting both large appliance and HVAC use (e.g., by adjusting thermostat settings). This shows that load reductions were largest for customers who shifted use of both large appliances and HVAC-related loads.

Figure 1-2 also shows the portion of cost impacts or bill savings that was due to load reduction for each of the groups described above. Total bill savings were the average dollar savings relative to the default rate for each customer. The percentage of these savings due to load reduction follows the percentage of load reduction.

This also shows that the self-reported actions of survey respondents were reasonably accurate in reflecting differences in how customers actually responded to PECO Smart Time Pricing.

Figure 1-2: Average July 2014 Peak (2-6 PM) Impacts by Self-reported Actions to Shift Peak Loads

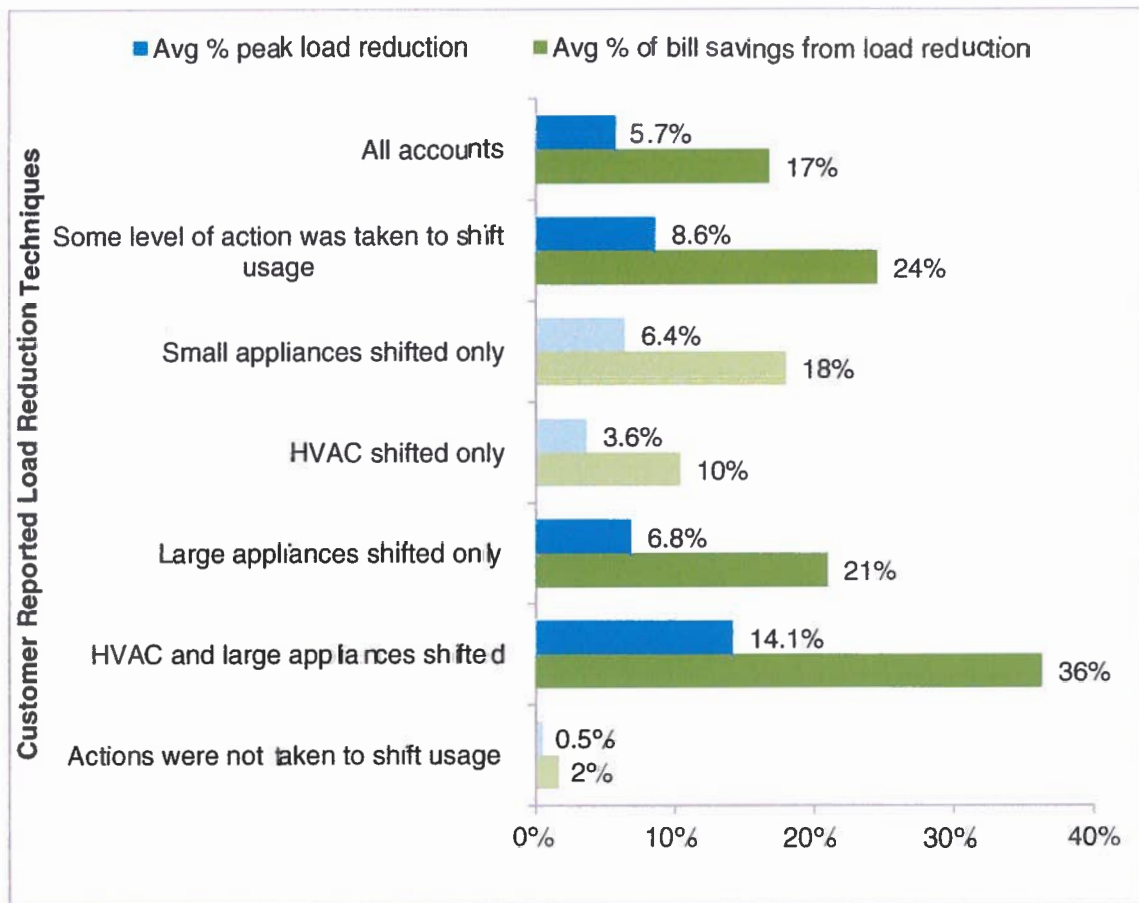
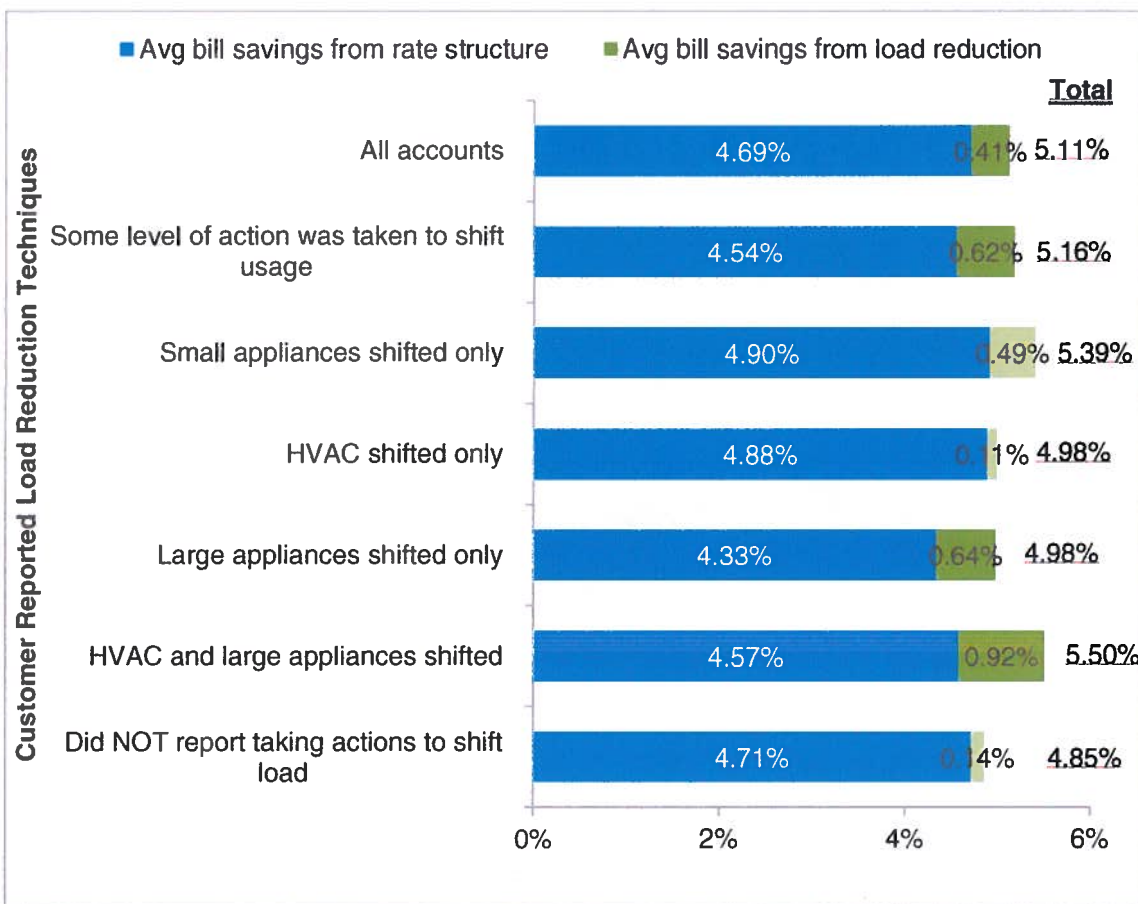


Figure 1-3 shows...

Figure 1-3 portrays average monthly bill savings for the duration of the program as a percentage of what customer bills would have been for each self-reported action group. These total average monthly bill savings (labeled to the right of the bars) are split into two components, the portion attributable to the rate structure as compared to the PECO default rate (in blue) and the portion attributable to load reduction behavior (green). While the total average bill savings were close to 5% for all groups, the portion attributable to load shifting is largest for the group reporting the most load shifting behavior (HVAC and large appliances), and lowest for the group that did not report load shifting behavior.

Figure 1-3: Average Total Savings and Percentage Attributable to Load Shifting Actions by Self-reported Actions to Shift Peak Loads



1.5 Residential Impacts by Select Demographic Groups

Nexant then performed a similar analysis using the combined residential load impact results, cost analysis, and the survey responses to determine the impacts from the three demographic groups that were eligible to participate in the Focus Group studies. Figure 1-4 shows the average July 2014 peak load and cost impacts (in blue and green, respectively) for seniors (age

Executive Summary

65+), income less than \$34k/year, and households who had reported to have one member who was qualified under the Americans with Disabilities Act (“ADA”). For comparison, the table also includes the average impacts for all residential PECO Smart Time Pricing customers. All results reported here are statistically significant.

The average peak load reduction per customer in July 2014 was 7.1% for seniors, 7.3% for low income, and 11.6% for households who have an ADA eligible member.

Figure 1-4 also shows the portion of cost impacts or bill savings attributable to load reduction for each of the groups described above. Total bill savings were the average dollar savings relative to the default rate for each customer. The percentage of these savings due to load reduction follows the percentage of load reduction.

Figure 1-4: Average July 2014 Peak (2-6 PM) Impacts by Select Demographic Groups

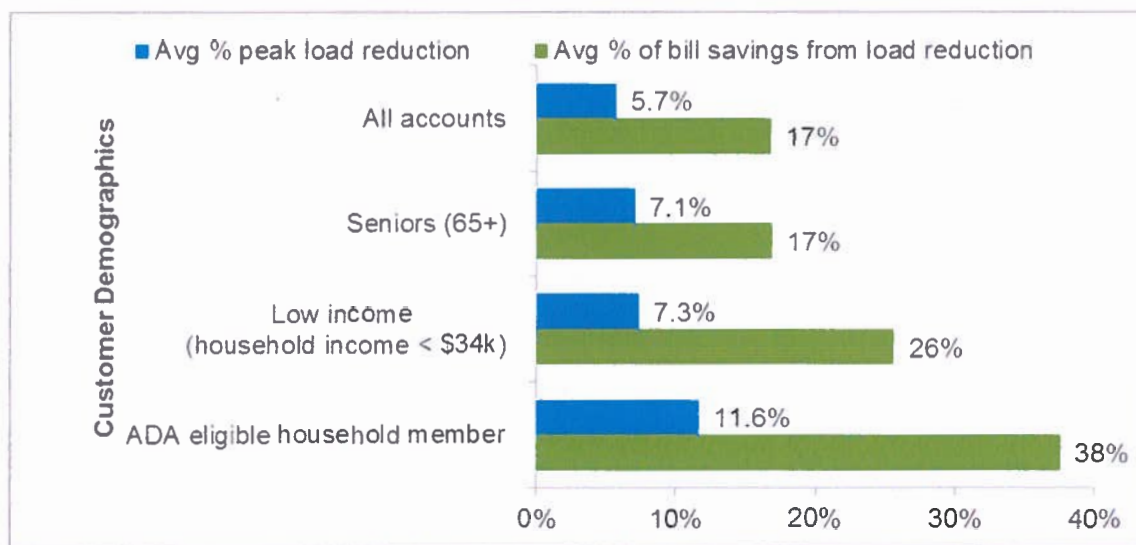
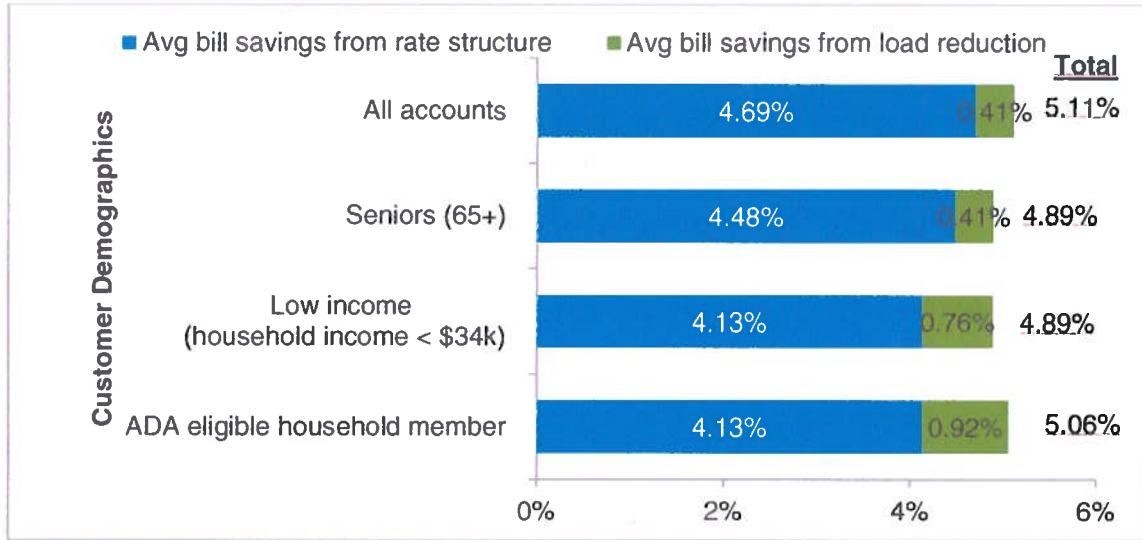


Figure 1-5 portrays average monthly bill savings for the duration of the program as a percentage of what customer bills would have been for each demographic group. These total average monthly bill savings (labeled to the right of the bars) are split into two components, the portion attributable to the rate structure as compared to the PECO default rate (in blue) and the portion attributable to load reduction behavior (green). While total average bill savings were close to 5% for all groups, the portion attributable to load shifting is largest for households with an ADA eligible member, which was also the group with the greatest percent load reduction in July 2014 (see Figure 1-4).

Figure 1-5: Average Total Savings and Percentage Attributable to Load Shifting Actions Achieved by Select Demographic Groups



2 Introduction

In October 2013, PECO launched a time-of-use (TOU) pricing pilot called PECO Smart Time Pricing. The offer combined a TOU rate with a bill protection feature plus a no-fee cancellation provision, all of which was supported by customer education and a call center staffed by trained NRG Retail Solutions agents. The TOU rate structure offered a reduced rate for electricity usage for most hours of the year and a higher rate during non-holiday, weekday afternoons from 2 PM to 6 PM. The bill protection feature provided assurance to customers who stayed on the program for a year that they would pay no more than what they would have paid on the PECO default rate. The offer was made to nearly 121,000 residential customers and more than 3,500 small & medium business (SMB) customers. NRG Retail Solutions was selected by PECO through a competitive process to perform program customer care (call center), program implementation tasks, and become the electric generation supplier (EGS) for customers who enrolled in the program. As the EGS, NRG Retail Solutions performed the normal EGS functions including bill calculation although all participants in PECO Smart Time Pricing were provided a single bill option where the EGS charges were placed on the normal PECO monthly bill.

The primary objectives of the pilot were to:

- Gauge customer interest in a TOU rate offered through a competitive supplier;
- Assess the reasons why customers chose to enroll or not enroll in PECO Smart Time Pricing; and
- Evaluate the impact of TOU prices on electricity consumption.

Nexant was retained as the measurement and evaluation (M&E) contractor to conduct the research associated with these pilot objectives. The first two objectives were addressed in the PECO Smart Time Pricing Pilot Enrollment Report that was prepared by Nexant and submitted on June 30, 2014. The final objective is addressed in this PECO Smart Time Pricing Final Report. In addition, based on the end-of-pilot surveys and focus groups summarized in Section 5, this report includes information on customer satisfaction with and impressions of PECO Smart Time Pricing.

2.1 Eligibility for PECO Smart Time Pricing

Throughout the development of PECO's Smart Time Pricing program, PECO engaged various stakeholder groups (including statutory advocates, the supplier community and PUC staff), via webinars and in-person meetings to cooperatively develop meaningful program parameters, including the establishment of the eligibility criteria for participation in the pilot. The findings of this report are limited to customers meeting those criteria, which were summarized in Section 2.2 of the PECO Smart Time Pricing Enrollment Report.

2.2 Residential Enrollment in PECO Smart Time Pricing

PECO solicited 120,998 residential customers to enroll in PECO Smart Time Pricing, starting in October 2013. In total, 4,779 customers enrolled over a 5-month period, which produced a 3.9% enrollment rate by the end of February 2014. The pilot ended for each customer as they reached their one-year enrollment anniversary. Of the 4,779 customers who enrolled in PECO

Smart Time Pricing, around 10% disenrolled before reaching one year on the pilot. Considering that pilot enrollment ramped up over a 5-month period, the phase out of the pilot also lasted 5 months (one year later), from October 2014 through February 2015. The pilot ended for most customers by the end of 2014, so this report focuses on the 2014 time period, which is when load impacts were estimated and when the end-of-pilot surveys were conducted (in October 2014).

2.3 SMB Enrollment in PECO Smart Time Pricing

PECO solicited 3,583 SMB customers to enroll in PECO Smart Time Pricing. In total, 23 customers accepted the offer, which produced a 0.64% acceptance rate. This experience showed that, among SMB customers that have never switched electricity suppliers, there was a lack of interest in PECO Smart Time Pricing. Due to the small number of SMB participants, this report primarily focuses on residential PECO Smart Time Pricing customers.

2.4 Summary of Survey Findings from Enrollment Report

Three prior surveys related to PECO Smart Time Pricing were summarized in the Enrollment Report. NRG Retail conducted a welcome survey among all residential customers who enrolled. Nexant conducted a residential decliner survey among a random sample of 5,500 customers who were solicited for PECO Smart Time Pricing, but who did not enroll in the program (referred to as “decliners”). Finally, Nexant also conducted a small-scale SMB phone survey, for which 22 customers completed the survey.

For the NRG Retail Welcome Survey for residential enrollees, the key findings were:

- More than two-thirds of respondents were satisfied with the pilot;
- Less than 10% of respondents were dissatisfied;
- The main reason respondents chose to participate in the program was to save money by taking advantage of a better rate during off-peak hours;
- PECO sponsorship of the program was an important reason in choosing to participate; and
- Over 75% of survey respondents were 55 years of age or older.

For the residential decliner survey, around half of respondents recalled receiving the offer to enroll in PECO Smart Time Pricing. Among customers who recalled receiving the offer, the key findings about why customers declined the offer were the following:

- Not wanting to switch away from their current service supplier;
- Not sure they would be better off on the new pricing plan;
- Simply not interested; and
- Thought they may experience higher costs on the program.

Finally, of the few customers who completed the small-scale SMB phone survey and recalled the offer, four out of five stated that they were just not interested, were not sure that they would be better off and that they thought it was too much hassle to sign up.

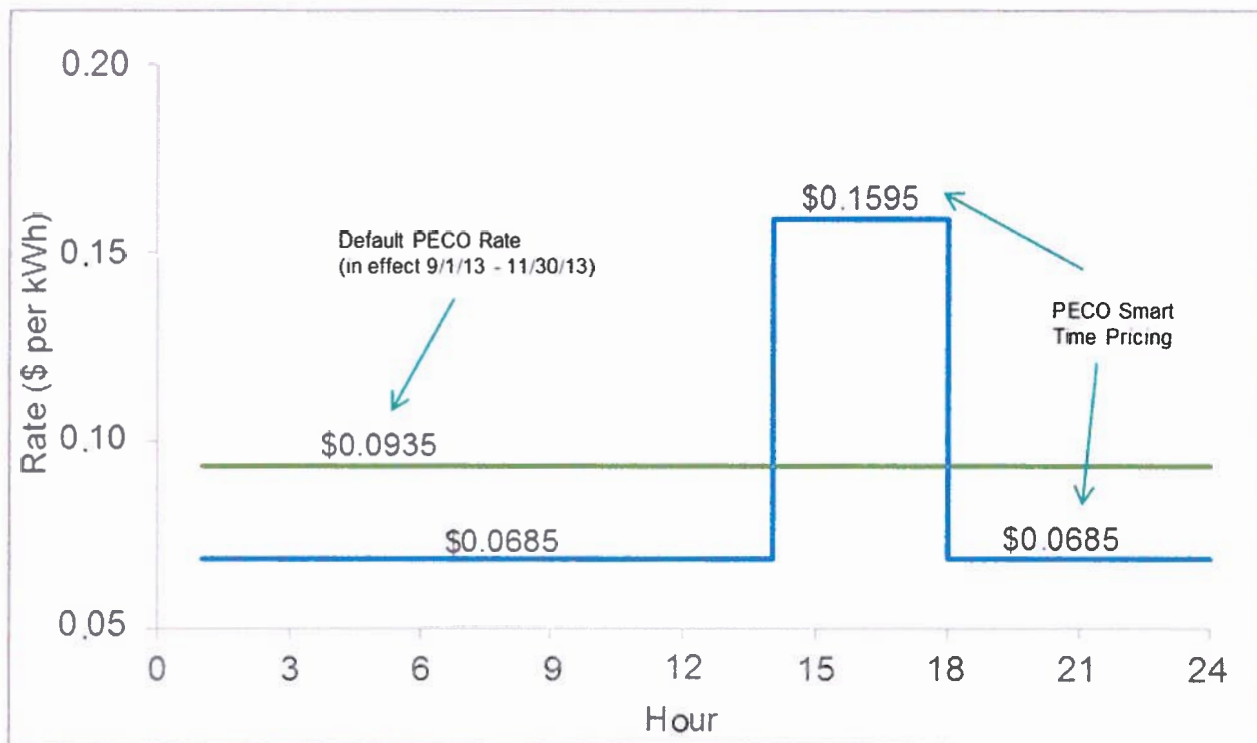
2.5 Overview of the Offer

As described in the Enrollment Report, the PECO Smart Time Pricing offer included three features – the TOU rate, bill protection and the option to leave the pilot at any time without a cancellation fee. The summary of these three features is also included in this report to ensure that readers of this report are aware of exactly what the pilot included.

2.5.1 The TOU Rate

PECO Smart Time Pricing applies to the generation portion of the rate that customers pay for electricity. The delivery portion of the rate stays the same. Figure 2-1 compares the generation rate under PECO Smart Time Pricing and under the default PECO rate (“PECO Price to Compare”) in effect at the time of the solicitation. PECO Smart Time Pricing had a peak generation rate of \$0.1595 per kWh on weekdays from 2 PM to 6 PM, excluding holidays, and an off-peak generation rate of \$0.0685 per kWh during the remaining hours of the year. The PECO Smart Time Pricing TOU rate remained the same for the entire pilot. PECO’s default rate for generation changed quarterly and was \$0.0935 per kWh at the time the solicitations began (that rate was in effect from September 1, 2013 through November 30, 2013). Basically, under PECO Smart Time Pricing, customers paid roughly 7 cents more per kWh during around 11% of the hours of the year and saved just over 2 cents per kWh during the remaining 89% of the hours.³

Figure 2-1: Comparison on Generation Rates (\$/kWh) on Non-holiday Weekdays



³ While the TOU pricing remained the same throughout the pilot, the on-peak premium and off-peak discount varied quarterly with changes to PECO’s default rate.

2.5.2 Bill Protection

PECO offered a bill protection feature that provided enrolled customers who remained with the program for 12 months the assurance that their total cost would not be greater than what they would have paid on PECO's default rate. If a customer's actual bill on PECO Smart Time Pricing was higher than it would have been with PECO's default rate, the customer received a check for the difference. The bill protection reconciliation was performed on the customer's aggregate twelve months of bills. Customers who left the pilot before completing the 12-month term were not eligible for bill protection.

At the end of the program, there were a total of thirteen customers who received bill-protection reimbursement from PECO. The individual amounts of bill-protection reimbursement ranged from \$1.01 to \$19.23, totaling \$100.64 for all thirteen customers.

2.5.3 Leave Anytime, No Cancellation Fee

Enrolled customers had the option of leaving the pilot at any time without a penalty or fee.

2.6 Report Organization

The remainder of this report proceeds as follows:

- **Section 3** summarizes the methodology for estimating the impact of PECO Smart Time Pricing on hourly and peak-period electricity consumption;
- **Section 4** provides the results of the PECO Smart Time Pricing load impact and cost saving analysis for residential participants;
- **Section 5** details the results of the end-of-pilot surveys and focus groups. and
- **Section 6** provides some observations

3 Load Impact Evaluation Methodology

The primary impact of interest for PECO Smart Time Pricing was the reduction of load during the peak hours. To measure this load impact, it was necessary to develop an estimate of the reference load. The reference load was an estimate of what load would have been in the absence of the price incentives. For this evaluation, the focus was on what the load would have been without PECO Smart Time Pricing during the pilot period November 2013 through December 2014.

