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November 15, 2017

Via Federal Express
Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street
Second Floor
Harrisburg, Pennsylvania 17120

Re: PUC Docket No. M-2015-2515691
Phase III Energy Efficiency and Conservation Program Annual Report for June 1, 2016 through May 31, 2017

Dear Secretary Chiavetta:

In accordance with Section IV.E.2 of the Commission's Opinion and Order Letter dated March 17, 2016 (Docket No. M-2015-2515691), enclosed is PECO's Phase III Annual Energy Efficiency & Conservation Report for the period June 1, 2016 through May 31, 2017.

PECO is providing a copy of the report to the Act 129 Statewide Evaluator (NMR Group) and is also posting the report on the PECO website.

Please acknowledge receipt of the foregoing on the enclosed copy of this letter.

If you have any further questions regarding this matter, please call me at 215-841-5777.

Sincerely,

RGW

cc: C. Walker-Davis, Director, Office of Special Assistants
P. T. Diskin, Director, Bureau of Technical Utility Services
K. Monaghan, Director, Bureau of Audits
R. Kanaskie, Director, Bureau of Investigation & Enforcement
Office of Consumer Advocate
Office of Small Business Advocate
McNees, Wallace & Nurick

Enclosures

NAVIGANT

Final Annual Report to the Pennsylvania Public Utility Commission

Phase III of Act 129

Program Year 8

(June 1, 2016 - May 31, 2017)

For Pennsylvania Act 129 of 2008

Energy Efficiency and Conservation Plan

Prepared for:

Prepared by:
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November 15, 2017

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ACRONYMS

BDR	Behavioral Demand Response
C&I	Commercial and Industrial
CAP	Customer Assistance Program
CDO	Commercial Date of Operation
CFL	Compact Fluorescent Lamp
CfP	Call for Projects
CHP	Combined Heat and Power
CSP	Conservation Service Provider or Curtailment Service Provider
CV	Coefficient of Variation
DLC	Direct Load Control
DR	Demand Response
DRA	Demand Response Aggregator
EDC	Electric Distribution Company
EDT	Eastern Daylight Time
EE&C	Energy Efficiency and Conservation
EEMF	Energy Efficiency Marketing Firm
EM&V	Evaluation, Measurement, and Verification
EUL	Effective Useful Life
FPL	Federal Poverty Level
G/E/NP	Government/Education/Non-Profit
GIS	Geographic Information Systems
HER	Home Energy Report
HIM	High Impact Measure
HVAC	Heating, Ventilating, and Air Conditioning
ICSP	Implementation Conservation Service Provider
ISR	In-Service Rate
kW	Kilowatt
kWh	Kilowatt-hour
LDV	Lagged Dependent Variable
LED	Light-Emitting Diode
LEEP	Low-Income Energy Efficiency Program (Phase II)
LIURP	Low-Income Usage Reduction Program
M&V	Measurement and Verification
MW	Megawatt
MWh	Megawatt-hour
NPV	Net Present Value
NTG	Net-to-Gross
P3TD	Phase III to Date

PA PUC	Pennsylvania Public Utility Commission
PSA	Phase III to Date Preliminary Savings Achieved; equal to VTD + PYRTD
PSA+CO	PSA savings plus Carryover from Phase II
PSD	Performance Systems Development
PUF	Part-Use Factor
PY	Program Year: e.g. PY8, from June 1, 2016, to May 31, 2017
PYRTD	Program Year Reported to Date
PYVTD	Program Year Verified to Date
RCT	Randomized Controlled Trial
RPPM	Regression with Pre-Program Matching
RR	Realization Rate
RTD	Phase III to Date Reported Gross Savings
RTO	Regional Transmission Organization
RUL	Remaining Useful Lifetime
SIDS	Smart Ideas Data System
SWE	Statewide Evaluator
TRC	Total Resource Cost
TRM	Technical Reference Manual
VFD	Variable Frequency Drive
VTD	Phase III to Date Verified Gross Savings

TYPES OF SAVINGS

Gross Savings: The change in energy consumption and/or peak demand that results directly from program-related actions taken by participants in an Energy Efficiency and Conservation (EE&C) program, regardless of why they participated.