This evaluation used a difference-in-difference methodology with a matched control group to estimate impacts for residential participants. At a high level, the steps for this process were as follows:

1. Selected a matched control group whose pre-treatment loads closely align with participant loads;
2. Calculated average control load during the treatment period to establish a counterfactual reference load;
3. Subtracted out any differences that existed between control and participant loads in the pre-treatment period;
4. Compared average participant loads to control loads during peak hours (2-6 PM on non-holiday weekdays), which produced average kW and percent impacts; and
5. Calculated aggregate impacts by multiplying average kW impacts by the number of participants enrolled during the treatment period.

The remainder of this section provides additional detail regarding the matching and difference-in-difference methodology used in the evaluation, including underlying assumptions made. The next three subsections summarize aspects of the residential impact evaluation methodology as follows:

- Section 3.1 describes the matched control group methodology;
- Section 3.2 describes the difference-in-differences approach; and
- Section 3.3 explains the estimation of aggregate impacts.

3.1 Matched Control Group Methodology – Residential

The primary source of reference loads, and hence impact estimates, was a matched control group. This matched control group was selected from the pool of 35,700 customers who were not solicited for enrollment in PECO Smart Time Pricing, but met all of the pilot eligibility criteria.⁴ By assembling a matched control group from a similar population that was not exposed to PECO Smart Time Pricing, it was possible to compare average control group loads to average participant loads and estimate impacts. The methods used to assemble this group were designed to ensure that the control group load during the treatment period was an

⁴ As discussed in the PECO Smart Time Pricing Pilot Enrollment Report, the pilot eligibility criteria led to only 25% of PECO residential customers being eligible. Therefore, it was important to draw the matched control group from a population that also met the eligibility criteria.

accurate estimate of what load would have been among PECO Smart Time Pricing customers had they not been exposed to the rate. The fundamental idea behind the matching process was to find customers who were not subject to the rate, but who met the eligibility criteria and had similar usage patterns to participants before enrollment.

A common alternative to a matched control group was a within-subjects analysis based only on the pretreatment and post-treatment loads of participants. This is usually carried out by constructing a regression model that predicts reference loads based on predictive variables such as weather and past usage. However, the matched control group method used for this analysis was superior to a within-subjects analysis because there was a large population of non-PECO Smart Time Pricing customers to use as a pool for matching and because it eliminated the problem of regression model misspecification.⁵ Any reference load model based on a participant's own loads before being exposed to the price signal requires the modeler to make assumptions about the relationships between load, time and temperature. If this assumed function does not reflect the true relationships between load, time and temperature, then the model can produce incorrect results. In contrast, the matched control group automatically deals with this problem by assuming that the customers who behaved similarly to PECO Smart Time Pricing participants prior to enrollment would also behave similarly after the participants enrolled. This eliminates the need to specify load as a function of weather, and therefore, reduces the uncertainty of a matched control group. PECO Smart Time Pricing conditions presented a case to use a matched control group as the basis for its analysis.

The PECO Smart Time Pricing population changed over time, due to rolling enrollments and disenrollments. Because of this, impacts were estimated separately for each month the program was offered. To do this, it was necessary to identify a participant group and a control group for each month. The participant group for each month was defined as the subset of participants who were fully enrolled for that month in the treatment period. Different matched control groups were selected for each month for each participant from among non-participants by comparing pretreatment loads for participants and non-participants. Selecting a different matched control group for each month, as opposed to selecting a match with the lowest average difference in load across months, results in a closer match within each month because the factors which result in similar load shapes for two customers in one month may be very different in another month. Therefore, selecting the closest match for each month resulted in a closer match and more accurate reference load.

For most months, pretreatment loads were from the same month one year prior to the treatment month, except for November and December 2014 because PECO Smart Time Pricing was already offered one year prior. For these two months, data from two years prior was used for the pretreatment matching month. This meant that for a non-participant to be a control group candidate, customer had to have interval data for both the treatment month and the pretreatment month. Participants used for impact analysis also had to have this interval data

⁵ For a comparison of results using various research methods, including RCT/RED designs, statistical matching and within-subjects regression analysis, see the interim report for Sacramento Municipal Utility District's Smart Pricing Options pilot: https://www.smartgrid.gov/sites/default/files/MASTER_SMUD%20CBS%20Interim%20Evaluation_Final_SUBMITTED%200%20TAG%2020131023.pdf.

Load Impact Evaluation Methodology

and must have been fully enrolled for the post-treatment month and not be enrolled in or exposed to PECO Smart Time Pricing in the pretreatment month.

To assess the accuracy of the control group match, Table 3-1 summarizes the following for each post-treatment month:

- Pretreatment month that was used;
- Number of participants fully enrolled in PECO Smart Time Pricing for that post-treatment month (e.g. enrolled on the first and last non-holiday weekday);
- Subset of enrolled customers who also had interval data for the pre-treatment month;
- Number of non-participants who were control group candidates because they had interval data for the pre-treatment and post-treatment months; and
- Subset of control group candidates who were selected as part of the matched control group.

It is important to note that PECO's smart meter rollout for these customers was in process during the winter of 2012 and the spring of 2013. Because interval data was only available for customers who had a smart meter installed, there were a limited number of participants or control group candidates who could be used for this analysis during certain months. In addition, because of rolling enrollments and disenrollments, the number of participants available for impact analysis was quite low in the fourth quarters of 2013 and 2014.

Table 3-1: Participants and Matched Control Group Used for Monthly Impact Analysis

Post-treatment Month	Pre-treatment Month	Participants Enrolled	Participants with Pre-treatment Data	Participant Sample as % of Total Enrolled	Control Group Candidates	Control Group	Control Group as % of Control Candidates
Nov 2013	Nov 2012	113	34	30%	10,687	33	0%
Dec 2013	Dec 2012	973	403	41%	10,641	367	3%
Jan 2014	Jan 2013	2,977	1,436	48%	10,608	1,098	10%
Feb 2014	Feb 2013	4,155	2,312	56%	10,576	1,646	16%
Mar 2014	Mar 2013	4,424	2,795	63%	10,530	1,999	19%
Apr 2014	Apr 2013	4,445	3,324	75%	10,491	2,391	23%
May 2014	May 2013	4,399	3,852	88%	10,434	2,718	26%
Jun 2014	Jun 2013	4,353	4,297	99%	10,378	3,068	30%
Jul 2014	Jul 2013	4,322	4,281	99%	10,307	3,111	30%
Aug 2014	Aug 2013	4,282	4,262	100%	10,226	3,046	30%
Sep 2014	Sep 2013	4,163	4,161	100%	10,179	2,965	29%
Oct 2014	Oct 2013	3,457	1,121	32%	10,134	817	8%
Nov 2014	Nov 2012	1,390	391	28%	10,084	357	4%
Dec 2014	Dec 2012	812	321	40%	10,042	299	3%

After identifying the subset of customers who could be used for matching, the match itself was performed as follows. To select a match for an individual participant, that customer's monthly average weekday load shape was compared to the monthly average weekday load shape for

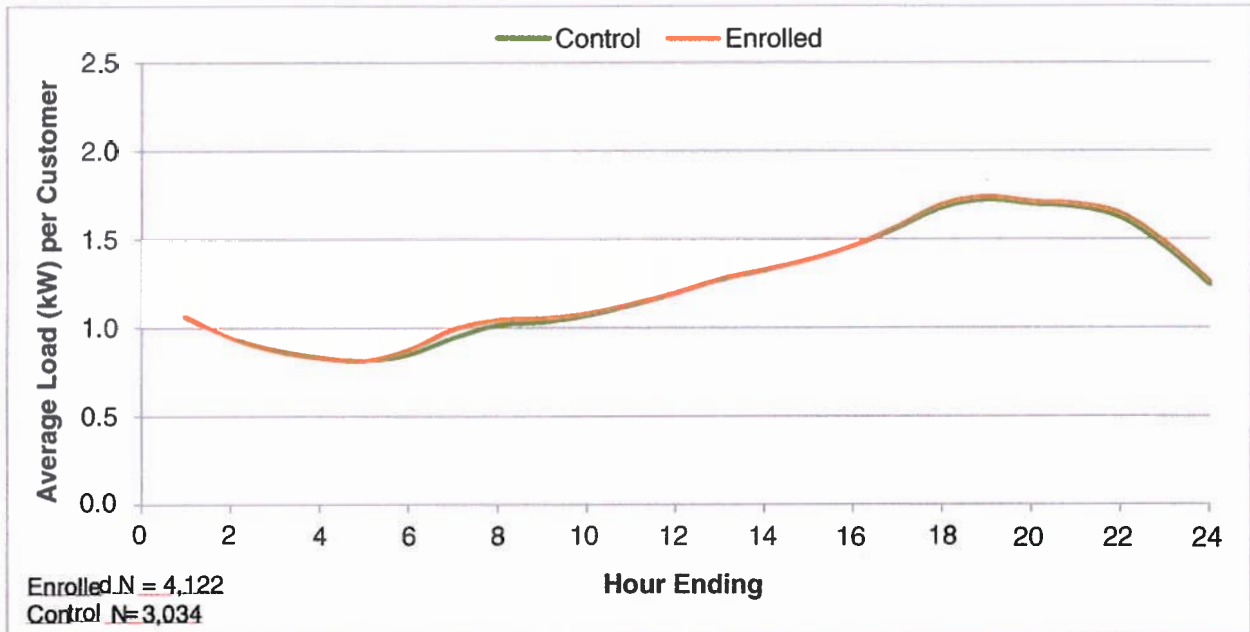
Load Impact Evaluation Methodology

each control group candidate. The candidate with the lowest absolute difference⁶ was selected as the match for that participant for that month.⁷ In effect, each participant was matched to the control candidate with the most similar pretreatment load shape on non-holiday weekdays. A match was found for each PECO Smart Time Pricing participant, but the same control customer could be matched to multiple PECO Smart Time Pricing participants, meaning that a control customer would be represented more than once in the control group.

3.2 Difference-in-differences Approach – Residential

Figure 3-1 shows the average pretreatment loads for the participant and matched control group in summer 2013, just before PECO Smart Time Pricing was rolled out. Note how closely the loads align; in effect, this is evidence that the control group was well matched to the participants. A well matched control group allowed for detection of relatively small impacts.

Figure 3-1: Average Weekday Loads Before PECO Smart Time Pricing, July-Sept. 2013

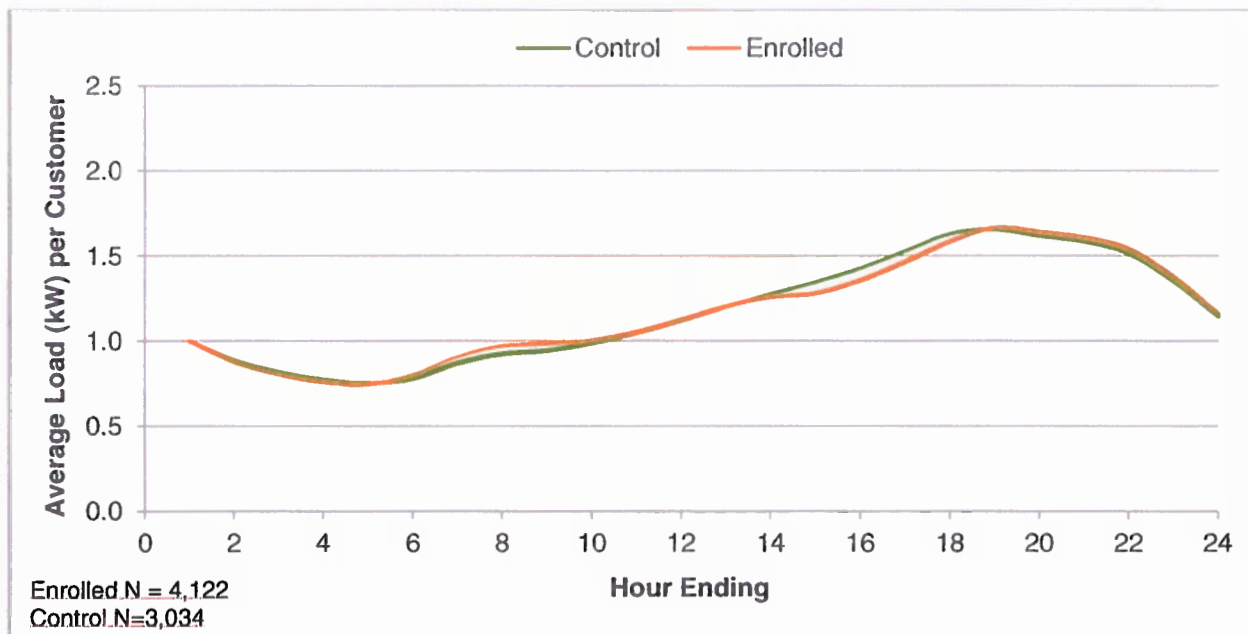


Once the matched control group was selected, the counterfactual load was derived by simply taking the average load across the control group during the post-treatment period. This reference load was compared to average participant load in the same period. Figure 3-2 shows these two loads for summer 2014. The counterfactual, or control, load is in green. Note that participant loads were reduced between the hours of 2 and 6 PM when the PECO Smart Time Pricing peak period was in effect.

⁶ Sum of absolute differences for each hour.

⁷ In a few cases, more than one candidate had the same absolute difference in which case the candidate with the lowest variance in hourly differences was selected.

Figure 3-2: Average Weekday Loads during PECO Smart Time Pricing, July-Sept. 2014



Equation 3-1 shows the difference-in-differences equation that was then used to estimate the hourly impacts of PECO Smart Time Pricing during the post-treatment period. In simple terms, this was done by comparing hourly loads for the matched control group to hourly loads for the PECO Smart Time Pricing participants, after subtracting out any underlying differences between control and participant loads as observed in the pretreatment period.

Equation 3-1: Difference-in-differences Calculation

$$kW_impact = (kW_{p,post} - kW_{c,post}) - (kW_{p,pre} - kW_{c,pre})$$

Table 3-2: Variables and Subscripts for Difference-in-differences Equation

Element	Description
kW_impact	Change in load during each hours
kW	Average load during the each weekday hour
p	Participant
c	Matched control customer
pre	Pre-treatment period (same month in year or two prior to PECO Smart Time Pricing)
post	Post-treatment period (during which PECO Smart Time Pricing was in effect)

3.3 Estimation of Aggregate Load Impact Results – Residential

While individual customer impacts to their savings were important, the main metric of interest was the aggregate load reduction during peak hours. As mentioned in the previous section, some participants were excluded from certain months in the impact analysis due to a lack of pretreatment interval data. This limitation occurred when a customer did not have an AMI Meter throughout the pre- and post-treatment time periods or when a customer was not an active PECO customer throughout the entire time period. Nexant analyzed the participants with and without data limitations and found that, for the most part, the two groups had similar load shapes. Therefore, aggregate load impacts for each month were estimated by multiplying the number of participants fully enrolled for that month (regardless of data availability) by the average load impact as estimated from the customers for which there weren't any data limitations.

In the few cases where the loads of participants with and without data limitations were not similar, this difference was mostly due to there being a very small number of excluded participants, such as in June and July of 2014 when only 1% of enrolled participants were lacking pretreatment data (see Table 3-1). Since only a small subset was excluded, it was reasonable to assume that impact results could be generalized to the whole group. The other noticeable difference was that loads for the included group were generally slightly lower. This meant that load impacts for the excluded group were likely to have been slightly larger, thus leading to a somewhat conservative aggregate impact estimate. For these two reasons it was deemed reasonable to arrive at aggregate load impacts by applying average load impacts derived from the subset with pretreatment data to the full group of participants enrolled in a given month.

3.4 Estimation of Bill Savings

While the impact analysis primarily focused on peak load reductions, a secondary analysis was also conducted on customer bill savings. The goal of this analysis was to understand the impact the PECO Smart Time rate had on customer bills and to what extent this bill impact could be attributed to behavioral peak load shifting. The inputs to this analysis were the monthly cost impacts calculated by PECO (and communicated periodically to customers throughout the program) and the total monthly usage for the same billing period each month. The total monthly usage was used to calculate what the bill would have been under the PECO default rate and included the tariff distribution and customer charges. From there dollar savings as a percent of what the bill would have been without PECO Smart Time Pricing was simply the cost savings divided by the estimated total bill. Average monthly savings over the duration of the PECO Smart Time Pricing program were weighted by the number of participants in each month.

4 Residential Load Impact Results

This section summarizes the load impact estimates for PECO Smart Time Pricing residential customers following their full year of participation in the pilot. First, hourly estimates are provided for July 2014, the month with the highest average usage. Next, average monthly load impact estimates are provided from November 2013 through December 2014, which nearly covers the entire PECO Smart Time Pricing pilot time period.⁸ Monthly load impact estimates are then compared for accounts with and without electric heat. In the next step the load impact estimates are combined with the participant survey responses (summarized in Section 5) to show how load impacts vary by self-reported actions to shift usage away from peak hours. Finally, the customer cost impacts due to load shifting are evaluated to show the overall savings plus the savings attributable to customer behavior changes.

Throughout this section, results are qualified as being statistically significant or not statistically significant, using the p-value and the 95% confidence interval. The p-value is the likelihood that a given estimated impact of PECO Smart Time Pricing is not different from zero. For example, a p-value of 5% means that there is a 5% chance that the impact of PECO Smart Time Pricing is not different from zero (put differently, there is a 95% chance that the impact is different than zero). A p-value of 5% or below is considered statistically significant because it corresponds to a high likelihood that the estimated impact is different from zero. The 95% confidence interval consists of a lower and upper bound within which actual results are likely to lie (with 95% likelihood). On impact charts throughout this section, hourly impacts are plotted along with the lower and upper bounds of the 95% confidence interval, a standard measure of statistical significance. If zero falls within the interval, the impact is considered to be not statistically significant. In the tables in the section, impact estimates that are not statistically significant are designated by a gray background in the table row in order to clearly show when a given result is not statistically different from zero.

4.1 Hourly Load Impacts for July 2014

Figure 4-1 shows the hourly load impact estimates for the average residential PECO Smart Time Pricing participant during the month of July 2014 – the month with the highest average usage during the 14 months analyzed. Above the figure, it shows average peak impacts, and below the figure, there is a table with hourly impacts.

For weekdays in July 2014, the average hourly reference load per participant was 1.86 kW. The average reduction during the peak period from 2 PM to 6 PM was 0.11 kW, which corresponds to a 5.7% reduction of whole-house load during that period. This impact was consistent throughout the 4-hour peak period resulting in an aggregate peak load reduction of 459 kW. This represents the highest peak load reduction achieved throughout the PECO Smart Time Pricing pilot, due to the high usage in July 2014 and enrollment being near its peak.

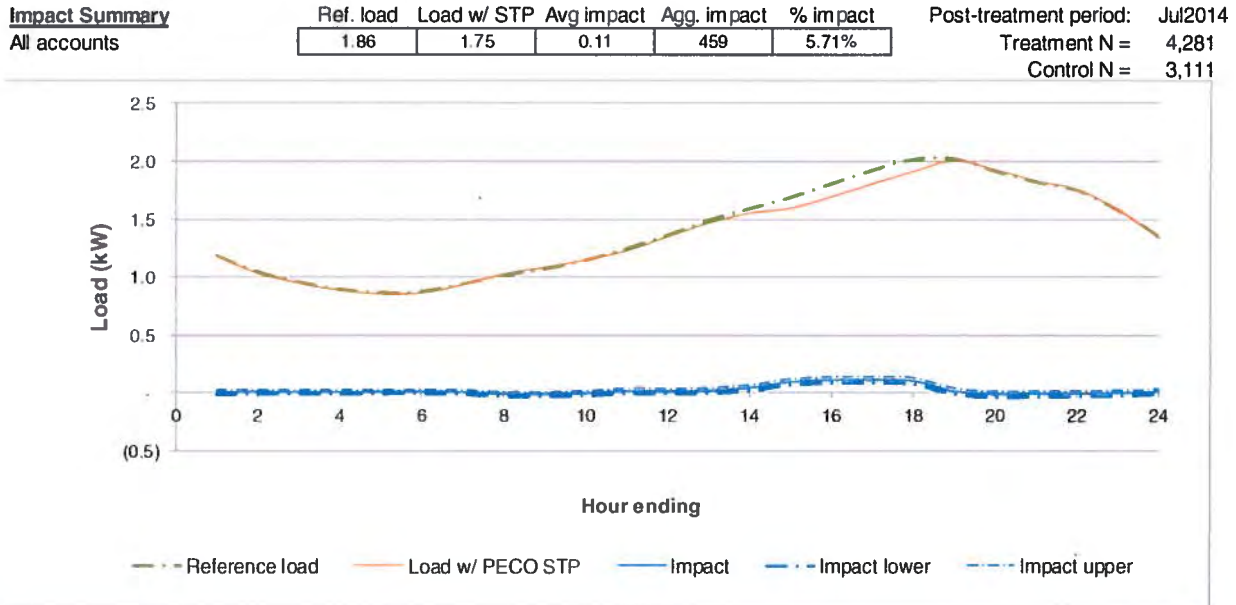
As for off-peak hours during weekdays in July, load did not significantly increase before or after the peak period, which suggests that peak loads were largely reduced as opposed to simply

⁸ A relatively small number of customers were still rolling off the rate in the beginning of 2015.

Residential Load Impact Results

shifted to off-peak hours. This was also the case in other summer months, including June, August and September 2014.

Figure 4-1: Residential PECO Smart Time Pricing Average Hourly Impacts for July 2014



Hour	Reference load (kW)	Load w/ PECO STP (kW)	Average impact (kW)	Aggregate impact (kW)	Percent Reduction (%)	Standard error (kW)	P-value (confidence)	Lower bound: 95% confidence	Upper bound: 95% confidence
12 AM - 1 AM	1.18	1.18	0.01	27	0.53%	0.01	54.6%	-0.01	0.03
1 AM - 2 AM	1.05	1.04	0.01	47	1.05%	0.01	25.1%	-0.01	0.03
2 AM - 3 AM	0.96	0.95	0.01	38	0.93%	0.01	32.2%	-0.01	0.03
3 AM - 4 AM	0.90	0.89	0.01	39	1.01%	0.01	29.6%	-0.01	0.03
4 AM - 5 AM	0.87	0.86	0.01	48	1.29%	0.01	18.3%	-0.01	0.03
5 AM - 6 AM	0.88	0.86	0.01	55	1.46%	0.01	14.8%	0.00	0.03
6 AM - 7 AM	0.94	0.93	0.01	31	0.77%	0.01	44.9%	-0.01	0.03
7 AM - 8 AM	1.01	1.03	-0.01	-45	-1.04%	0.01	30.5%	-0.03	0.01
8 AM - 9 AM	1.07	1.08	-0.01	-52	-1.13%	0.01	25.3%	-0.03	0.01
9 AM - 10 AM	1.15	1.15	0.00	-12	-0.25%	0.01	79.6%	-0.02	0.02
10 AM - 11 AM	1.25	1.23	0.02	77	1.43%	0.01	12.4%	0.00	0.04
11 AM - 12 PM	1.36	1.35	0.01	59	1.00%	0.01	26.3%	-0.01	0.04
12 PM - 1 PM	1.49	1.47	0.02	93	1.45%	0.01	8.6%	0.00	0.05
1 PM - 2 PM	1.59	1.55	0.04	190	2.76%	0.01	0.1%	0.02	0.07
2 PM - 3 PM	1.69	1.60	0.10	412	5.64%	0.01	0.0%	0.07	0.12
3 PM - 4 PM	1.81	1.69	0.11	486	6.23%	0.01	0.0%	0.09	0.14
4 PM - 5 PM	1.92	1.81	0.11	489	5.89%	0.01	0.0%	0.09	0.14
5 PM - 6 PM	2.02	1.91	0.10	447	5.13%	0.01	0.0%	0.08	0.13
6 PM - 7 PM	2.02	2.00	0.02	68	0.78%	0.01	24.4%	-0.01	0.04
7 PM - 8 PM	1.91	1.92	-0.01	-49	-0.60%	0.01	39.6%	-0.04	0.01
8 PM - 9 PM	1.82	1.83	-0.01	-41	-0.53%	0.01	46.5%	-0.04	0.02
9 PM - 10 PM	1.75	1.76	-0.01	-25	-0.33%	0.01	65.3%	-0.03	0.02
10 PM - 11 PM	1.58	1.58	0.00	-11	-0.16%	0.01	83.9%	-0.03	0.02
11 PM - 12 AM	1.35	1.34	0.01	53	0.91%	0.01	28.7%	-0.01	0.04

Residential Load Impact Results

4.2 Monthly Load Impact Summary

Table 4-1 shows the average load reduction during peak hours for residential customers enrolled in PECO Smart Time Pricing for each month included in the analysis, from November 2013 through December 2014. For each month, the analysis only included accounts that were enrolled for the entire month.⁹ As shown in Table 4-1, load reductions for PECO Smart Time Pricing customers were statistically significant in the spring and summer months. On average, PECO Smart Time Pricing participants had peak loads that were about 6% lower than those of the control group during summer peak period hours (June through August 2014), resulting in an average load impact of 0.09 kW to 0.11 kW and an aggregate load reduction of 367 kW to 459 kW. During September and spring months (March through May), load reductions were about 3% to 4%. Aggregate impacts fluctuated throughout these periods due to rising and falling PECO Smart Time Pricing enrollment.

In fall and winter months, load impacts were largely not statistically significant, which was due to lower enrollment and usage (weekday afternoon load is lower in the fall and winter). The one exception is November 2013, which had a statistically significant impact of over 13% of peak load reduction. However, this result may have been an anomaly due to the small sample size: only 34 participants were included in the November 2013 analysis. Alternatively, this result could be that the first group of customers to be enrolled were early adopters and perhaps were initially more enthusiastic about managing their load to save money than the average enrollee.

Table 4-1: Monthly Average Peak (2-6 PM) Impacts, Residential PECO Smart Time Pricing

Month	Reference Load kW	Load w/ PECO STP kW	Average Impact kW	Aggregate Impact kW	Percent Reduction (%)	Standard Error (Impact)	P-value (Impact)	Lower Bound: 95% Conf.	Upper Bound: 95% Conf.
Nov 2013	1.02	0.88	0.14	15	13.35%	0.06	1.9%	0.02	0.25
Dec 2013	1.25	1.19	0.06	55	4.49%	0.03	7.9%	-0.01	0.12
Jan 2014	1.40	1.40	0.00	-5	-0.11%	0.02	94.5%	-0.05	0.04
Feb 2014	1.19	1.16	0.03	106	2.15%	0.02	11.8%	-0.01	0.06
Mar 2014	1.01	0.97	0.04	181	4.06%	0.01	0.1%	0.02	0.06
Apr 2014	0.79	0.77	0.03	120	3.41%	0.01	0.0%	0.01	0.04
May 2014	0.82	0.79	0.03	111	3.10%	0.01	0.3%	0.01	0.04
Jun 2014	1.44	1.36	0.09	382	6.07%	0.01	0.0%	0.07	0.11
Jul 2014	1.86	1.75	0.11	459	5.71%	0.01	0.0%	0.08	0.13
Aug 2014	1.47	1.38	0.09	367	5.83%	0.01	0.0%	0.06	0.11
Sep 2014	1.10	1.06	0.04	148	3.24%	0.01	0.0%	0.02	0.05
Oct 2014	0.76	0.74	0.02	63	2.40%	0.01	19.4%	-0.01	0.05
Nov 2014	1.02	1.01	0.02	24	1.72%	0.03	54.6%	-0.04	0.08
Dec 2014	1.23	1.23	0.00	4	0.35%	0.04	90.8%	-0.07	0.08

⁹ For example, June 2014 impacts are only for accounts enrolled on the first and last weekday in June 2014

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4.3 Impacts by Electric vs. Non-electric Heating

Customers who used electricity as their primary source of heat¹⁰ had higher electric loads during colder months, especially in morning and evening hours. Therefore, these customers had the potential to provide relatively large load reductions during winter months. To assess this, Table 4-2 provides a comparison of monthly percent impacts for customers with and without electric heat. When comparing impacts for these two groups, it is important to note that there were only 600 customers with electric heat compare to 3,697 non-electric heating customers (comparison of peak PECO Smart Time Pricing enrollment numbers in June 2014). Due to the small sample size, most of the monthly load impact estimates were not statistically significant for electric heat customers. Interestingly, the only load impact estimates that were statistically significant were during the summer and early fall. These summer and early fall percent impact estimates were also higher for the most part for electric heat customers. One potential explanation for this observation could be that a higher percentage of the electric heat customers who enrolled had heat pumps than the percentage of non-electrically heated customers who had central air conditioners. As such, contrary to what may have been expected, electric customers were actually shown to provide larger percent load reductions in non-winter months. Also note the 7.8 percent swing between the non-electrically heated and electrically heated homes in January 2014 which was the month of the polar vortex.

Table 4-2: Comparison of Monthly Percent Impacts (2-6 PM) for Customers With and Without Electric Heat

Month	Percent Reduction (%)	
	Electric Heat	Non-electric Heat
Nov 2013	10.02%	14.41%
Dec 2013	-2.90%	7.18%
Jan 2014	-5.12%	2.68%
Feb 2014	-2.21%	4.27%
Mar 2014	2.72%	4.62%
Apr 2014	2.16%	3.78%
May 2014	3.65%	2.97%
Jun 2014	8.20%	5.65%
Jul 2014	4.31%	5.96%
Aug 2014	9.92%	5.00%
Sep 2014	7.39%	2.34%
Oct 2014	9.10%	0.75%
Nov 2014	-0.60%	2.63%
Dec 2014	-3.64%	2.01%

¹⁰ These customers were identified using the PECO rate code.

4.4 Impacts by Self-reported Load Shifting Actions

This section analyzes impacts for the subset of residential customers who completed the participant survey and focuses on identifying the extent to which load impacts varied by self-reported actions to shift usage away from peak hours. These self-reported actions were detailed by survey respondents in an open-ended question asking them to describe actions taken to shift peak load (Question 13 in the participant survey instrument, provided in Appendix B).

Table 4-3 shows the average peak load impacts in July 2014 for participants reporting taking various actions or inactions to shift their usage away from peak hours. For comparison, the table also includes the average impacts for all residential PECO Smart Time Pricing customers and impacts for customers reporting taking no action to shift usage away from the peak hours. Impacts for most of these groups were statistically significant, except for three groups with small sample sizes (customers only reporting shifting use of small appliances, customers reporting shifting only the HVAC/thermostat settings, and those who reported taking no action to shift usage). The average peak load reduction was 7% (0.14 kW) for customers who only shifted use of large appliances (e.g., washer and dryer, oven, stove). Impacts were twice as high, or 14% (0.28 kW), for customers who reported shifting both large appliance and HVAC use (e.g., by adjusting thermostat settings). This shows that load reductions were largest for customers who shifted use of both large appliances and HVAC-related loads – possibly an indication that this group of customers was more diligent in their behavior to shift load away from the peak price time of day. This observation is reinforced by evaluating the comparison between the sum of the individual large appliance reduction and the HVAC only reduction and the reduction experienced by customers reported to be doing both (10.47% vs. 14.13%).

Finally, the results demonstrate that the self-reported actions of survey respondents seemed reasonably accurate in reflecting differences in how customers actually responded to PECO Smart Time Pricing.

Table 4-4 shows the set of statistics as Table 4-3 for select demographic groups as compared to all accounts. For all three demographic groups percent load reduction was substantially higher than for the average across all accounts and all of these impacts were statistically significant. Seniors (65+) were the largest group and had reference loads very similar to the average customer but produced peak load impacts (7.05%) that were over one percentage point higher than for average customers (5.71%). Households with incomes below \$34k/year were a smaller group and had a below average reference load (1.34 kW compared to 1.86 kW) indicating lower overall peak electricity usage. However, the impacts for this group (7.32%) were also higher than average. Households with an ADA eligible member represented a very small minority (sample size of 66 participants analyzed for July 2014). However, this group produced peak load impacts (11.61%) over twice those of average customers (5.71%). This indicates that all three of these groups were no less able to shift their peak load than were average customers.

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Table 4-3: Average July 2014 Peak (2-6 PM) Impacts by Self-reported Actions to Shift Peak Loads (Statistical Data)

Month	Accounts Analyzed (N)	Reference Load kW	Load w/ PECO STP kW	Average Impact kW	Percent Reduction (%)	Standard Error (Impact)	P-value (Impact)	Lower Bound: 95% Conf.	Upper Bound: 95% Conf.
All accounts	4,281	1.86	1.75	0.11	5.71%	0.01	0.0%	0.08	0.13
Actions were taken to shift load	1,143 ¹¹	1.99	1.82	0.17	8.57%	0.03	0.0%	0.12	0.22
Small appliances only ¹²	19	1.17	1.10	0.08	6.40%	0.15	63.4%	-0.25	0.40
HVAC only ¹³	80	1.97	1.90	0.07	3.64%	0.10	49.3%	-0.14	0.28
Large appliances only ¹⁴	468	2.05	1.91	0.14	6.83%	0.04	0.0%	0.07	0.21
HVAC and large appliances	328	1.98	1.70	0.28	14.13%	0.05	0.0%	0.17	0.39
Actions were NOT taken to shift load	380	1.78	1.77	0.01	0.51%	0.04	81.4%	-0.07	0.09

Table 4-4: Average July 2014 Peak (2-6 PM) Impacts by Select Demographic Groups (Statistical Data)

Month	Accounts Analyzed (N)	Reference Load kW	Load w/ PECO STP kW	Average Impact kW	Percent Reduction (%)	Standard Error (Impact)	P-value (Impact)	Lower Bound: 95% Conf.	Upper Bound: 95% Conf.
All accounts	4,281	1.86	1.75	0.11	5.71%	0.01	0.0%	0.08	0.13
Seniors (65+)	689	1.83	1.70	0.13	7.05%	0.03	0.0%	0.07	0.18
Low income (household income < \$34k)	159	1.34	1.24	0.10	7.32%	0.05	4.2%	0.00	0.19
ADA eligible household member	66	2.15	1.90	0.25	11.61%	0.09	0.6%	0.07	0.43

¹¹ This represents the 73% of respondents who took some level of action to shift energy usage from peak hours.

¹² These items include appliances such as kitchen appliances, entertainment (television, sound systems) and lighting.

¹³ These appliances cover central heating and air conditioning.

¹⁴ These items include heavier appliances such as washing machines, dryers, and dishwashers.

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4.5 Impacts and Average Monthly Dollar Savings

Throughout the PECO Smart Time Pricing pilot the generation costs for the TOU rate compared to the PECO default rate were calculated and communicated to customers.¹⁵ Nearly all customers saved money on PECO Smart Time Pricing, with monthly savings amounts exceeding \$5 for over 2350 customers. Nonetheless, customers from all savings levels showed evidence of load reductions in response to PECO Smart Time Pricing. Table 4-5 shows the average of these savings for each month during the pilot.¹⁶ It also shows the PECO default rate (“Price to Compare”) that was used to calculate bill savings in each month.

Table 4-5: Average Monthly Bill Savings

Month	Accounts analyzed (N)	PECO Price to Compare (\$)	Avg monthly savings (\$)
Nov 2013	34	\$0.0935	\$11.24
Dec 2013	403	\$0.0977	\$15.52
Jan 2014	1436	\$0.0977	\$19.36
Feb 2014	2312	\$0.0977	\$17.37
Mar 2014	2795	\$0.0877	\$7.96
Apr 2014	3324	\$0.0877	\$6.51
May 2014	3852	\$0.0877	\$5.36
Jun 2014	4297	\$0.0866	\$4.03
Jul 2014	4281	\$0.0866	\$3.48
Aug 2014	4262	\$0.0866	\$3.39
Sep 2014	4161	\$0.0825	\$1.40
Oct 2014	1121	\$0.0825	\$1.97
Nov 2014	390	\$0.0825	\$2.56
Dec 2014	320	\$0.0890	\$11.24

Figure 4-2 shows the percent of customer savings attributable only to the behavioral shift in peak load alongside the percent peak load reductions for each month in 2014. Both bill savings and load reductions appeared to be positively correlated with warm weather as both were

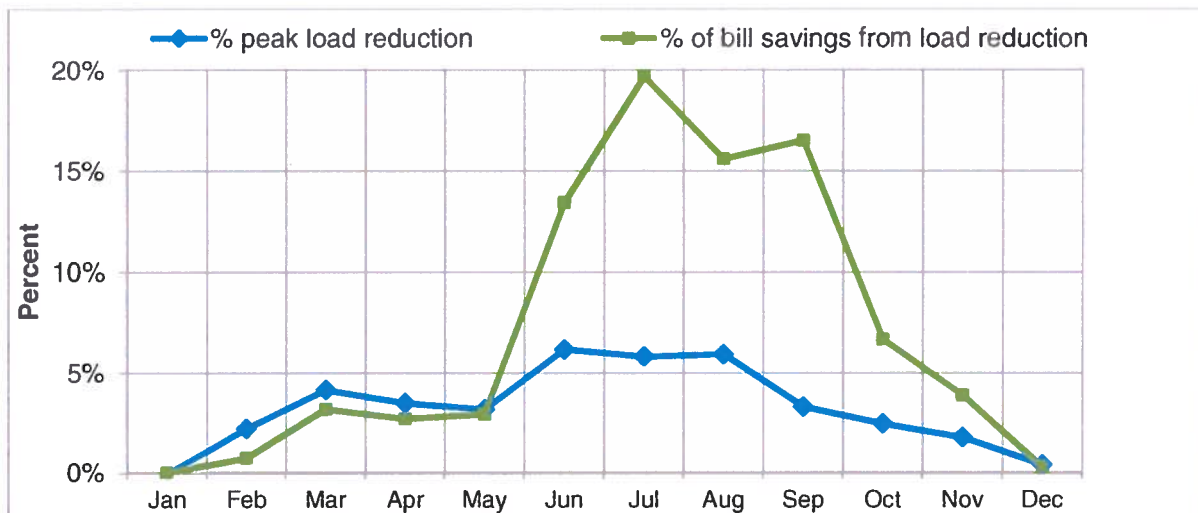
¹⁵ See Appendix C for an explanation of the PECO Smart Time Pricing Communication Plan.

¹⁶ Savings were typically highest in the first few months of participation, skewing average savings towards participants who were only enrolled for a few months. Savings stabilize after about 8 months of participation so the 415 participants with fewer than 8 months of enrollment were removed to address this skewing.

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highest in the warmer summer months. The percentage of savings due to load reduction was highest in June, comprising 20% of total savings, and lowest in January and December of 2014 when there were no significant peak load reductions. It is notable that the percent of savings due to load shifting was highest in the summer months when the average percent load reduction was also at its highest.

Figure 4-2: Percent Reduction in 2014 Monthly Peak Usage (2-6 PM) and Percent of Bill Savings from Load Reduction as a Result of Residential PECO Smart Time Pricing

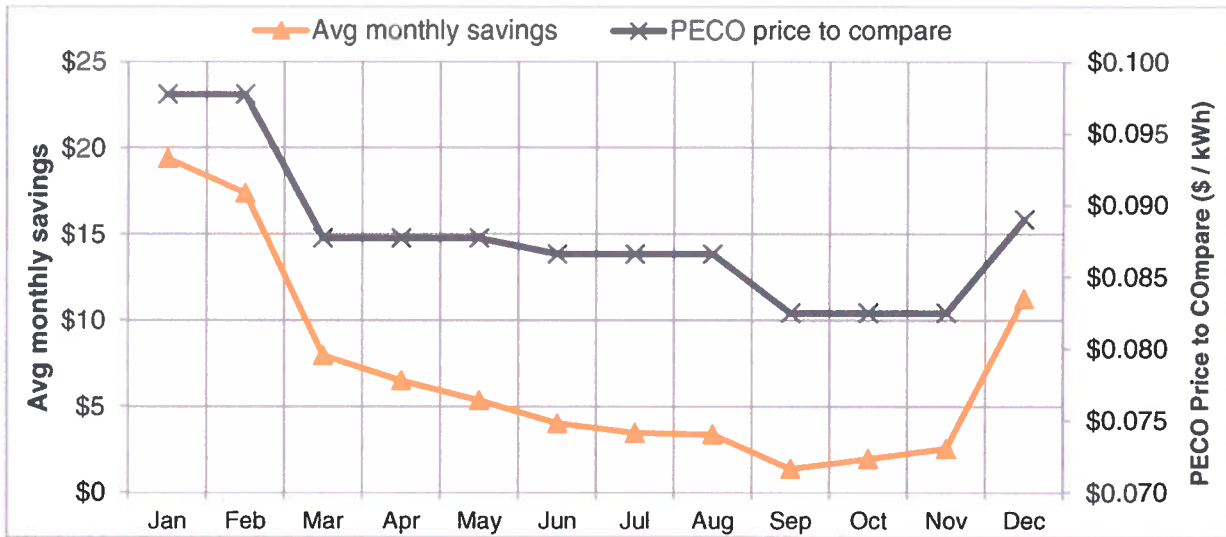


The calculation of savings attributable to load reduction (illustrated in Figure 4-2) took into account the load shift along with the PECO price to compare and average bill savings for each month.¹⁷ Figure 4-3 shows total average dollar savings for each month alongside PECO's price to compare. This figure illustrates that average monthly savings were highest in winter months when PECO price to compare was also highest.

¹⁷ This estimate is calculated by multiplying the average load reduction for each group by the number of peak hours in each month from November 2013 to December 2014 (4 hours per day times the number of non-holiday weekdays) and the difference between the PECO Smart Time Pricing rate and the PECO default rate for the same period. Only peak hours were considered because load shifting was not statistically significant during off-peak hours. The average across months was weighted by the enrollment in each month.

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Figure 4-3: Percent Reduction in 2014 Monthly Peak Usage (2-6 PM) and Percent of Bill Savings from Load Reduction as a Result of Residential PECO Smart Time Pricing



Comparing Figure 4-2 with Figure 4-3, it is notable that the percent of savings due to the load reduction was accentuated between June and November 2014, when the PECO default rate was at its lowest. The percent of savings from load reduction was highest when the total dollar savings were lowest, suggesting that the high dollar savings in the winter months were primarily driven by the difference in rates while the summer savings were more driven by load reductions.

Table 4-6 shows the average of bill savings for the month of July 2014 for the load shifting action categories discussed in section 4.4, Impacts by Self-reported Load Shifting. The table also shows an estimate of the portion of savings attributable only to the behavioral shift in peak load.¹⁸ The behavioral load shift accounted for about 17% of the \$4.06 average July 2014 bill savings across all participants. This percentage was higher for participants who reported taking actions to shift load (24% of savings were from load shift) and highest for participants who reported shifting both HVAC-related and large appliance use, the most substantial load shifting actions (36% of savings were from load shift).

Table 4-6: Average July 2014 Peak (2-6 PM) Bill Savings by Self-reported Actions to Shift Peak Loads

Segment	Accounts analyzed (N)	Average bill savings (\$)	Average savings from load shift (\$)	Portion of savings from load shift (%)
All accounts	4,281	\$4.06	\$0.68	16.8%
Some level of action was taken to shift usage	1,143	\$4.46	\$1.09	24.5%

¹⁸ This estimate is calculated by multiplying the average load reduction for each group by the number of peak hours in July (4 hours per day times 22 non-holiday weekdays) and the difference between the PECO Smart Time Pricing rate and the PECO default rate for the same period. Only peak hours were considered because load shifting was not statistically significant during off-peak hours.

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Segment	Accounts analyzed (N)	Average bill savings (\$)	Average savings from load shift (\$)	Portion of savings from load shift (%)
Small appliances shifted only	19	\$2.68	\$0.48	17.9%
HVAC shifted only	80	\$4.44	\$0.46	10.4%
Large appliances shifted only	468	\$4.30	\$0.90	20.9%
HVAC and large appliances shifted	328	\$4.95	\$1.80	36.3%
Did NOT report taking actions to shift load	380	\$3.48	\$0.06	1.7%

Bill savings for the month of July 2014 were also analyzed for selected demographic groups. Table 4-7 shows the average of bill savings for the month of July 2014 for three specific groups as compared to all customers. The table also shows an estimate of the portion of savings attributable only to the behavioral shift in peak load. The behavioral load shift accounted for about 17% of the \$4.06 average July 2014 bill savings across all participants. This percentage was about the same for seniors (65+), it was substantially higher for households with incomes below \$34k/year (26% of savings were from load shift), and highest for households with an ADA eligible household member (36% of savings were from load shift). Of note households with an ADA eligible member were more likely to report HVAC and large appliances load shifting behavior than the average customer.

Table 4-7: Average July 2014 Peak (2-6 PM) Bill Savings for Select Demographic Groups

Segment	Accounts analyzed (N)	Average bill savings (\$)	Average savings from load shift (\$)	Portion of savings from load shift (%)
All accounts	4,281	\$4.06	\$0.68	16.8%
Seniors (65+)	689	\$4.90	\$0.83	16.9%
Low income (household income < \$34k)	159	\$2.46	\$0.63	25.6%
ADA eligible household member	66	\$4.27	\$1.60	37.5%

Finally, bill savings were analyzed as a percentage of what the customer bill would have been without PECO Smart Time Pricing under the PECO default rate.¹⁹ For this analysis average total monthly savings were calculated for the duration of the program (November 2013 to December 2014). As above, the portion of these savings that could be attributed to load shifting behavior was also identified.

¹⁹ Estimated used the average monthly usage and the PECO default rate for each month, see section 3.4 for more details

Residential Load Impact Results

Table 4-8 shows average monthly bill savings in dollars and as a percentage of what the bill would have been for the load shifting action categories discussed above. It also shows the average monthly usage, average monthly dollar savings, and the portion of monthly savings that were due to load shifting behavior. As with the analysis specific to July 2014, average monthly savings were highest for groups reporting the most load shifting actions (\$7.95 or 5.50% of the total bill for those shifting HVAC and large appliance usage) and lowest for customers not reporting taking actions to shift loads (\$6.07 or 4.85% of the total bill).

Table 4-8: Average Total Bill Monthly Savings by Self-reported Actions to Shift Peak Loads

Segment (for all months)	Average monthly usage (kWh)	Average monthly bill savings (\$)	Average total savings (%)	Portion of total savings from load shift
All accounts	911	\$6.95	5.11%	8.1%
Some level of action was taken to shift usage	962	\$7.42	5.16%	12.1%
Small appliances shifted only	725	\$5.87	5.39%	9.2%
HVAC shifted only	920	\$6.84	4.98%	2.1%
Large appliances shifted only	1001	\$7.43	4.97%	12.8%
HVAC and large appliances shifted	967	\$7.95	5.50%	16.8%
Did NOT report taking actions to shift load	838	\$6.07	4.85%	2.9%

Table 4-9 shows average monthly bill savings in dollars and as a percentage of what the bill would have been for selected demographic groups. It also shows the average monthly usage, average monthly dollar savings, and the portion of monthly savings that were due to load shifting behavior. Average monthly savings were similar for all of these groups (about 5% of the total bill). However, the portion of these bill savings due to load shifting behavior was about twice as high for low income households (15.6%) and households with an eligible ADA member (18.3%), as compared to the average for all customers (8.1%). As stated above households with an ADA eligible member were more likely to report HVAC and large appliances load shifting behavior than the average customer.

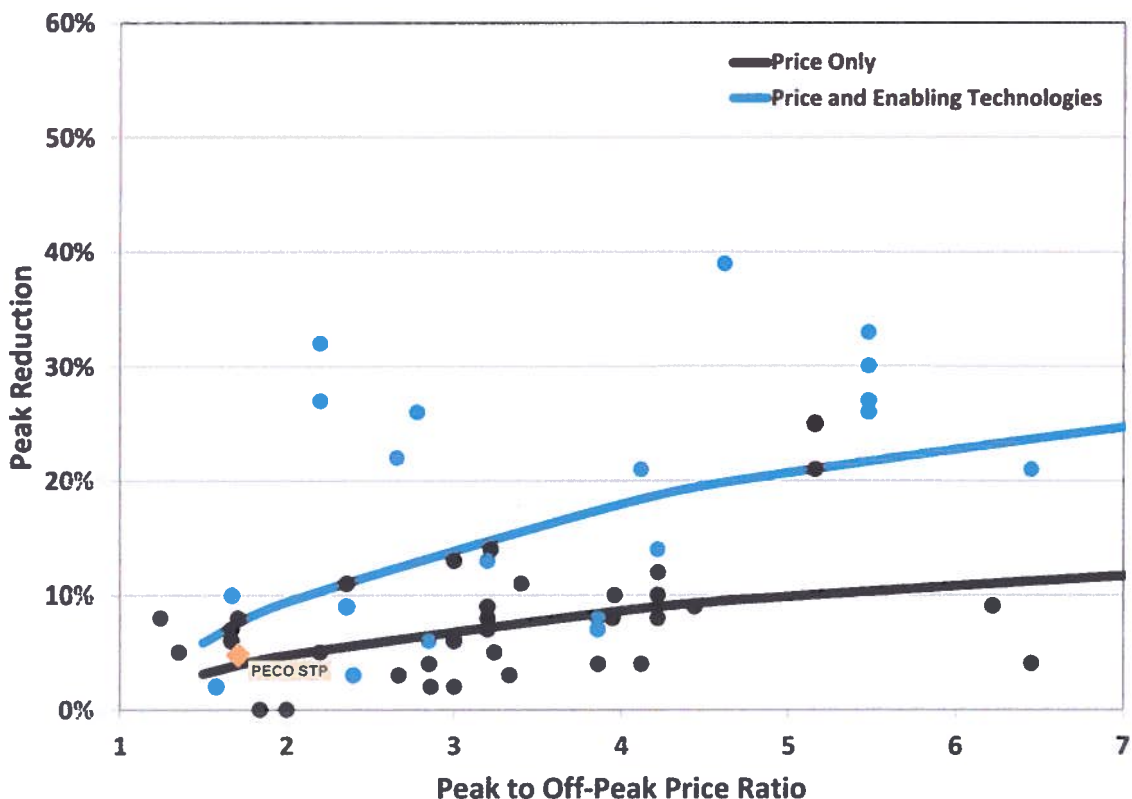
Table 4-9: Average Total Bill Monthly Savings for Select Demographic Groups

Segment (for all months)	Average monthly usage (kWh)	Average monthly bill savings (\$)	Average total savings (%)	Portion of total savings from load shift
All accounts	911	\$6.95	5.11%	8.1%
Seniors (65+)	842	\$6.15	4.89%	8.4%
Low income (household income < \$34k)	670	\$4.91	4.89%	15.6%
ADA eligible household member	952	\$7.19	5.06%	18.3%

4.6 Comparison of Impacts to Other Price Studies

Section 4 has laid out the load impacts observed for PECO Smart Time Pricing. To put these load impacts in context, they can be compared to load reductions found in other pilots and programs. Figure 4-4 shows results from other studies. The smooth lines in the figure represent regression equations, referred to as the Arc of Price Responsiveness, that relate peak load reduction to the ratio of peak to off-peak prices.²⁰ The black line shows the econometrically modeled relationship between peak load reduction and the ratio of peak to off-peak prices for TOU rates where no enabling technology was provided by the utility (such as programmable thermostats or automatic load control switches) and the blue line shows the relationship for programs that involve enabling technology. The orange diamond shows where PECO Smart Time Pricing would fall on the Arc of Price Responsiveness.²¹ This implies that the load reductions achieved by PECO Smart Time Pricing were very much in line with those observed historically for TOU rates.

Figure 4-4: Average PECO STP Summer Load Reductions on the Arc of Price Responsiveness for TOU Rates



²⁰ "Arcturus: International Evidence on Dynamic Pricing", Faruqui and Sergici 2013. Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2288116

²¹ For an average peak load reduction of 5% from July to September and a peak to off-peak price ratio of 1.7

5 Residential End-of-pilot Surveys and Focus Groups

This section summarizes the methodology, survey instrument design, response rate, and results of the residential participant and disenrollment surveys, which were conducted by Nexant toward the end of the pilot. This section also draws comparisons to focus groups commissioned by PECO from Mary Treisbach, an independent consultant.

5.1 Survey Methodology

In total, 120,998 residential customers were solicited to enroll in PECO Smart Time Pricing. At the end of the pilot enrollment period (March 31, 2014), nearly 4,800 residential customers had enrolled in PECO Smart Time Pricing. Of these participants, 481 customers ended up disenrolling during the course of the pilot. In September 2014, 333 disenrolled customers were still active PECO accounts, so they could be surveyed about their experience with PECO Smart Time Pricing and about their reasons for disenrolling. All 333 disenrolled customers that were still active PECO accounts as of September 2014 were included in the disenrollment survey. As for the participant survey, a randomly selected group of 2,500 enrolled customers were invited to participate. The primary objective of these two end-of-pilot surveys was to understand satisfaction with the pilot, self-reported behavior changes, and reasons for disenrolling (for disenrolled customers). To ensure comparability, the satisfaction and demographics sections of the two surveys were similar for participants and disenrolled customers. Participants also had an additional section of questions focused on their perceptions of any changes in billing or behavior in response to the program.

Table 5-1 summarizes the implementation timeline for the two end-of-pilot surveys. The surveys began on October 8 with an initial recruitment letter that included a \$2 bill, which was an unconditional incentive that was sent to all 2,500 participants and all 333 disenrolled customers before they decided to complete the survey or not.²² This initial recruitment letter was followed 5 days later by an initial email, which was sent to the 36% of participants and 20% of disenrolled customers with an available email address. The final three communications were sent to customers who had not completed the survey at that time. Data collection ended on November 21.

Table 5-1: Implementation Timeline for Residential End-of-pilot Surveys

Date	Communication Sent
October 8, 2014	Initial recruitment letter with \$2 bill (unconditional incentive)
October 13, 2014	Initial recruitment email
October 16, 2014	Paper version of survey instrument
October 21, 2014	Email reminder
October 30, 2014	Postcard reminder

²² This type of incentive has proven to be a highly cost-effective method for producing high response rates, as discussed in detail in: Dillman, Don A., Jolene D. Smyth and Leah Melani Christian. *Internet, Mail, and Mixed-Mode Surveys: The Tailored Design Method*. Wiley: 3rd edition (October 12, 2008).

5.2 Survey Instrument Design

The participant and disenrollment survey instruments included the following sections:

- Familiarity and satisfaction with PECO Smart Time Pricing;
- *Participant survey only* – Impressions of PECO Smart Time Pricing (perceived value, comfort of home, control over bill, convenience, actions taken to reduce peak use, and bill savings achieved);
- *Disenrolled survey only* – Reasons for withdrawing from PECO Smart Time Pricing; and
- Demographic questions.

5.3 Focus Groups Background

In addition to the two end-of-pilot surveys, PECO commissioned four focus groups toward the end of the pilot to study residential customer feedback on PECO Smart Time Pricing. While the focus groups were conducted by a different researcher and not specifically coordinated with the end-of-pilot surveys conducted by Nexant, some demographics in the Nexant surveys were used for recruiting focus group participants from specific demographic profiles. Four groups of 10 participants each were recruited among the following customer groups:

- Seniors (aged 65 or above);
- Households with income less than \$34,000/year;
- Households that indicated they have an ADA eligible resident; and a control group of PECO Smart Time Pricing customers who did not fall under the three categories listed above.

Several topics explored in the focus groups overlapped with the Nexant end-of-pilot surveys, including satisfaction with PECO Smart Time Pricing, perceptions of control over electricity costs, and actions taken to shift electricity use away from peak hours. For overlapping topics, the key findings from the focus groups research were largely similar to the findings from the end-of-pilot surveys. The remainder of this section focuses on findings from the end-of-pilot surveys, but relevant comparisons to focus group findings are also made throughout. Complimentary focus group findings are highlighted separately to preserve a clear distinction between focus group and survey findings. The executive summary of the focus group findings can be found in Appendix A.

5.4 Survey Response Rates

Table 5-2 summarizes the response rates for the two end-of-pilot surveys. Nexant received 1,543 responses from participants, resulting in a 62% response rate for that survey. Ninety-five responses were received for the disenrollment survey, resulting in an overall response rate of 28%. Though the response rate for the disenrollment survey was lower, a response rate of 28% is higher than is typically seen in the industry for this type of target respondent.

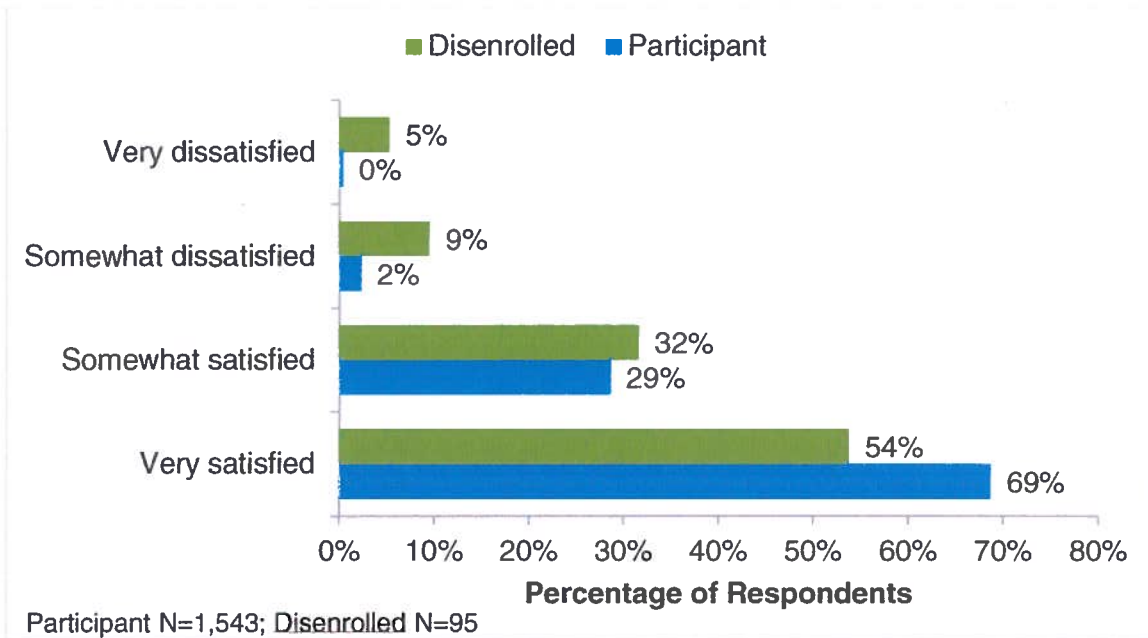
Table 5-2: Response Rate Summary for Residential End-of-pilot Surveys

Survey	Invitations sent	Responses received	Response rate
Participant	2,500	1,543	62%
Disenrolled	333	95	28%

5.5 Participant and Disenrolled Customer Satisfaction

Each of the surveys asked respondents to rate their satisfaction with PECO Smart Time Pricing. This was the only non-demographic question that was asked to both participant and disenrollment survey respondents. In general, both participants and disenrolled customers were highly satisfied with PECO Smart Time Pricing. As shown in Figure 5-1, 98% of participant survey respondents and 86% of disenrollment survey respondents were somewhat or very satisfied with PECO Smart Time Pricing. A majority of both groups responded that they were very satisfied.

Figure 5-1: “Overall, how satisfied are/were you with PECO Smart Time Pricing?”



Complementary Findings from Focus Groups

Each focus group participant was asked to rate their satisfaction with PECO Smart Time Pricing on a scale from 0, not at all satisfied, to 10, extremely satisfied. The seniors group had an average rating of 8.8, the ADA eligible group had an average rating of 9.2, the low income group had an average rating of 9.7, and the control group had an average rating of 8.9.

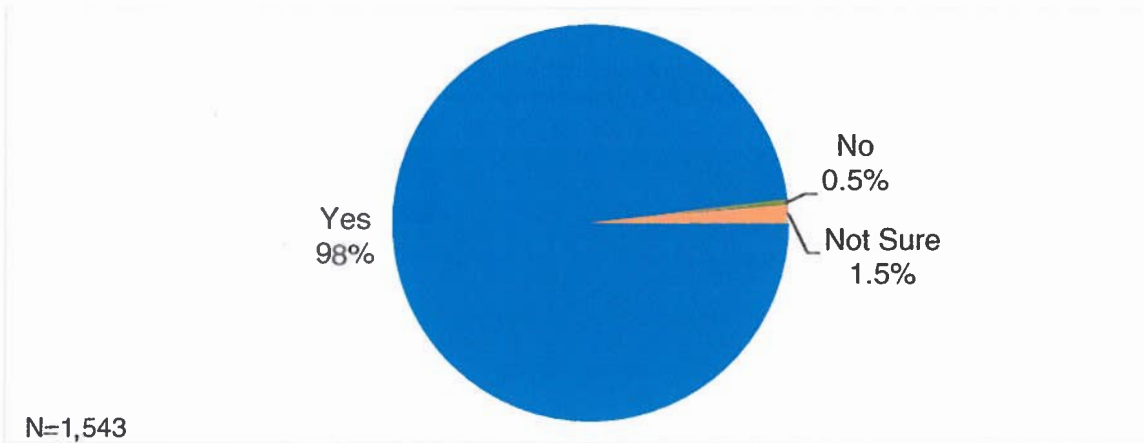
5.6 Participant Perceptions and Actions

The remainder of the participant survey (excluding demographics) focused on the impressions respondents had about PECO Smart Time Pricing: perceived value, comfort of home, control over bill, convenience, actions taken to reduce peak use, and bill savings achieved. Many of these questions were asked in two parts, first as a multiple choice question, then with an optional follow-up question asking respondents to explain their selection. Throughout this section of the report, representative respondent comments are included in grey call-out boxes as appropriate with certain figures.

Residential End-of-pilot Surveys and Focus Groups

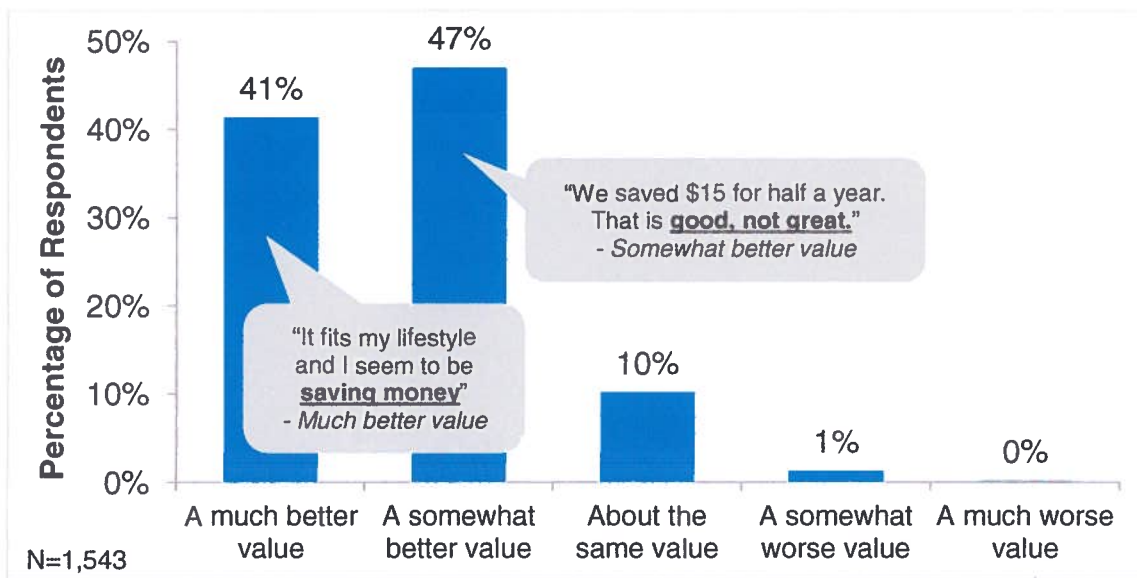
Figure 5-2 shows how participants responded when asked how familiar they were with PECO Smart Time pricing. The high familiarity rate (98%) indicates that nearly all participants were aware of their enrollment in PECO Smart Time Pricing and understood that, under the rate, pricing was more expensive during peak hours than off-peak hours.

Figure 5-2: “Under PECO Smart Time Pricing, you receive a discounted price on your electricity during most of the hours in the year except for non-holiday weekday afternoons between 2 PM and 6 PM. Does that sound familiar?”



The next three questions asked participants to compare aspects of their previous rate plan to PECO Smart Time Pricing.²³ Figure 5-3 shows the extent to which participants considered PECO Smart Time Pricing to be a change in value over their previous rate plan (the PECO default rate). A very large majority (88%) considered PECO Smart Time Pricing to be a much better or somewhat better value. However, this may be at least partially due to lower overall NRG Retail pricing as compared to the PECO default rate. Under PECO Smart Time Pricing, customers pay roughly 7 cents more per kWh during around 11% of the hours of the year and save just over 2 cents per kWh during the remaining 89% of the hours.

Figure 5-3: “Compared to your previous rate plan, how would you rate the value of PECO Smart Time Pricing?”



Complementary Findings from Focus Groups

This perception of value was echoed in focus groups conducted with participants. Participants in all groups mentioned bill savings as one of the aspects they liked best about PECO Smart Time Pricing.

²³ All customers who were solicited for PECO Smart Time Pricing were taking default service from PECO at the time of solicitation. Therefore the comparison to the previous rate plan is a comparison to the PECO default plan in nearly all instances.

Residential End-of-pilot Surveys and Focus Groups

Figure 5-4 shows how participants perceived the comfort of their home during peak hours with PECO Smart Time Pricing, as compared to their previous rate. About 72% of respondents found that their home was about as comfortable. In a follow-up, open-ended question, many of these participants reported not being home during peak hours or simply not perceiving a decline in comfort. In addition, fewer than 10% of respondents perceived a decline in comfort, while 20% perceived an increase in comfort.

Figure 5-4: “Compared to your previous rate plan, how would you rate the comfort of your home on weekday afternoons from 2 PM to 6 PM on PECO Smart Time Pricing? Would you say your home is...”

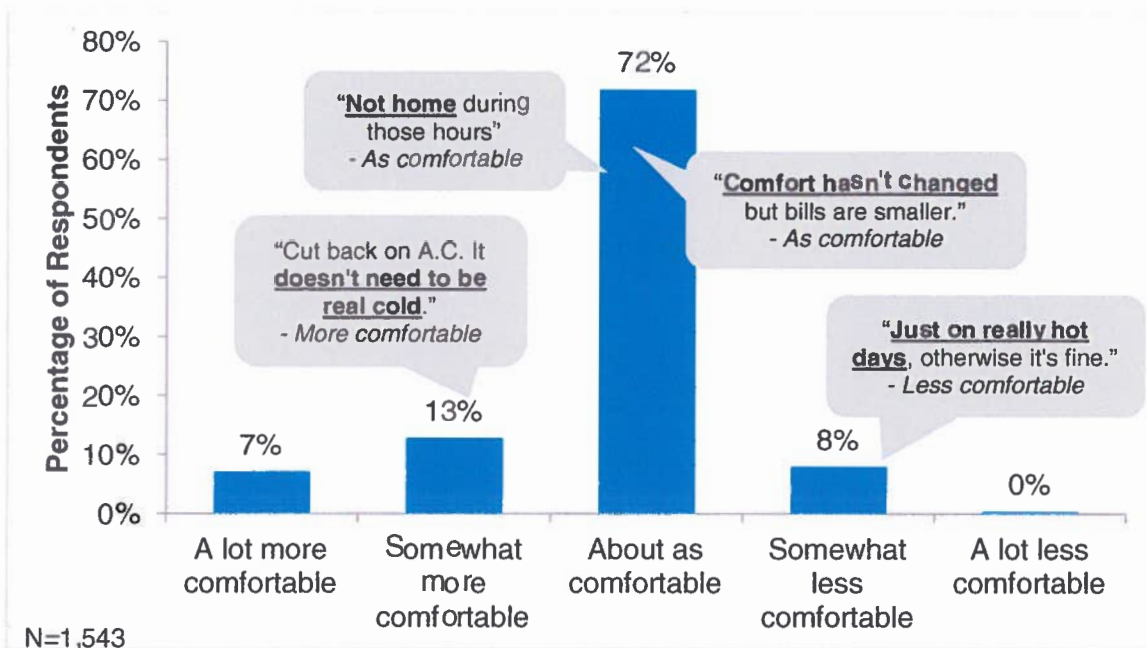


Figure 5-5 reflects respondents' views about the control they had over household electricity costs with PECO Smart Time Pricing as compared to their previous rate. Seventy percent of participants found that they had more control over their household's electricity cost with PECO Smart Time Pricing. Several customers reported liking the discount and increased awareness of usage in general under the new rate.

Figure 5-5: "As a result of participating in PECO Smart Time Pricing, do you feel you have more control over your household's electricity cost?"

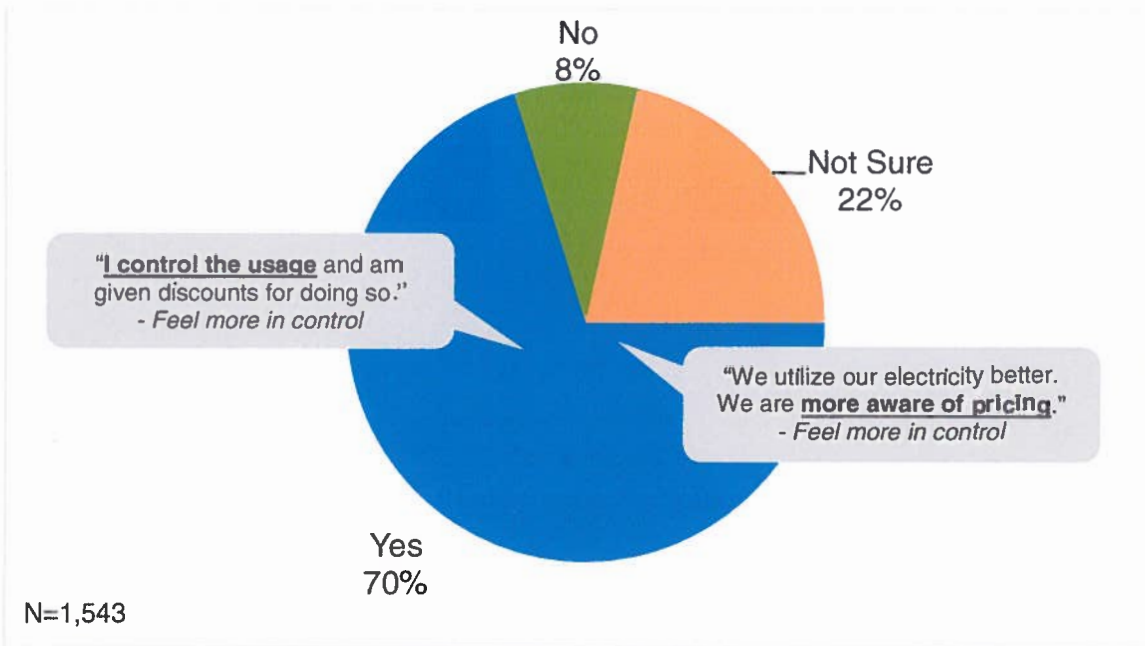
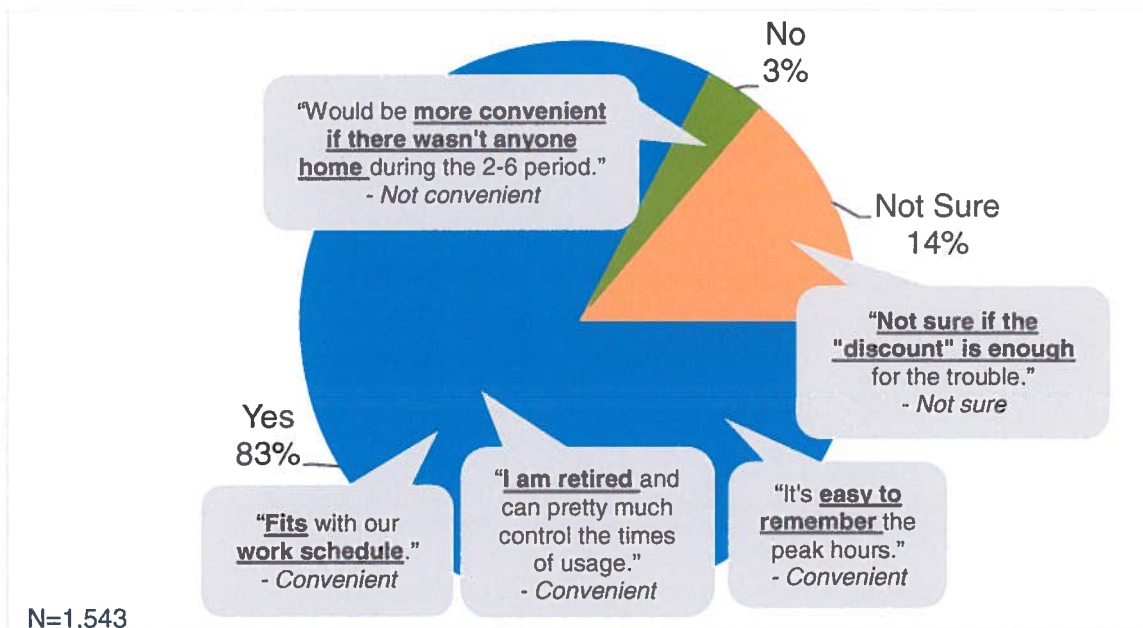


Figure 5-6 reflects how participants perceived the convenience of PECO Smart Time Pricing. Over 80% of participants found PECO Smart Time Pricing to be convenient. Commonly cited reasons for this perceived convenience were that:

1. The peak hours aligned with hours when the home was unoccupied;
2. Tasks requiring electricity were easy to shift; and
3. The peak schedule was easy to remember.

Conversely, the few participants (3%) who did not consider PECO Smart Time Pricing convenient commonly stated that it would be more convenient if their household was unoccupied during peak hours.

Figure 5-6: “Is PECO Smart Time Pricing convenient for your household?”



Complementary Findings from Focus Groups

In the focus groups, participants emphasized that the rate could be appropriate for customers with any household profile (single, working away from home during the day, retired, family with children, low income, etc.). However, when pressed, focus group participants also stated that the rate would be more convenient for households that are largely unoccupied during peak hours.

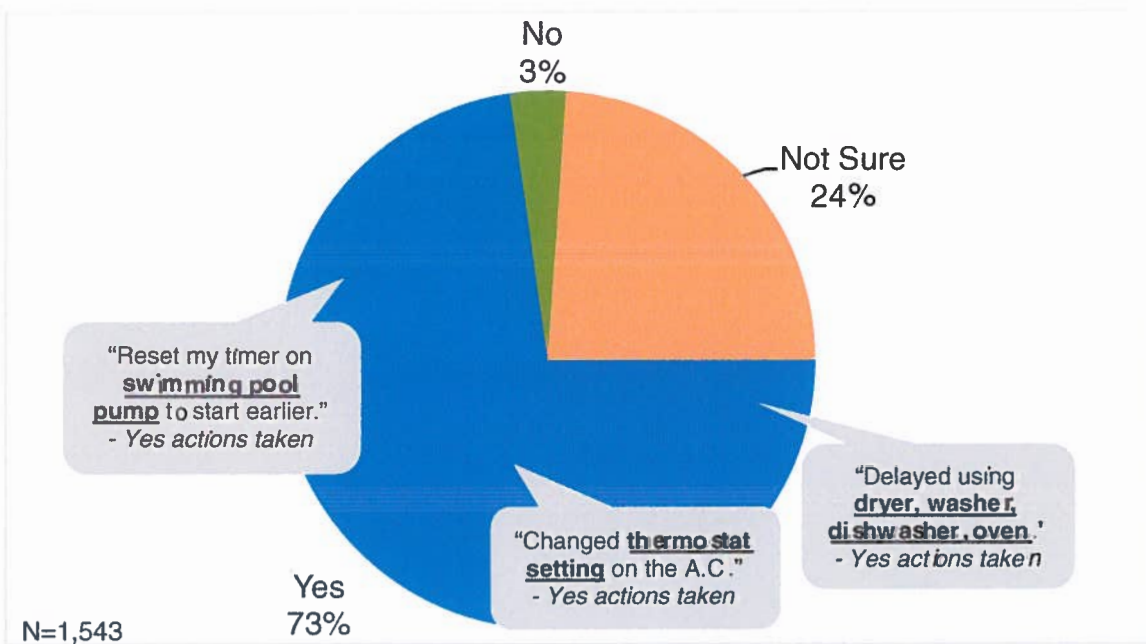
Regarding whether tasks requiring electricity were easy to shift, focus group participants described a small but manageable inconvenience of shifting activities to non-peak hours as the aspect they liked least about PECO Smart Time Pricing.

Finally, while survey respondents noted that peak hours were easy to remember, participants in focus groups further elaborated on how they remembered peak time hours. Several stated that they made charts showing the peak hours schedule or left signs on large appliances (especially clothes washers, dryers, and dishwashers). Some also suggested that visual aids, such as a refrigerator magnet, should be provided at sign up to help household members

remember peak hours. This shows that while PECO Smart Time Pricing may have been perceived as convenient, participants often still needed some visual reminders in the home about the rate.

Figure 5-7 shows the proportion of respondents who took actions to shift electricity usage away from peak hours. Almost three in four (73%) participants reported taking some level of action to shift electric usage away from peak hours, while only 3% reported not shifting usage. In light of the previous question showing that most participants considered PECO Smart Time Pricing to be convenient, this suggests that most participants found the rate convenient despite taking actions to shift usage. Commonly cited actions included shifting laundry, cooking or cleaning chores, which implies that most participants were not substantially inconvenienced by shifting these tasks.

Figure 5-7: “Have you or anyone else in your household done anything to reduce the amount of electricity you use on weekday afternoons for example, delaying the use of dish or clothes washers or changing your thermostat setting?”



Complementary Findings from Focus Groups

Focus group participants also cited electricity use shifting, though some stated that the most difficult activity to shift was cooking, due to early evening household dinner times. The perceived convenience of PECO Smart Time Pricing may also have resulted because many of the actions taken were facilitated by device automation. Commonly cited automated actions among survey respondents and focus group participants included changing thermostat settings and resetting timers on pool pumps and filters.

Residential End-of-pilot Surveys and Focus Groups

Figure 5-8 shows an analysis of respondent-entered descriptions of actions taken to reduce peak usage, for the 59% of respondents who reported taking action and also provided a specific description. Though responses were typed in by respondents, common themes were identified and could be summarized into the following three action categories:

- Shifting use of large appliances (dishwasher, clothes washer, dryer, oven, pool filter, etc.);
- Shifting use of space heating or cooling (HVAC);
- Shifting use of small appliances (lighting, vacuuming, etc.).

A vast majority of participants who took action (89%) reported shifting their use of large appliances such as dishwashers or clothes washers/dryers. Over two-thirds of this 89% also reported shifting or changing use of space heating and cooling, mostly by adjusting their thermostat. Very few participants who took action, just 2%, reported only taking small actions such as turning out the lights.

Figure 5-8: “Tell us in a couple of sentences what you have done [to reduce the amount of electricity you use on weekday afternoons].”

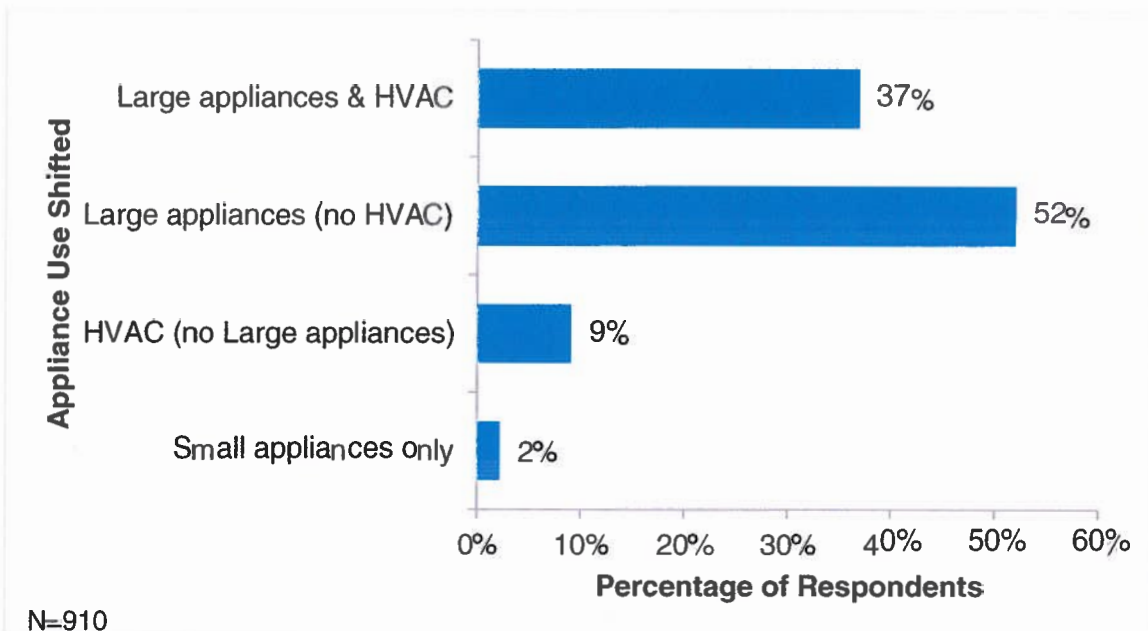
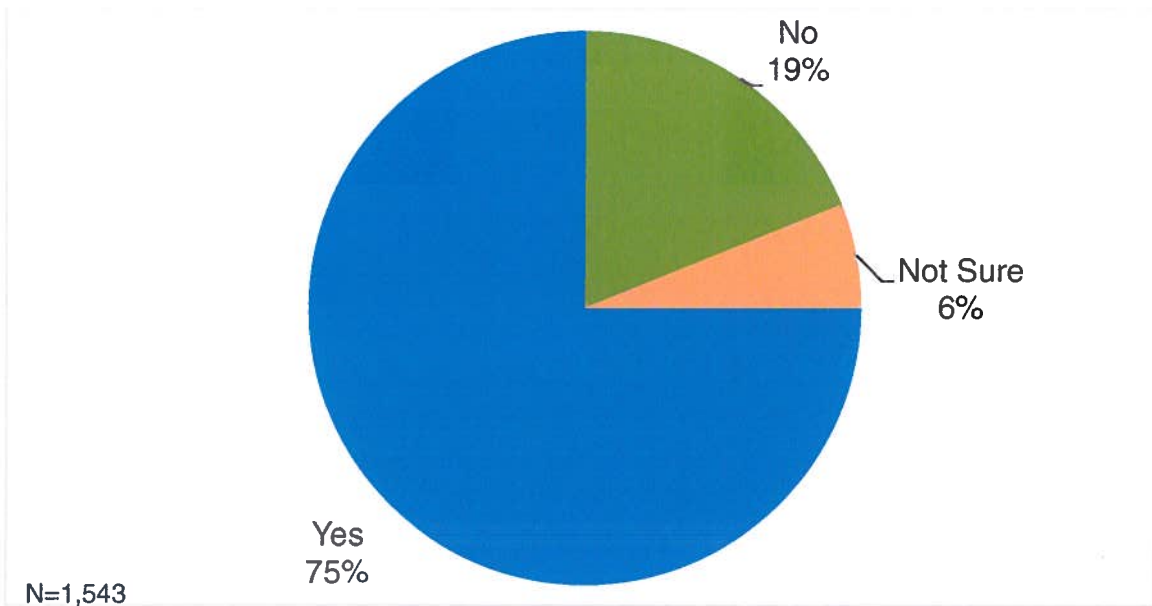


Figure 5-9 shows the proportion of participants that felt they saved money with PECO Smart Time Pricing. About 75% of participants reported saving money on their bill. By contrast, 19% reported not saving money. Few participants, only 6%, responded that they were not sure if they saved money, which indicates that respondents generally had a clear perception of whether or not they saved money. Nonetheless, in write-in comments several respondents mentioned that savings were not communicated clearly enough.

Figure 5-9: “Do you believe you saved any money as a result of selecting PECO Smart Time Pricing?”



Complementary Findings from Focus Groups

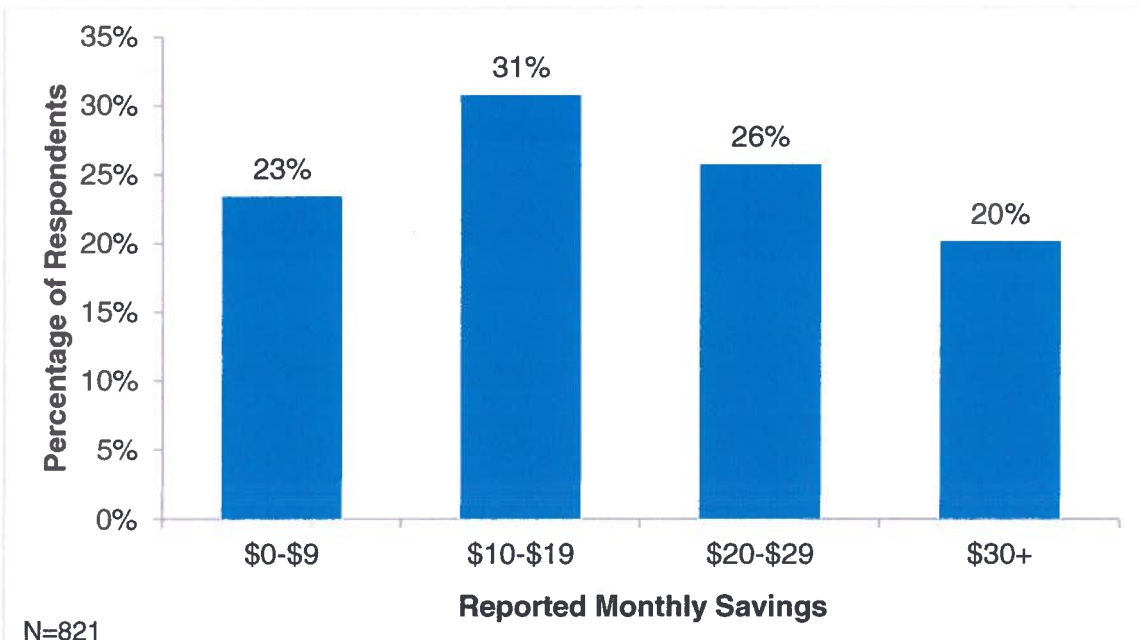
Many focus group participants reported only remembering receiving a bill analysis at the end of the year, noting that this did not help them track savings or adjust behaviors during the year. In both the participant survey and the focus groups, several participants suggested that savings be clearly communicated on a monthly basis, both by comparing usage and cost for the previous year as well as by showing what that month’s bill would have been under the PECO default rate.²⁴

Participants who reported saving money were further asked to specify how much money was saved per month, on average. Respondents were asked to type in number amounts to indicate their perceived savings. Figure 5-10 groups these responses into \$10 increments and shows that respondents most commonly reported saving between \$10 and \$19 per month. The second most common savings range was between \$20 and \$29. The median amount respondents reported saving was \$15 per month. Satisfaction with the level of savings varied. When reported savings were high, such as above \$10 per month, participants tended to be more satisfied with their savings. In addition, as discussed in Section 4, PECO tracked dollar

²⁴ See Appendix x for a complete description of the Smart Time Pricing communication plan.

savings relative to the default rate for each customer and periodically communicated these savings amounts to customers throughout the PECO Smart Time Pricing pilot as described in Appendix C. For the customers who responded to the survey, Nexant compared self-reported savings to actual savings and found that 86% percent of participants thought they saved more on PECO STP than they actually did. Among this 86%, most customers actually saved between \$5 and \$19 per month less than they thought they did. On a related note, when survey respondents mentioned savings in unrelated open-ended comments, savings tended to be referred to in annual terms (as opposed to in monthly terms).

Figure 5-10: “How much money do you think you have saved on a monthly basis?”

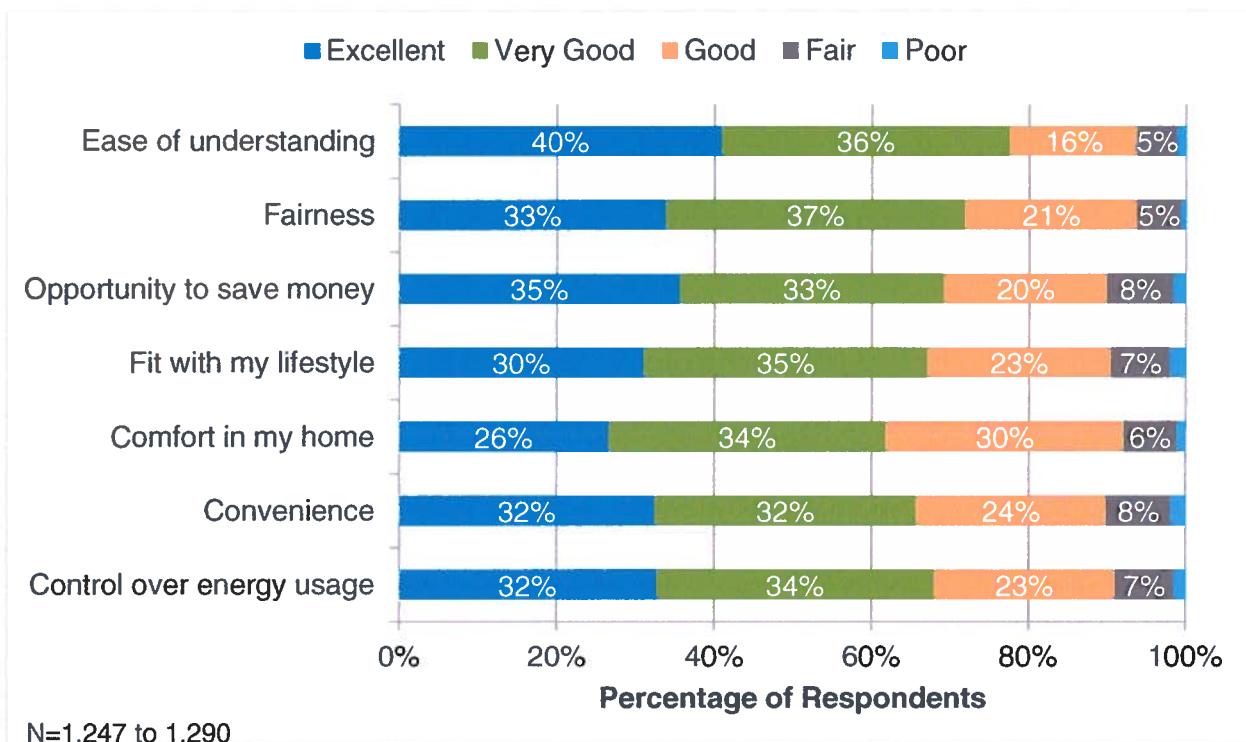


Complementary Findings from Focus Groups

Generally, both survey respondents and focus group participants who reported saving less than a few dollars per month felt the savings were disappointing, though some stated they still would have kept PECO Smart Time Pricing. Focus group participants also tended to characterize their savings on annual basis, as opposed to monthly savings. It is not clear to what extent this was influenced by the PECO end-of-pilot communication showing estimated savings for the entire year.

The final program-related question asked participants to rate several aspects of PECO Smart Time pricing from “Excellent” to “Poor.” Figure 5-11 summarizes participant responses to this question, indicating that PECO Smart Time Pricing was largely perceived as fair, easy to understand, and an opportunity to save money. Participants gave the highest rating to “Ease of understanding,” with 76% rating it as “Very Good” or “Excellent.” By contrast, “Comfort in my home” was rated the lowest, with about 60% giving a rating of “Very Good” to “Excellent.” The small amount of variation between the highest and lowest ratings shows that all aspects of PECO Smart Time Pricing were rated relatively high. No aspects of PECO Smart Time Pricing were commonly rated as “Fair” (less than 8%) or “Poor” (less than 2%).

Figure 5-11: “Please rate the following aspects of PECO Smart Time Pricing from excellent to poor.”



Complementary Findings from Focus Groups

Focus group participants were asked in an open-ended question what they liked best about PECO Smart Time Pricing, a different though related question. In order of frequency, bill savings, control and convenience were mentioned the most often. These responses do not exactly reflect the survey responses in which, for example, convenience and control were rated least highly and ease of understanding and fairness were rated above opportunity to save money. However, these discrepancies are not particularly consequential because of the difference in how the questions were formulated and because there was a relatively small amount of variation between ratings in the survey question, with all aspects receiving high ratings.

5.7 Reasons for Disenrolling

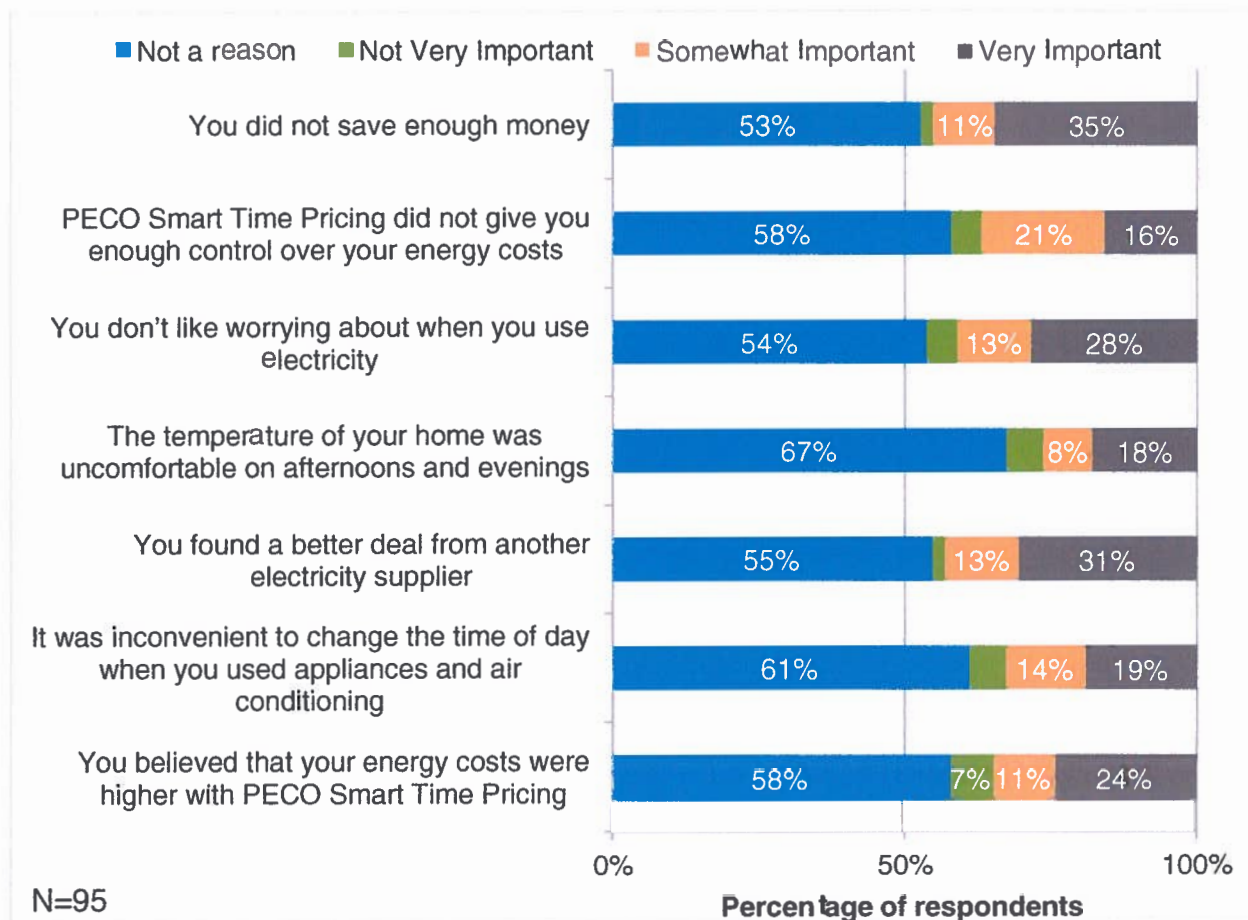
Disenrolled customers were asked to share their views on why they withdrew from PECO Smart Time Pricing after initially enrolling. Figure 5-12 reflects disenrolled customer responses to this question. The reasons chosen most commonly as very or somewhat important for withdrawing were: 1) did not save enough money; and 2) found a better deal elsewhere. Both of these reasons pertain to savings, suggesting that money was more of a motivator for withdrawal than inconvenience or discomfort. However, analysis of average monthly bill savings (discussed more in depth in section 4.5) showed that savings were actually slightly higher for disenrolled customers than they were for participants. Since savings were typically higher in the first months of the program, and disenrolled customers stayed in the program for fewer months (4 months on average), average savings in the first fourth months of enrollment were compared for participants and disenrolled customers. This ensured that savings were compared for a comparable period. Average monthly savings for disenrolled customers who responded to the survey were \$13.84 per month after four months of enrollment, while average monthly savings for participants who responded to the survey were \$12.63 per month for the same period of time - about 9% lower than the savings experienced by the disenrolled customers. This comparison reinforces previously noted observations that customer perceptions of savings are not necessarily indicative of actual savings where participants responding to the survey reported their monthly savings to be much higher than they actually were. In contrast, customers who disenrolled reported that savings were not high enough for them to keep PECO Smart Time Pricing, even though their average monthly savings were slightly higher than they were for participants. This may imply that disenrolled customers were more likely to pay attention to their savings and to perceive these savings as not worthwhile, despite experiencing above average savings.²⁵

Unexpectedly, 21% of disenrollment survey respondents indicated via open-ended responses that they had not intended to disenroll, with several stating that they only became aware of their disenrolling by receiving the invitation to participate in the disenrollment survey. Most respondents describing these unintentional disenrollments expressed that they would have preferred to keep PECO Smart Time Pricing.²⁶

²⁵ In January of 2014 the PECO territory experienced a time of extreme weather referred to as the Polar Vortex. It is possible that some customers associated a higher bill following this time with the PECO Smart Time Pricing program TOU rate when in reality it was associated with higher usage due to the unusual weather. It should be noted here that customers on PECO Smart Time Pricing did not experience any pricing fluctuation during the Polar Vortex since the on-peak and off-peak prices were locked for the duration of the pilot.

²⁶ 20 of the 333 customers who were invited to participate in the disenrollment survey contacted either Nexant or PECO to ask why they were no longer enrolled in PECO Smart Time Pricing. Of these customers, 18 customers had switched to a competitive supplier, 1 customer was removed because of a meter mix-up, and 1 customer never returned attempts to contact them.

Figure 5-12: “Below are some reasons for withdrawing from PECO Smart Time Pricing. For each reason, please indicate whether it was a consideration in your decision to withdraw from the plan and how important it was.”



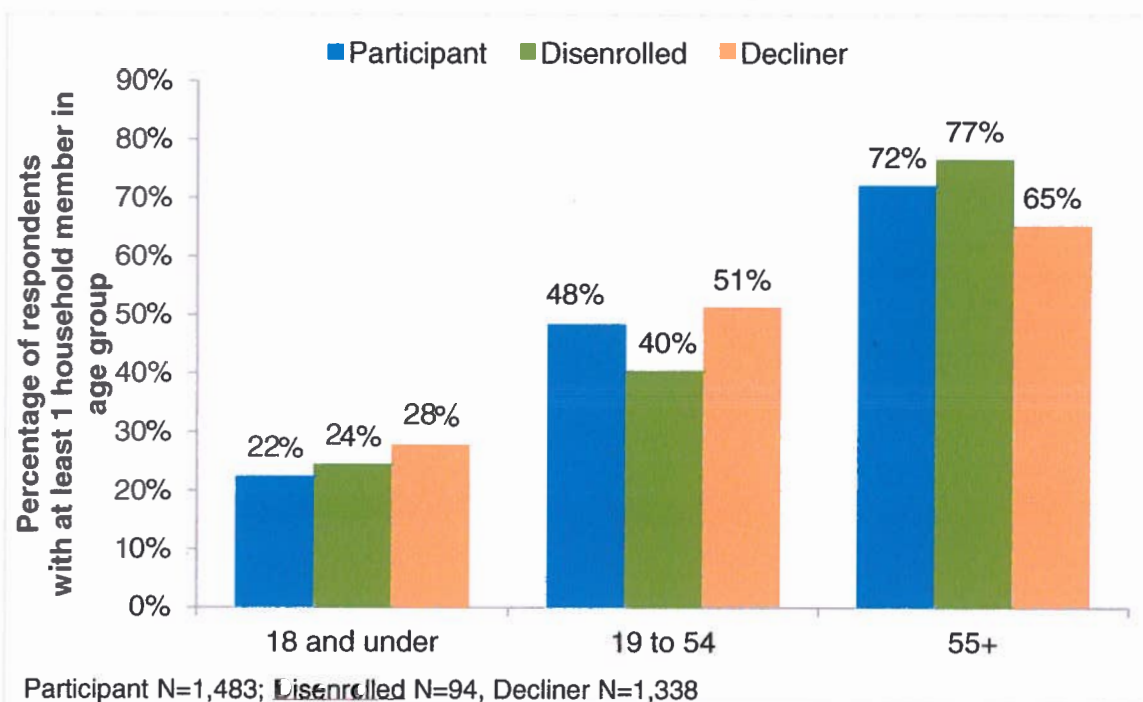
5.8 Demographic Comparison

The participant survey and the disenrollment survey included the same demographic questions so that comparisons could be made between the two groups. This section also includes responses to similar demographic questions from the decliner survey, which included customers who did not accept the offer to enroll in PECO Smart Time Pricing. The decliner survey was conducted from January 22 through March 14, 2014 and was summarized in the PECO Smart Time Pricing Pilot Enrollment Report. The decliner survey response rate of 24% was similar to that of the disenrollment survey (28%). Considering that the participant survey response rate (62%) was substantially higher, it is somewhat unclear whether the observed demographic differences between the three surveys resulted from actual differences between the three groups or from variation in the response rates. Nonetheless, the comparisons in this section are at least suggestive of what demographic differences may exist between the three population groups.

Residential End-of-pilot Surveys and Focus Groups

Figure 5-13 shows the percent of households with at least one resident in selected age groups. Around 22% of participant survey respondents reside in households that include at least one minor, compared with 28% of decliner households. At the same time, around 72% of participant survey respondents reside in households that include at least one member 55 years old or above, compared with 65% of decliner households. Both of these differences are statistically significant with 99% confidence.²⁷ This suggests that decliners in the subset of 25% of residential customers who met the pilot eligibility criteria were generally younger than participants. Like participants, disenrolled customers were also more likely than decliners to have at least one older household resident.

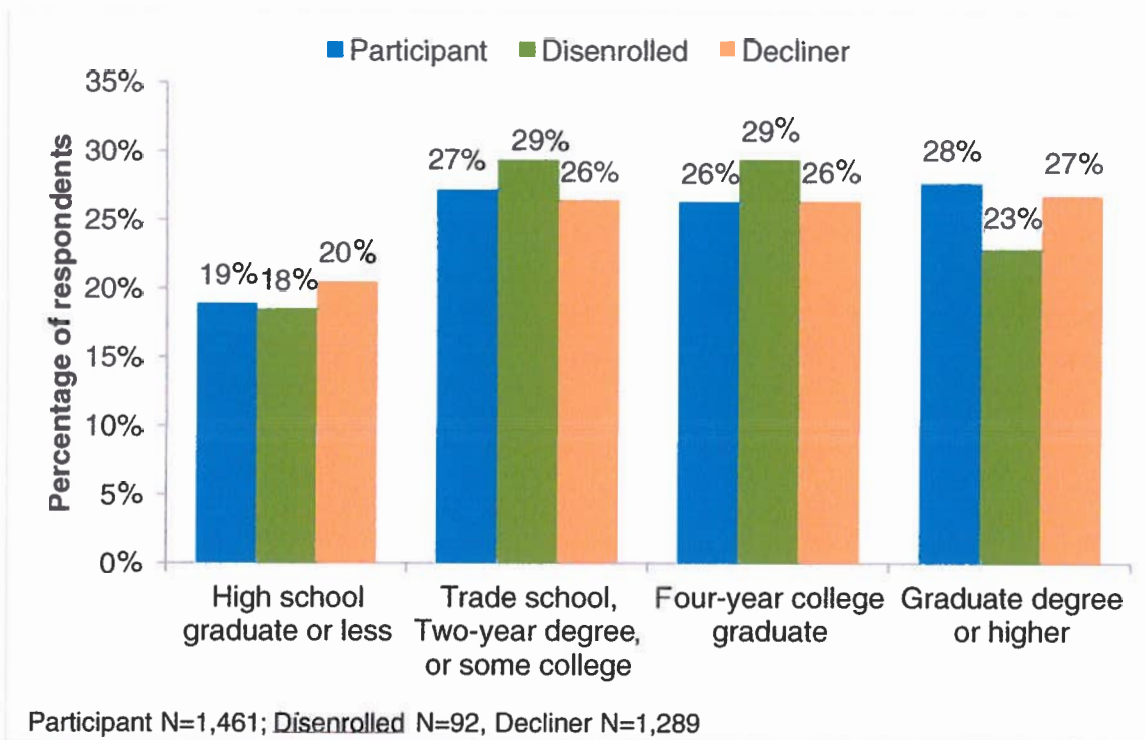
Figure 5-13: “For each of the following age groups, how many people, including you, live in this home for more than half of the year?” (Graph Shows Percent of Households with At Least One Resident in Each Age Group)



²⁷ 99% confidence means that we can be 99% sure that these observed differences are not due to random chance.

Figure 5-14 shows the highest level of education completed by anyone in the household for disenrolled customers and decliners. For participants, the figure shows the highest level of education completed by the respondent, due to a slight difference in the wording of the question. However, it is reasonable to assume that the participant completing the survey is likely to have close to the highest level of education in the household and that the questions are still somewhat comparable. Disenrolled and decliner respondents had no significant difference in level of education relative to each other and participants had at least the same level of education as these two other groups.

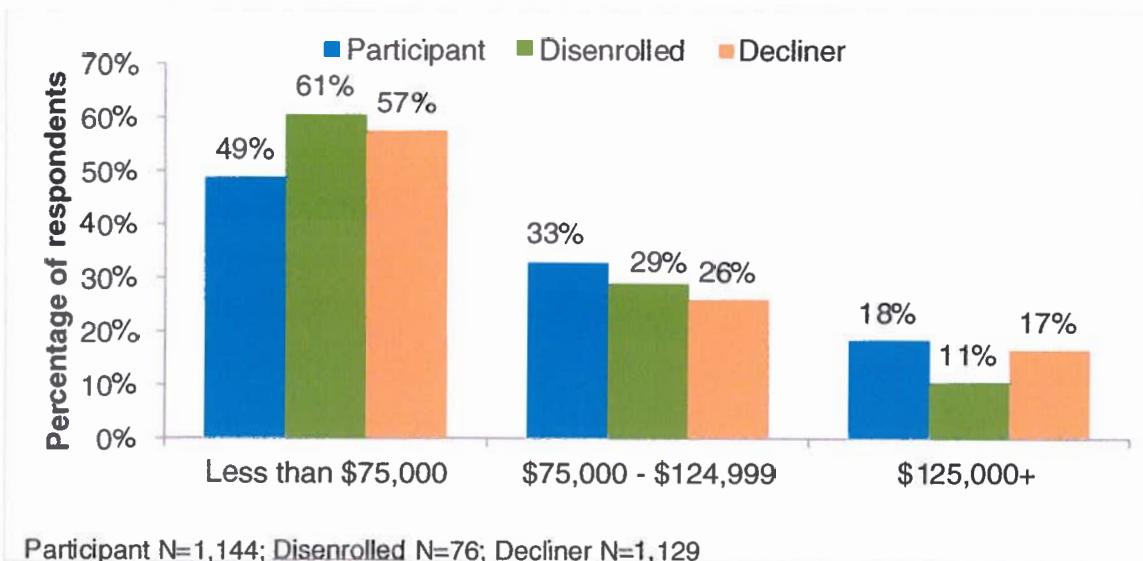
Figure 5-14: Participants – “What is the highest grade of schooling you completed?”; Disenrolled & Decliners – “What is the highest grade of schooling anyone in your household has completed?”



Residential End-of-pilot Surveys and Focus Groups

Figure 5-15 shows the distribution of reported household incomes for participants, disenrolled customers, and decliners. In general, a smaller proportion of participants had incomes below \$75,000. Forty-nine percent of participants had incomes below this level compared to 61% of disenrolled customers and 57% of decliners. This difference is statistically significant with 95% confidence.

Figure 5-15: “Which of the following best describes your total household income from all sources in 2013, before taxes? (Check one)”



Residential End-of-pilot Surveys and Focus Groups

The next two demographic questions asked respondents to indicate how many adults work outside the home on most days and how many adults work from home on most days. Figure 5-16 compares participants, disenrolled customers, and decliners based on how many adults work outside the home on most days. Figure 5-17 compares participants, disenrolled customers, and decliners based on how many adults work exclusively at home on most days. None of the differences between respondent categories are statistically significant for either of these demographic questions.

Figure 5-16: “How many adults in your household work outside the home on most days?”

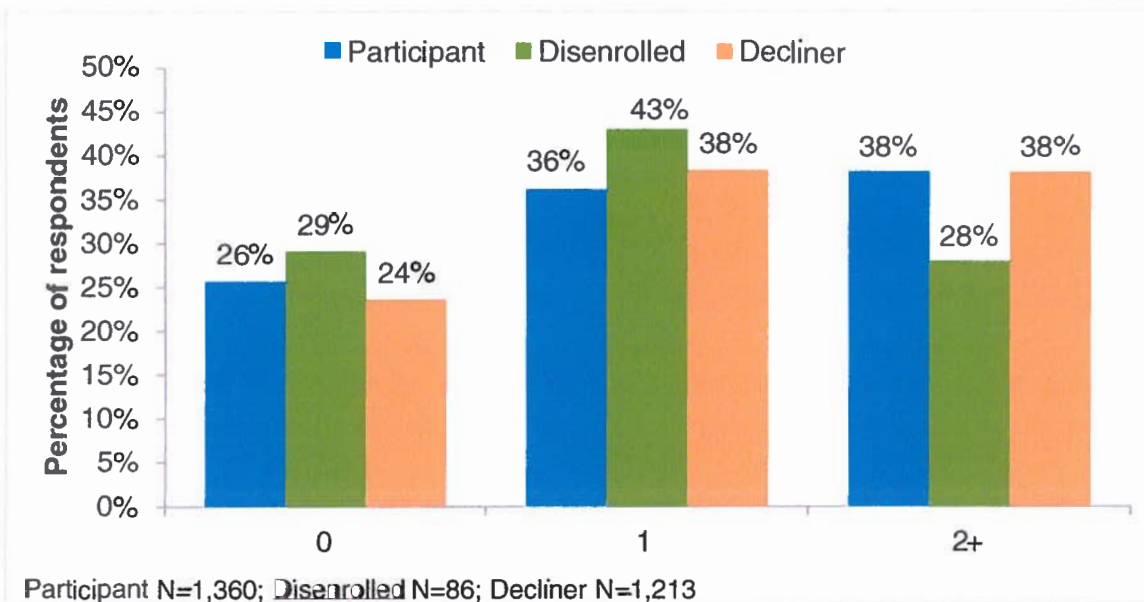
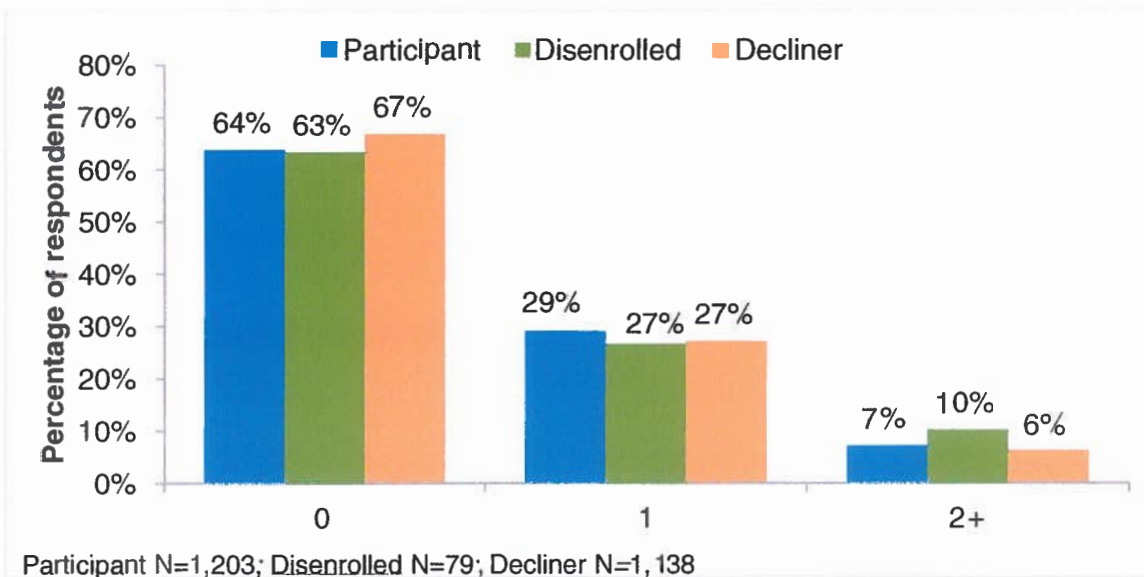


Figure 5-17: “How many adults in your household work exclusively at home on most days?”

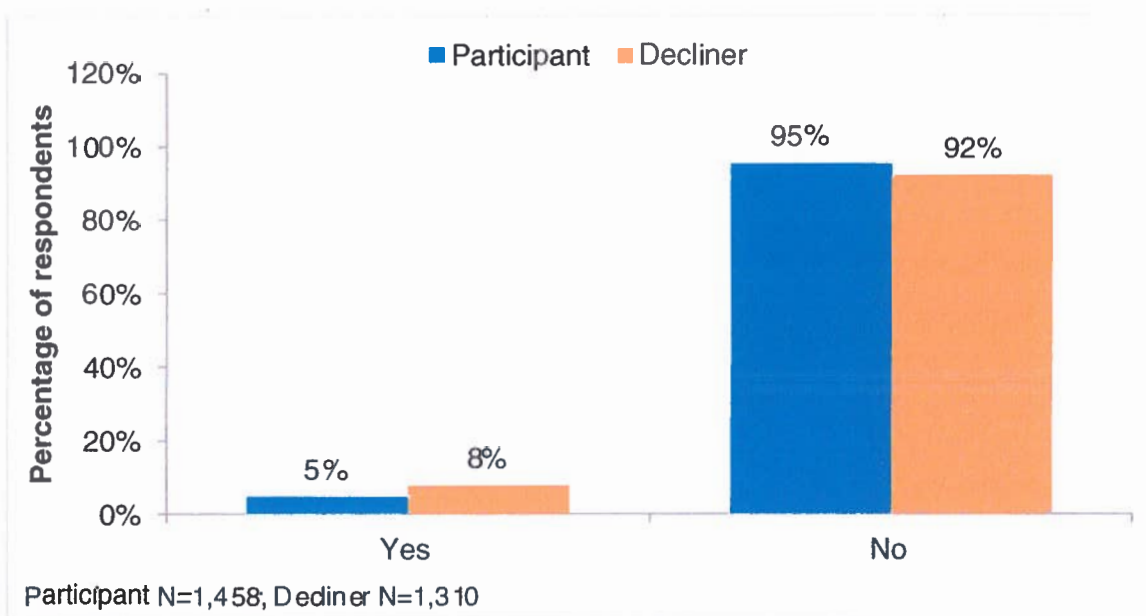


Residential End-of-pilot Surveys and Focus Groups

The final demographic question inquired whether any household members were eligible for accommodations under the Americans with Disabilities Act (ADA) (i.e., sight impairment, mobility impairment, etc.). This question was asked to participant and decliner survey respondents, but not to disenrollment survey respondents.

Figure 5-18 shows that both participants and decliners were unlikely to have a member of the household who was disabled. However, 8% of decliner respondents, compared to 5% of participant respondents, reported having an ADA-eligible household member. While this difference is statistically significant, the incidence rates of households with ADA-eligible members were so low for both participants and decliners that the difference is not meaningful.

Figure 5-18: “Are any members of your household eligible for accommodations under the Americans with Disabilities Act?”



Complementary Findings from Focus Groups

ADA participants were specifically targeted for focus group participation and reported similar levels of satisfaction and behavior modifications as other groups. In fact, focus group participants with ADA-eligible household members gave a slightly higher average satisfaction rating (9.2) for PECO Smart Time Pricing than did the control group (8.9), though this difference is not statistically significant due to the small focus group sample size (10 per group). Participants with ADA-eligible household members also reported considering similar factors when initially deciding to sign up for PECO Smart Time Pricing.

6 Observations

- The collaborative process used to develop the program and then periodically update the stakeholders was an asset as the program proceeded to conclusion.
- Some customers who had not previously shopped for a competitive energy supplier decided to enroll (and thereby switch to a supplier) under the umbrella of PECO Smart Time Pricing.
- There seems to be a group of residential customers who are interested in saving money where a time-varying rate is not an inconvenience but rather a tool to help them control their energy costs.
- Non-shopping SMB customers were not interested in PECO Smart Time Pricing.
- Focus group feedback reported that customers felt like they didn't receive enough updates on their progress regarding savings with PECO Smart Time Pricing. Any EGS undertaking a similar TOU program might benefit from a proactive approach to providing this information. See Appendix C for more information on PECO's customer communication plan.

Appendix A Focus Group Findings: Executive Summary

In addition to the two end-of-pilot surveys, PECO commissioned four focus groups toward the end of the pilot to study residential customer feedback on PECO Smart Time Pricing. The executive summary of the focus groups findings is provided in this appendix.

PECO Smart Time Pricing Focus Groups

December 2, 2014

Detailed Report of Findings

Background

PECO commissioned four focus groups to study customer feedback for the PECO Smart Time Pricing (PSTP) program. There were three specific targeted customer groups: seniors (aged 65+), income less than \$34,000/year and households who reported to have one member who was qualified under the Americans with Disabilities Act and one control group of “typical” PSTP customers.

Executive Summary

1. Participants in all groups were extremely enthusiastic about PSTP.
2. For most, the initial source of information about PSTP was via a separate letter inviting them to join the program. When asked unaided, most gave as reasons to consider PSTP the opportunity to save money on the electric bill and the fact that PECO seemed to “endorse” NRG as the supplier for the program.
3. Most signed up via mail, and few cited any difficulties with enrollment.
4. When asked to rate eight factors in the PSTP decision-making process, the characteristic that received the highest ratings varied slightly by group. Top rated were:
 - Better rate during off peak hours/save money
 - Sponsored by PECO
 - Certainty of 12-months fixed price
 - Bill protection guarantee
 - More control over energy bill.In most cases, the opportunity to save money was the most important factor.

Focus Group Findings: Executive Summary

5. In an exercise where they were asked to describe the program to a person who had never heard of PSTP, most participants focused on savings, convenience and a description of peak and off-peak usage. Overall they were highly favorable about the program.

6. Most thought the program could be “for anyone” who wants to save; when pressed, they admitted that households with no one at home during the 2PM-6PM time period would be a good fit for PSTP. Some thought the program would be especially appealing to customers on fixed incomes.

7. When asked what they liked best about the program, customers in all groups mentioned:
 - Savings/smaller bills;
 - Sense of control over electricity usage; and
 - Convenient/simple to participate.Some mentioned that being on the program made them more aware of electricity usage and challenged them to think of additional ways to save.

8. When asked what they liked least about PSTP, participants mentioned:
 - The fact that the program is coming to an end;
 - Small inconvenience involved in shifting some household activities out of the peak timeframe;
 - Lack of ongoing reporting about their performance/savings with PSTP; and
 - High differential in cost between peak and off-peak.
 - In a few cases, some mentioned that savings were not as high as expected.

9. Few seemed to be aware of the actual amount of monthly savings they garnered through PSTP, though most had a sense that some money was saved. In all groups, participants asked for more ongoing communication about the program, and especially about how much they were saving along the way.

10. Overall satisfaction with the program was high across all groups. Interest in recommending the program was also extremely high. High levels of satisfaction with PECO edged out satisfaction with NRG, though this may have had more to do with overall familiarity and loyalty to PECO than anything else.

11. Participants in all groups were disappointed that the program was coming to a close and wanted an opportunity to continue PSTP. Many talked about “going back to PECO” rather than staying with NRG as a supplier, though not all had acted on this at the time of the focus groups. For some, end of program communication could be improved.

Appendix B Residential End-of-pilot Survey Instruments

B.1 PECO Smart Time Pricing Participant Survey

PECO Smart Time Pricing Participant Survey

Thank you for agreeing to complete this short survey about your experience with PECO Smart Time Pricing. The survey should take just a few minutes and we would appreciate it if you complete all of the questions. Your responses will be reported along with hundreds of other people and your identity will not be reported to PECO along with your answers.

Q1. Our records indicate that you are enrolled in PECO Smart Time Pricing. Under PECO Smart Time Pricing, you receive a discounted price on your electricity during most of the hours in the year except for non-holiday weekday afternoons between 2 PM and 6 PM. Does that sound familiar?

- Yes No Not Sure

Q2. Overall how satisfied are you with PECO Smart Time Pricing? (Check one)

- Very satisfied – Go to Q4
 Somewhat satisfied – Go to Q4
 Somewhat dissatisfied
 Very dissatisfied

Q3. Tell us in a couple of sentences why you feel that way.

Q4. Previously you were charged a single price per kilowatt hour of electricity no matter when you used it. Under PECO Smart Time Pricing you receive a discount on most hours during the year but are charged a higher price on non-holiday weekday afternoons between 2 PM and 6 PM. Compared to your previous rate plan, how would you rate the value of PECO Smart Time Pricing?

- A much better value
 A somewhat better value
 About the same value
 A somewhat worse value
 A much worse value

Q5. Tell us in a couple of sentences why you feel that way.

Q6. Compared to your previous rate plan, how would you rate the comfort of your home on weekday afternoons from 2 PM to 6 PM on PECO Smart Time Pricing? Would you say your home is...

- A lot more comfortable
- Somewhat more comfortable
- About as comfortable
- Somewhat less comfortable
- A lot less comfortable

Q7. Tell us in a couple of sentences why you feel that way.

Q8. As a result of participating in PECO Smart Time Pricing, do you feel you have more control over your household's electricity cost?

- Yes No – Go to Q10 Not Sure – Go to Q10



Q9. Tell us in a couple of sentences why you feel that way.

Q10. Is PECO Smart Time Pricing convenient for your household?

- Yes
- No
- Not Sure

Q11. Tell us in a couple of sentences why you feel that way.

Residential End-of-pilot Survey Instruments

Q12. Have you or anyone else in your household done anything to reduce the amount of electricity you use on weekday afternoons for example, delaying the use of dish or clothes washers or changing your thermostat setting?

Yes No - Go to Q14 Not Sure - Go to Q14



Q13. Tell us in a couple of sentences what you have done.

Q14. Do you believe you saved any money as a result of selecting PECO Smart Time Pricing?

Yes No - Go to Q16 Not Sure - Go to Q16



Q15. How much money do you think you have saved on a monthly basis?

\$ _____ per month

Q16. Please rate the following aspects of PECO Smart Time Pricing from excellent to poor.

	Excellent	Very Good	Good	Fair	Poor	No Opinion
Ease of understanding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fairness	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Opportunity to save money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Fit with my lifestyle	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comfort in my home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Convenience	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Control over energy usage	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Now we have a few questions about you and that will help us understand how different people view PECO Smart Time Pricing. Your individual answers will not be reported to PECO or anyone else and will only be used to create statistical summaries.

Q17. For each of the following age groups, how many people, including you, live in this home for more than half of the year?

Age Group	Number of People	Age Group	Number of People
5 and under	_____	55 - 64	_____
6 - 18	_____	65 - 74	_____
19 - 34	_____	75+	_____
35 - 54	_____		

Residential End-of-pilot Survey Instruments

Q18. What is your age? _____

Q19. How many adults in your household work outside the home on most days? _____ Adults
Q20. How many adults in your household work exclusively at home on most days? _____ Adults

Q21. What is the highest grade of schooling you completed? (Check one)

<input type="checkbox"/> Elementary or middle school	<input type="checkbox"/> Some college, no degree
<input type="checkbox"/> Some high school, no diploma	<input type="checkbox"/> Two-year college graduate
<input type="checkbox"/> High school graduate	<input type="checkbox"/> Four-year college graduate
<input type="checkbox"/> Trade or technical school	<input type="checkbox"/> Graduate degree or higher

Q22. Which of the following best describes your total household income from all sources in 2013, before taxes? (Check one)

<input type="checkbox"/> Less than \$23,000	<input type="checkbox"/> \$57,000 - \$74,999	<input type="checkbox"/> \$175,000 - \$199,999
<input type="checkbox"/> \$23,000 - \$33,999	<input type="checkbox"/> \$75,000 - \$89,999	<input type="checkbox"/> \$200,000 - \$224,999
<input type="checkbox"/> \$34,000 - \$38,999	<input type="checkbox"/> \$90,000 - \$124,999	<input type="checkbox"/> \$225,000 - \$249,999
<input type="checkbox"/> \$39,000 - \$46,999	<input type="checkbox"/> \$125,000 - \$149,999	<input type="checkbox"/> \$250,000 plus
<input type="checkbox"/> \$47,000 - \$56,999	<input type="checkbox"/> \$150,000 - \$174,999	

Q23. Are any members of your household eligible for accommodations under the Americans with Disabilities Act? (Examples include sight impairment, mobility impairment, etc.)

Yes No

Q24. We will be inviting a small number of people to meet with us to discuss their experience with PECO Smart Time Pricing. These small, informal discussion groups will help us gain additional insights into how you felt about your experience. In return for discussing PECO Smart Time Pricing with others like yourself for 90 minutes we will pay you \$150. If you are interested please provide your telephone number and/or email address. We will then contact you if you are selected.

Telephone: _____
Email: _____

Q25. Thanks for answering our questions. If there are any comments you have on PECO Smart Time Pricing please record them in the space provided below.

Thank you! Please return your completed survey using the enclosed envelope. NEXID

Residential End-of-pilot Survey Instruments

B.2 PECO Smart Time Pricing Disenrollment Survey

Thank you for agreeing to complete this short survey about your experience with PECO Smart Time Pricing. The survey should take just a few minutes to finish and we would appreciate it if you complete all of the questions asked. Your responses will be reported along with hundreds of other people and your identity will not be reported to PECO along with your answers.

Q1. Overall how satisfied were you with PECO Smart Time Pricing? (Check one)

- Very satisfied – Go to Q3
- Somewhat satisfied – Go to Q3
- Somewhat dissatisfied
- Very dissatisfied



Q2. Tell us why you feel that way.

Q3. Please tell us why you chose to leave PECO Smart Time Pricing.

Q4. Below are some reasons for withdrawing from PECO Smart Time pricing. For each reason, please indicate whether it was a consideration in your decision to withdraw from the plan and how important it was.

Reason for Leaving	Not a reason	Not Very Important	Somewhat Important	Very Important
You did not save enough money	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
PECO Smart Time Pricing did not give you enough control over your energy costs	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
You don't like worrying about when you use electricity	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
The temperature of your home was uncomfortable on afternoons and evenings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
You found a better deal from another electricity supplier	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
It was inconvenient to change the time of day when you used appliances and air conditioning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
You believed that your energy costs were higher with PECO Smart Time Pricing	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other – please specify (if any):	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Residential End-of-pilot Survey Instruments

Q5. For each of the following age groups, how many people, including you, live in this home for more than half of the year?

Age Group	Number of People	Age Group	Number of People
5 and under	_____	55 - 64	_____
6 - 18	_____	65 - 74	_____
19 - 34	_____	75+	_____
35 - 54	_____		

Q6. How many adults in your household work outside the home on most days? Number of people _____

Q7. How many adults in your household work exclusively at home on most days? Number of people _____

Q8. What is the highest grade of schooling anyone in your household has completed? (Check one)

- | | |
|---|---|
| <input type="checkbox"/> Elementary or middle school | <input type="checkbox"/> Some college, no degree |
| <input type="checkbox"/> Some high school, no diploma | <input type="checkbox"/> Two-year college graduate |
| <input type="checkbox"/> High school graduate | <input type="checkbox"/> Four-year college graduate |
| <input type="checkbox"/> Trade or technical school | <input type="checkbox"/> Graduate degree or higher |

Q9. Which of the following best describes your total household income from all sources in 2013, before taxes? (Check one)

- | | | |
|--|--|--|
| <input type="checkbox"/> Less than \$23,000 | <input type="checkbox"/> \$57,000 - \$74,999 | <input type="checkbox"/> \$175,000 - \$199,999 |
| <input type="checkbox"/> \$23,000 - \$33,999 | <input type="checkbox"/> \$75,000 - \$89,999 | <input type="checkbox"/> \$200,000 - \$224,999 |
| <input type="checkbox"/> \$34,000 - \$38,999 | <input type="checkbox"/> \$90,000 - \$124,999 | <input type="checkbox"/> \$225,000 - \$249,999 |
| <input type="checkbox"/> \$39,000 - \$46,999 | <input type="checkbox"/> \$125,000 - \$149,999 | <input type="checkbox"/> \$250,000 plus |
| <input type="checkbox"/> \$47,000 - \$56,999 | <input type="checkbox"/> \$150,000 - \$174,999 | |

Q10. Thanks for answering our questions. If there are any comments you have on PECO Smart Time Pricing please record them in the space provided below.

Thank you! Please return your completed survey using the enclosed envelope.

NEXID

Appendix C PECO Smart Time Pricing Customer Communication Plan

C.1 Introduction

The following outlines the communication plan that the PECO Smart Time Pricing team designed and rolled out with the program.

This section details the communication plan for a customer during their post enrollment period – for information on pre-enrollment, please refer to the PECO Smart Time Pricing Interim Report submitted to the PUC on June 24th, 2014

C.2 Objective

The stated²⁸ objective of the communication plan for customers enrolled in PECO Smart Time Pricing was to educate customers on how the TOU rate works and how they can take advantage of load shifting to maximize cost savings. PECO used the web, bill messaging, and progress letters as the primary means of providing this information. The details of these avenues of communication follow.

C.3 Web

PECO STP customers who enrolled are able to view additional information through their account webpage pertinent to PECO STP. The My Account features allowed the ability to track savings, energy usage, bill comparison, and other information that customers would find helpful.

Figure C-1 displays what a customer enrolled in PECO STP would see when they clicked on 'view my bill' from their PECO My Account page. The main feature of this page is the PECO Smart Time Pricing Bill Comparison. The first column in the Bill Comparison Tool shows what the customer is paying on the PECO Smart Time Pricing rate. The second column displays the PECO Default Rate, or what a customer not enrolled in PECO Smart Time Pricing would be paying for the same energy usage. The third column details the difference of the first two columns, displaying an aggregate savings for the customer on the bottom. The bill comparison feature would be refreshed each customer's billing cycle.

²⁸ See section 3.3 Customer Education of the Supplement to PECO Energy Company's Initial Dynamic Pricing and Customer Acceptance Plan, February 22, 2013, Docket No. P 2012 2297304

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PECO Smart Time Pricing Customer Communication Plan

Figure C-1: PECO STP Customer Landing Page and Bill Comparison Tool

Link to access interval usage data

Keep an eye on your energy usage.
VIEW USAGE
Tips to help you save energy & money.
MORE

History of monthly bill comparisons of STP TOU rate to PECO's default rate

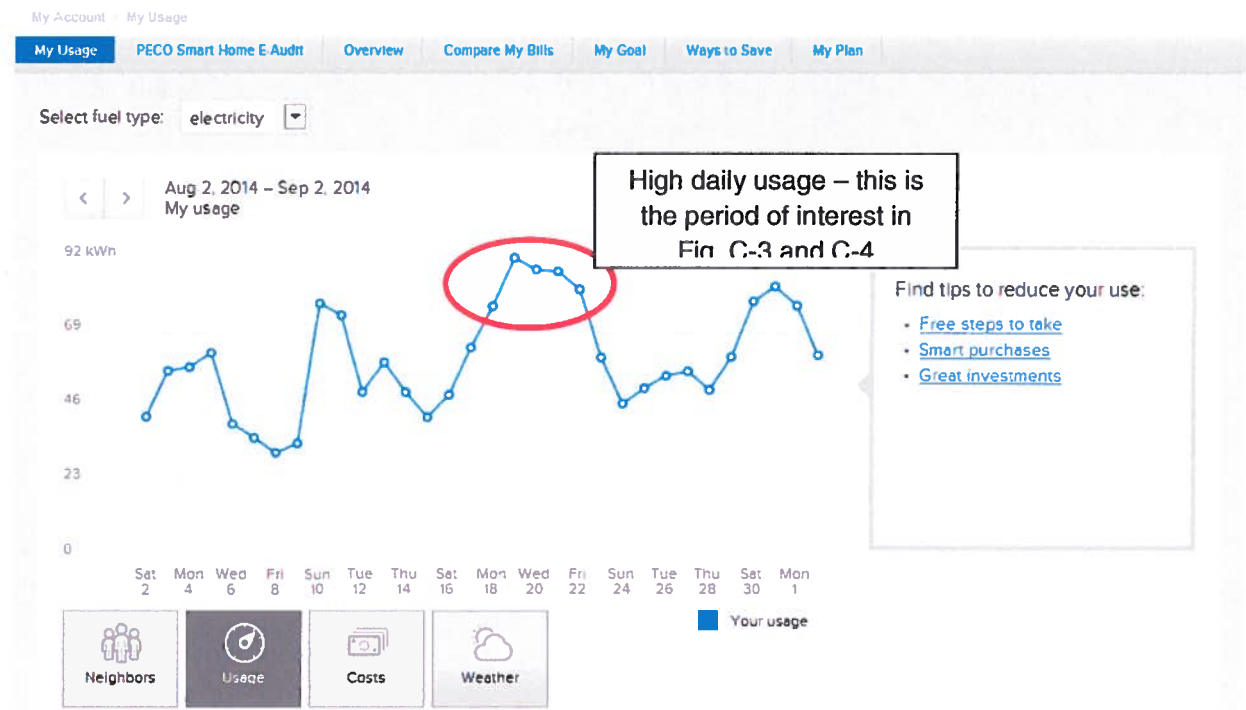
Date	NRG Retail Solutions Rate	PECO Price-To-Compare	Monthly Program Savings
03-05-2015	\$57.43	\$59.44	\$2.01
04-05-2015	\$55.55	\$74.84	\$19.29
01-05-2015	\$38.75	\$102.05	\$63.30
12-03-2014	\$72.28	\$53.33	\$18.95
10-31-2014	\$91.45	\$55.75	\$35.70
10-03-2014	\$110.49	\$115.20	\$4.71
09-03-2014	\$152.45	\$151.43	\$0.98
08-04-2014	\$125.54	\$145.23	\$19.69
07-03-2014	\$103.93	\$141.54	\$37.61
06-04-2014	\$119.94	\$125.11	\$5.17
05-04-2014	\$55.52	\$50.91	\$4.61
Program-to-date Savings:			\$88.33

PECO Smart Time Pricing customers could also view detailed usage history by clicking on the 'view usage' tab on the upper-right hand side of the screen.

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PECO Smart Time Pricing Customer Communication Plan

Figures C-2, C-3, and C-4 show example images of what a PECO STP customer could view. The line graph represents the customer's energy usage over a specified period of time. The customer could switch their view from months, days, and even hours to gain a better understanding of how to manage their energy usage habits. This was especially relevant to customers who were attempting to shift their energy usage away from the 2 to 6 PM peak hours and maximize savings. Customers could view all of their energy usage up to the day before through this method. Below are three examples of what a customer on PECO STP could view through viewing their usage.

Figure C-2: PECO STP 'View My Usage' – Month View



Figures C-3 and C-4 further show a comparison of what a customer would see during a day when the peak time usage was relatively low and flat vs. when it was higher and had a spiky pattern.

Figure C-3: PECO STP 'View My Usage' – Daily View

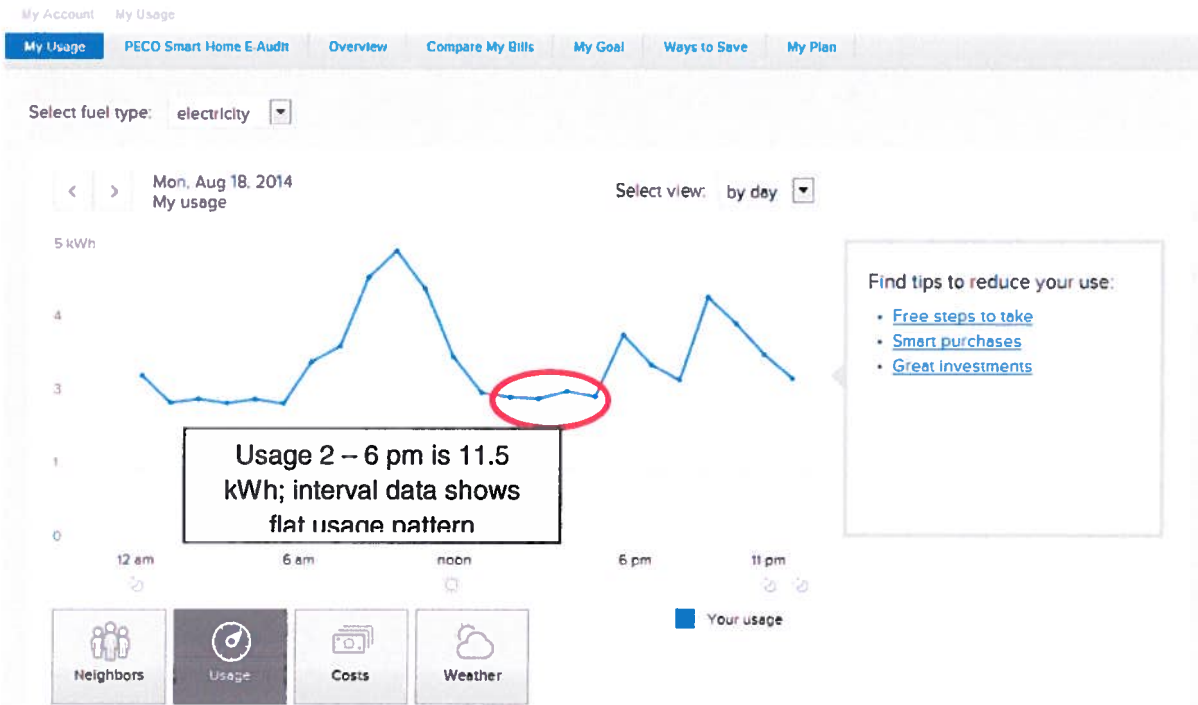
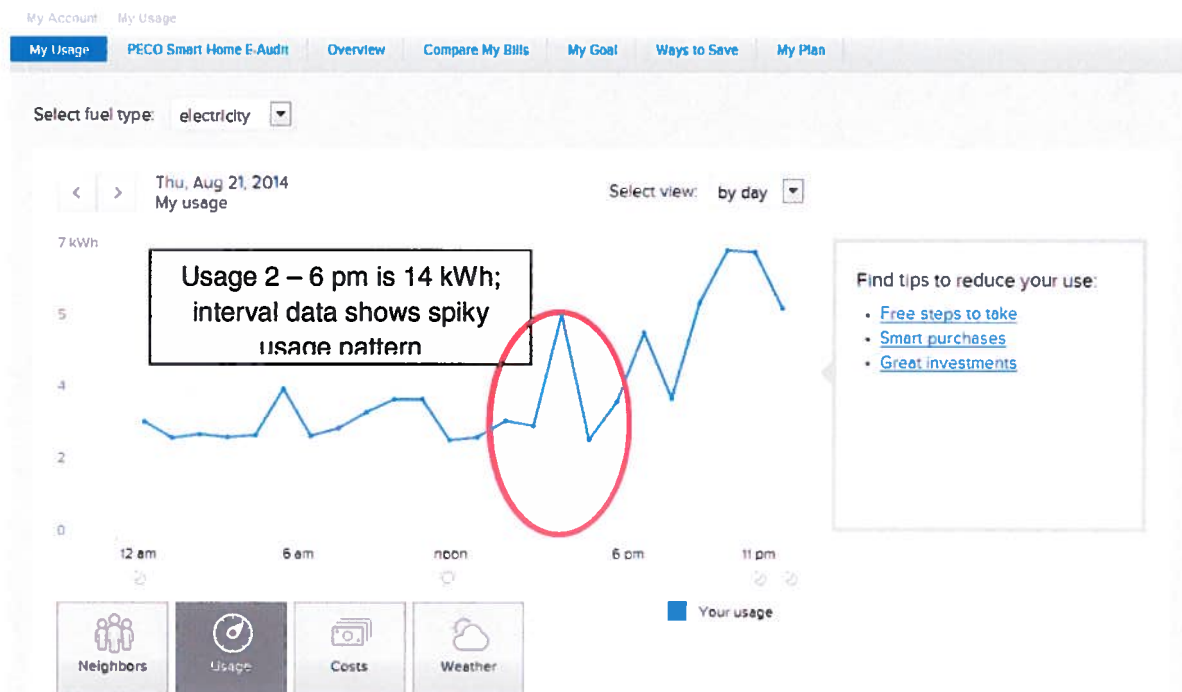


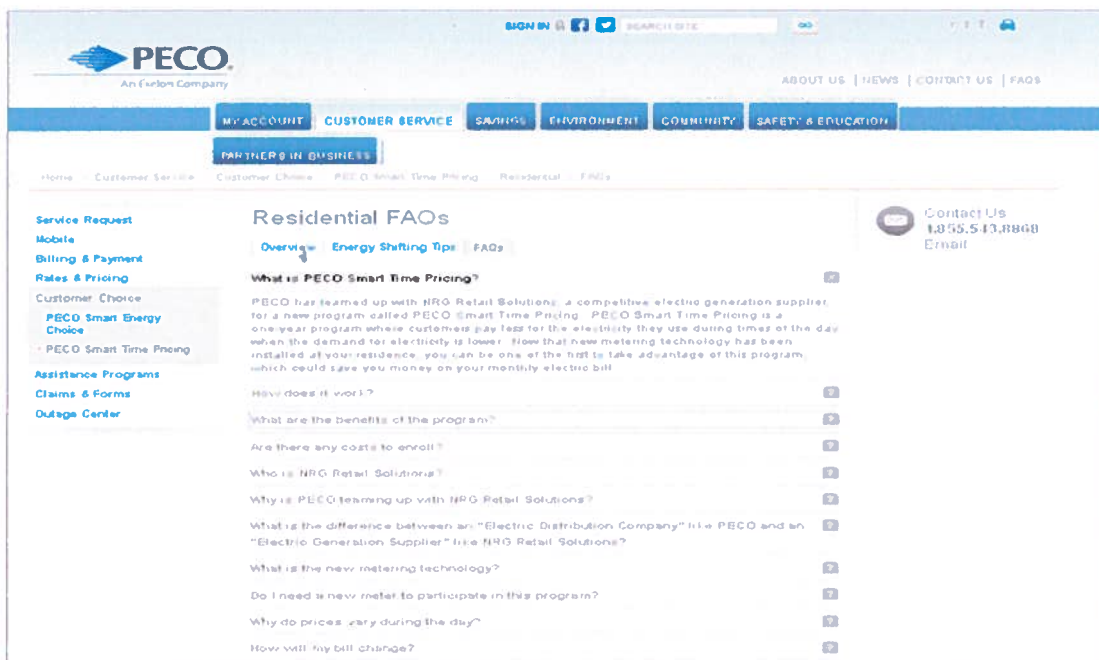
Figure C-4: PECO STP 'View My Usage' - Daily View



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PECO Smart Time Pricing Customer Communication Plan

The final communication avenue using the web is the FAQ's. Figure C-5 illustrates how the FAQ's were presented on the PECO Smart Time Pricing website. In the pre-launch focus groups PECO included discussions about what questions that PECO STP customers may ask before and during the course of the program. These were then accessible from the PECO STP homepage shown above. The page also displays contact info to reach PECO or NRG if they have any questions that are not answered satisfactorily to the customer on the web page.

Figure C-5: PECO STP PECO STP FAQ's



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PECO Smart Time Pricing Customer Communication Plan

C.4 Bill

PECO customers receive a hard copy of their bills on a monthly basis. PECO customers enrolled in PECO STP could receive messages regarding the program in the message center box on their bill. The example below shows how customers were referred back to the online component of the PECO STP program for details.

The message highlighted below in Figure C-6 is an example of a bill with a custom message from PECO STP.

Figure C-6: Message Center Example of PECO STP Message on a PECO Bill

Page 1

Name
Account Number:
Phone Number:
Service Address:

Billing Summary
Bill Date
Thank you for your payment of

Current Period Charges
Gas
Electric
Total New Charges
Total Amount Due on

General information
Next scheduled meter reading, November 3, 2014
PECO 2301 Market St, Philadelphia, PA 19103-1380 If you have any questions or concerns, please call 1-800-434-6000 before the due date.
Si tiene alguna pregunta, favor de llamar al numero 1-800-434-6000 antes de la fecha de vencimiento.

Customer Self Service - Manage Your Account 24/7
• www.pECO.com/bill - Go paperless, receive and pay your bill
• www.pECO.com/service - Start, stop and transfer your service
• www.pECO.com/smarttime - Save energy and money
• Pay by phone with credit/debit card at 1-877-432-8384 (32 35 line)


NRG Retail Solutions-STP 1201 Fern n St, Houston, TX 77002, 855-543-8868

Message Center
New charges contain estimated total state taxes of \$6.65, including \$4.41 for State Gross Receipts Tax.
Your estimated electric price to compare is \$0.0825 per kWh. This may change in March, June, September and December. For more information and supplier offers visit www.PAPowerSwitch.com and www.oce.state.pa.us.
Your gas price to compare for your rate class is \$0.5484 per Ccf. This may change in March, June, September and December. For more information on how to shop for natural gas, visit <http://www.pu.com> or <http://www.pu.com> information: naturalgas_gas_shopping/gas_shopping.html.
With PECO Smart Time Pricing shift your energy use to avoid paying peak energy prices. Visit peco.com/SmartTimePricing for tips to shift your energy use.

(continued on next page)

When paying in person, please bring the entire bill

Return only this portion with your check made payable to PECO. Please write your account number on your check.

 An Exelon Company

Check here to enroll in Power Pay automatic account debit and complete form on reverse side.

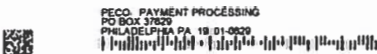
Check here to pledge a donation to MRAP and complete form on reverse side.

To pay by phone call 1-877-432-8384. A convenience fee will apply.

Account Number _____ Payment Receipt Stamp _____

Payment Amount _____

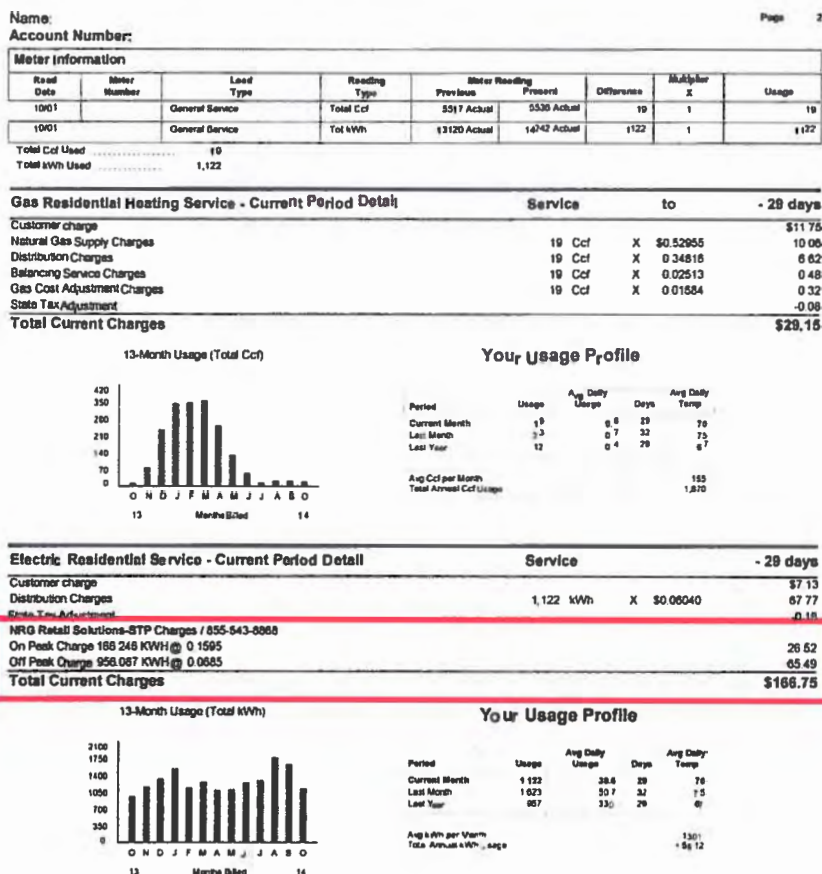
Please pay this amount by _____

PECO, PAYMENT PROCESSING
PO BOX 37820
PHILADELPHIA PA 19101-0820


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PECO Smart Time Pricing Customer Communication Plan

NRG's supplier charges detailing the breakdown of their On and off peak usage and associated charges were included on the bill. Highlighted below is an example of how this was displayed on a PECO bill.

Figure C-7: PECO Bill with PECO STP Charges Listed



DO NOT MAIL THIS PORTION WITH YOUR PAYMENT

009306 13573 GAZBOM RE08148 2/24/1

E-Bill

PECO Smart Time Pricing customers who received their bills through e-bills saw the exact same information as those who received paper bills.

C.5 Program Letters

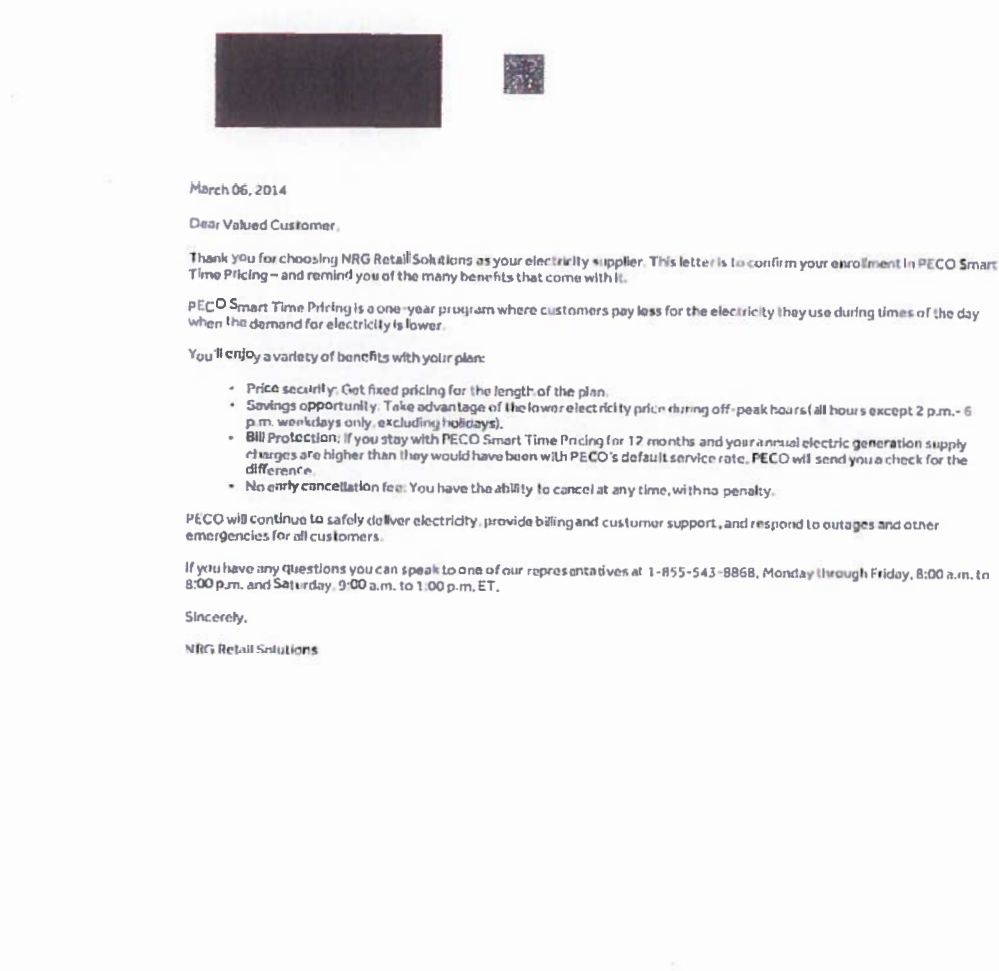
PECO Smart Time Pricing customers received three written program related communications: a welcome package, a progress letter, and an end of program letter.

Welcome Package

Following enrollment customers received a welcome package letter and insert from NRG Retail Solutions. The letter and inserts were designed to introduce newly enrolled Smart Time Pricing customers to the program and inform customers about the benefits of enrollment. This communication came directly from NRG Retail Solutions because the customer had switched to NRG upon enrollment.

Figure C-8 is an example letter

Figure C-8 Welcome Letter

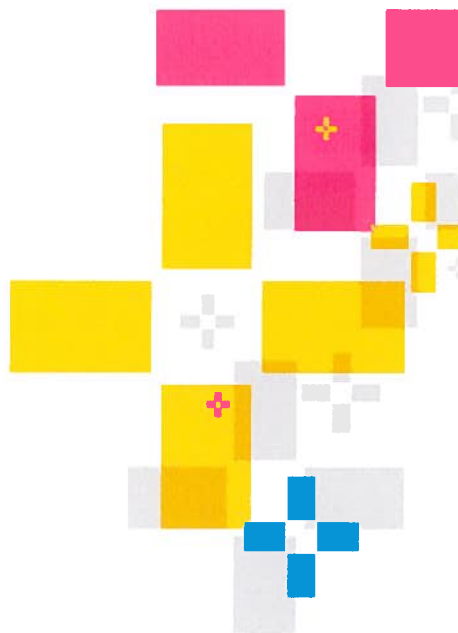


Inserts were also provided with the welcome package. They mirror similar information included in the welcome letter, while expanding on NRG's participation and the mechanics of the Time of Use process. Below are examples of the inserts. Figure C-9 show the inserts that were included.

Figure C-9: Inserts in the Welcome Package

Who is NRG Retail Solutions, and how are they related to PECO Smart Time Pricing?

NRG Retail Solutions is part of the retail division of NRG, a Fortune 500 company and one of the nation's largest energy suppliers. NRG Retail Solutions is also the competitive electric generation supplier PECO has contracted with to provide PECO Smart Time Pricing. By participating in the program, you'll enjoy the best of both worlds. You'll get all the benefits of being an NRG Retail Solutions Customer, with PECO continuing to safely deliver electricity, provide billing and customer support, and respond to outages and other emergencies.



How does PECO Smart Time Pricing work?

This program gives you the opportunity to save money based on your electricity usage habits. It features a lower price for electricity during times of the day when the demand for electricity is lower (off-peak hours), and a higher price for electricity during times of the day when the demand for electricity is higher (peak hours). These lower-priced, non-peak hours are defined as any time other than 2 p.m. to 6 p.m. on non-holiday weekdays, which means they make up almost 90% of the year.

For more information, visit peco.com/smarttimepricing or call 1.855.543.8868.



Reliant Energy Northeast LLC d/b/a NRG Retail Solutions PA PUC License No. A-2010-2192350 © 2013 NRG Energy, Inc. All rights reserved. SS_2306

Progress Letter


In June of 2014, every customer enrolled in PECO Smart Time Pricing received a progress letter. The Progress Letter was designed to not only update customers on the current savings on the Smart Time Pricing Rate, but also to remind customers about the mechanics of the program and its' eventual end. The timing of the progress letter was designed to serve as a reminder as we entered the summer cooling season. The letter included:

- Customer Progress
- Program savings to date
- Breakdown of savings month to month
- Tools to maximize savings by shifting load
- Facts about the NRG and PECO Price to Compare
- A brief list of the benefits of the PECO Smart Time Pricing Program
- Call center information

Below is a sample of a progress letter that PECO Smart Time Pricing customers received.

CAUSE-PA STATEMENT 1, APPENDIX B
PECO Smart Time Pricing Customer Communication Plan

Figure C-10: PECO STP Progress Letter Example



PECO
An Exelon Company

██████████

Dear ██████████

Thank you for participating in PECO Smart Time Pricing. Your program savings to date is \$65.90. Below is a chart showing your monthly PECO Smart Time Pricing charges through NRG Retail Solutions and the PECO Price-To-Compare, along with your total program savings to date for Account Number ██████████.

Date	NRG Retail Solutions Rate	PECO Price-To-Compare	Monthly Program Savings
11/15/13	\$43.00	\$58.14	\$10.14
12/11/13	\$44.67	\$43.20	\$8.53
1/14/14	\$49.58	\$62.68	\$17.10
2/13/14	\$44.21	\$55.04	\$10.83
3/14/14	\$50.32	\$57.85	\$7.56
4/13/14	\$50.91	\$60.54	\$9.63
5/13/14	\$40.15	\$46.26	\$6.11
Total Program-to-date Savings			\$65.90

If your monthly or program-to-date savings display \$0.00


We are heading into the summer months, so the time of day that you use electricity will impact your bill. Maximize your savings this summer by running high use appliances during off-peak hours to take advantage of the NRG Retail Solutions price of 6.85¢ per kilowatt-hour from 2 p.m. to 6 p.m. — weekdays only, excluding holidays. That means that you can save money by shifting your use of the time! For more energy shifting tips please visit www.pECO.com/smart

You will continue to receive these great benefits through the program:

- Price security:** Your price is fixed for the 12 months you are in the program.
- Savings opportunity:** Monitor your savings by logging in to your account on peco.com and selecting the PECO Smart Time Pricing Bill Compare link on the "My Bill" page.
- Bill protection:** If you stay with the program for 12 months and your total electric generation supply charges are higher than they would have been with PECO's default service during the 12 months, PECO will send you a check for the difference.

If you have any questions or concerns, please contact us at 1-855-543-8868, Monday through Friday, 8 a.m. to 6 p.m. EST, and Saturday, from 9:00 a.m. to 1:00 p.m. EST.

Sincerely,
PECO Smart Time Pricing Team




End of Program Letter

The End of Program Letter was distributed to customers shortly after they disenrolled from the PECO Smart Time Pricing Program. The letter took one of two forms, either a saving letter informing them of how much they saved or a bill protection version that presented the data on how much more they spent on STP. The bill protection letter also included the bill protection check. Both versions included a reminder to contact NRG Retail Solutions with questions.

Figure C-11 is an example of the End of Program Savings Letter.

Figure C-11: PECO STP End of Program Saving Letter Example



PECO
An Exelon Company

<First_Name> <Last_Name>
 <Billing_Address>
 <City>, <State> <Zip>

Dear <First_Name> <Last_Name>.

Thank you for participating in PECO SmartTime Pricing. Congratulations, you saved <\$\$\$.xx> overall during this one-year program.

PECO Smart Time Pricing charged less for electricity during times of the day when the demand for electricity was typically lower. By shifting your energy usage, you saved money based on your electricity usage habits.

Below is a chart showing your monthly PECO SmartTime Pricing charges through NRG Retail Solutions and the PECO Price-To-Compare charges, along with your total program savings for Account Number <XXXXXXXXXX>.

Date	NRG Retail Solutions Charges	PECO Price-To-Compare Charges	Monthly Program Savings
<MM/DD YY>	<\$\$\$.xx>	<\$\$\$.xx>	<\$\$\$.xx>
<MM/DD YY>	<\$\$\$.xx>	<\$\$\$.xx>	<\$\$\$.xx>
<MM/DD YY>	<\$\$\$.xx>	<\$\$\$.xx>	<\$\$\$.xx>
<MM/DD YY>	<\$\$\$.xx>	<\$\$\$.xx>	<\$\$\$.xx>
<MM/DD YY>	<\$\$\$.xx>	<\$\$\$.xx>	<\$\$\$.xx>
<MM/DD YY>	<\$\$\$.xx>	<\$\$\$.xx>	<\$\$\$.xx>
<MM/DD YY>	<\$\$\$.xx>	<\$\$\$.xx>	<\$\$\$.xx>
Total Program Savings			<\$\$\$.xx>

As part of PECO SmartTime Pricing, we offered you bill protection. If your annual least 2 emission supply charges were higher than they would have been with PECO's default service rate, your total program savings would display a negative amount and we would have provided a rebate check for the difference.

If you have any questions or concerns please contact us at 1-855-543-8968, Monday through Friday, 8 a.m. to 6 p.m. EST, and Saturday from 9:00 a.m. to 1:00 p.m. EST.

Again, thank you for your participation in PECO SmartTime Pricing.

Sincerely,
PECO SmartTime Pricing Team

PECO Smart Time Pricing Customer Communication Plan

Figure C-12 is an example of the End of Program Bill Protection Letter

Figure C-12: End of Program Bill Protection Letter Example



2/27/15

Dear _____,

Thank you for participating in PECO Smart Time Pricing. This one-year program has now ended. The chart below provides an overview of your monthly charges through NRG Retail Solutions, what you would have been charged if you remained with PECO, and any monthly savings you achieved through this program.

As part of PECO Smart Time Pricing, we offered you bill protection. If your annual electric generation supply charges were higher than they would have been with PECO's default service rate, your total program savings below will appear as a negative amount. Enclosed is your bill protection rebate check for the difference.

Date	NRG Retail Solutions Charges	PECO Price-To-Compare	Monthly Program Savings
02/01/14	\$0.00	\$0.00	\$0.00
03/11/14	\$0.00	\$0.00	\$0.00
04/09/14	\$0.00	\$0.00	\$0.00
05/08/14	\$0.00	\$0.00	\$0.00
06/09/14	\$0.00	\$0.00	\$0.00
07/09/14	\$0.02	\$0.02	\$0.00
08/08/14	\$0.85	\$0.91	\$0.06
09/08/14	\$0.82	\$0.85	\$0.03
10/07/14	\$0.50	\$0.53	\$0.03
11/05/14	\$6.38	\$4.97	(\$1.41)
12/08/14	\$0.18	\$0.21	\$0.03
01/06/15	\$0.46	\$0.36	(\$0.10)
Total Program Savings			(\$1.36)

If you have not already chosen to purchase the electricity you use from another competitive electric generation supplier, or returned your service to PECO, you were automatically enrolled in another time-of-use rate from NRG retail solutions. If you have any questions, please call 1-855-543-8868, Monday through Friday, 8 a.m. to 6 p.m., and Saturday, from 9 a.m. to 1 p.m.

Sincerely,
PECO Smart Time Pricing Team

Pennsylvania Public Utility Commission
v.
PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company
To Interrogatories of the
Office of Consumer Advocate
OCA Set II
Response Date: 05/22/2020

OCA-II-19

Referencing page 15, lines 21 through 23. Please explain how a CAP customer selecting the TOU rate could adversely impact the benefits received under the CAP program, regardless of whether the customer the flexibility must shift usage.

RESPONSE:

Please note that PECO has proposed CAP customers as ineligible for selection of the optional TOU rate.

The CAP credit is calculated based on the customer's actual undiscounted bills over the previous twelve months. If CAP customers were eligible to select a TOU rate and did so for the first time, their previous twelve months of bills would not reflect pricing under TOU rates. This could adversely impact the benefits received by a customer under the CAP program if the customer's usage patterns on the TOU rate result in higher bills than the previous twelve months on a non-TOU rate.

Responsible Witness: Joseph A Bisti

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the

Office of Consumer Advocate

OCA Set II

Response Date: 05/22/2020

OCA-II-20

Referencing page 16, lines 1 through 7. How would a CAP customer selecting the proposed TOU rate change the cost burden on all other residential customers that pay for the CAP, assuming that the TOU rate were to be available to CAP customers?

RESPONSE:

Assuming PECO's proposed TOU rate option was available to CAP customers, the usage patterns of those customers might change the cost burden on all residential customers. If participating CAP customers principally use energy within the TOU on-peak period hours, their default service charges and CAP credits may increase, thereby increasing the cost burden on all residential customers who pay for CAP.

Responsible Witness: Joseph A Bisti

Pennsylvania Public Utility Commission

v.

PECO Energy Company

Petition of PECO Energy Company for Approval of
Default Service Program

Docket No. P-2020-3019290

Response of PECO Energy Company

To Interrogatories of the
Electric Suppliers Coalition
ESC Set I

Response Date: 05/18/2020

ESC-I-8

Reference Fisher Direct Testimony, p. 20. You present a chart to show an increase in EGS participation in the PECO zone from December 2010 through December 2019.

- A. Do you agree that since December 2016, the growth in EGSs serving residential customers has been relatively nonexistent?
- B. Do you have data for the same time period as shown on this chart showing the number of residential customers have been served by EGSs? If so, please provide.

RESPONSE:

- A. As of December 2016, 97 EGSs were serving residential customers in PECO's service area. The most recent data available is for the month ending April 28, 2020. As of the month ending April 28, 2020, 96 EGSs were serving residential customers in PECO's service area. The change during this time is therefore -1%. An assessment of whether this is considered "relatively non-existent" cannot be made without defining to what other growth rate and/or in what context this is being compared.
- B. The following table provides historical numbers of residential customers being served by EGSs.

CAUSE-PA STATEMENT 1, APPENDIX B

Month	Active or Pending EGS Customers*	Month	Active or Pending EGS Customers*	Month	Active or Pending EGS Customers*
12/10	44,935	2/14	466,572	4/17	505,868
1/11	119,840	3/14	465,065	5/17	502,658
2/11	165,191	4/14	463,299	6/17	500,005
3/11	205,478	5/14	462,103	7/17	497,012
4/11	225,816	6/14	460,065	8/17	492,235
5/11	245,682	7/14	457,318	9/17	489,102
6/11	260,226	8/14	459,395	10/17	487,900
7/11	273,806	9/14	462,028	11/17	487,134
8/11	287,795	10/14	464,194	12/17	485,582
9/11	297,711	11/14	466,870	1/18	482,936
10/11	308,501	12/14	468,431	2/18	479,839
11/11	317,725	1/15	469,591	3/18	478,667
12/11	326,365	2/15	470,003	4/18	476,751
1/12	335,716	3/15	470,072	5/18	472,604
2/12	344,736	4/15	471,120	6/18	469,527
3/12	354,135	5/15	471,431	7/18	466,089
4/12	360,289	6/15	472,541	8/18	461,060
5/12	368,926	7/15	474,066	9/18	457,724
6/12	374,910	8/15	475,717	10/18	454,479
7/12	384,536	9/15	478,120	11/18	451,972
8/12	391,435	10/15	478,330	12/18	448,933
9/12	394,609	11/15	480,188	1/19	446,723
10/12	411,449	12/15	481,757	2/19	444,275
11/12	419,176	1/16	484,694	3/19	442,078
12/12	428,043	2/16	486,066	4/19	440,213
1/13	436,695	3/16	488,337	5/19	438,373
2/13	440,335	4/16	489,949	6/19	436,517
3/13	444,149	5/16	491,355	7/19	434,872
4/13	448,178	6/16	493,968	8/19	432,375
5/13	448,549	7/16	496,358	9/19	431,138
6/13	445,985	8/16	498,248	10/19	430,914
7/13	442,810	9/16	498,685	11/19	429,389
8/13	440,620	10/16	500,010	12/19	427,888
9/13	441,753	11/16	502,672	1/20	426,149
10/13	444,041	12/16	504,344	2/20	425,215
11/13	449,989	1/17	505,538		
12/13	459,581	2/17	505,808		
1/14	463,982	3/17	507,005		

* Includes customers being served by EGSs and those who will be switched to EGSs within 3 days.

Responsible Witness: Scott G. Fisher and John J. McCawley