Net Savings: The total change in energy consumption and/or peak demand that is attributable to an EE&C program. Depending on the program delivery model and evaluation methodology, the net savings estimates may differ from the gross savings estimate due to adjustments for the effects of free riders, changes in codes and standards, market effects, participant and nonparticipant spillover, and other causes of changes in energy consumption or demand not directly attributable to the EE&C program.

Reported Gross: Also referred to as ex ante (Latin for “beforehand”) savings. The energy and peak demand savings values calculated by the Electric Distribution Company (EDC) or its program Implementation Conservation Service Providers (ICSPs) and stored in the program tracking system.

Unverified Reported Gross: The Phase III Evaluation Framework allows EDCs and the evaluation contractors the flexibility to not evaluate each program every year. If an EE&C program is being evaluated over a multiyear cycle, the reported savings for a program year where evaluated results are not available are characterized as unverified reported gross until the impact evaluation is completed and verified savings can be calculated and reported.

Verified Gross: Also referred to as ex post (Latin for "from something done afterward") gross savings. The energy and peak demand savings estimates reported by the independent evaluation contractor after the gross impact evaluation and associated measurement and verification (M&V) efforts have been completed.

Verified Net: Also referred to as ex post net savings. The energy and peak demand savings estimates reported by the independent evaluation contractor after applying the results of the net impact evaluation. Typically calculated by multiplying the verified gross savings by a net-to-gross (NTG) ratio.

Annual Savings: Energy and demand savings expressed on an annual basis, or the amount of energy and/or peak demand an EE&C measure or program can be expected to save over the course of a typical year. Annualized savings are noted as MWh/year or MW/year. The Pennsylvania Technical Reference Manual (TRM) provides algorithms and assumptions to calculate annual savings, and Act 129 compliance targets for consumption reduction are based on the sum of the annual savings estimates of installed measures or behavior change.

Lifetime Savings: Energy and demand savings expressed in terms of the total expected savings over the useful life of the measure. Typically calculated by multiplying the annual savings of a measure by its effective useful life. The Total Resource Cost (TRC) Test uses savings from the full lifetime of a measure to calculate the cost-effectiveness of EE&C programs.

Program Year Reported to Date (PYRTD): The reported gross energy and peak demand savings achieved by an EE&C program or portfolio within the current program year. PYTD values for energy efficiency will always be reported gross savings in a semiannual or preliminary annual report.

Program Year Verified to Date (PYVTD): The verified gross energy and peak demand savings achieved by an EE&C program or portfolio within the current program year as determined by the impact evaluation findings of the independent evaluation contractor.

Phase III to Date (P3TD): The energy and peak demand savings achieved by an EE&C program or portfolio within Phase III of Act 129. Reported in several permutations described below.

1. **Phase III to Date Reported (RTD):** The sum of the reported gross savings recorded to date in Phase III of Act 129 for an EE&C program or portfolio.
2. **Phase III to Date Verified (VTD):** The sum of the verified gross savings recorded to date in Phase III of Act 129 for an EE&C program or portfolio, as determined by the impact evaluation finding of the independent evaluation contractor.
3. **Phase III to Date Preliminary Savings Achieved (PSA):** The sum of the verified gross savings (VTD) from previous program years in Phase III where the impact evaluation is complete plus the reported gross savings from the current program year (PYTD). For PY8, the PSA savings will always equal the PYTD savings because PY8 is the first program year of the phase (no savings will be verified until the PY8 final annual report).
4. **Phase III to Date Preliminary Savings Achieved + Carryover (PSA+CO):** The sum of the verified gross savings from previous program years in Phase III plus the reported gross savings from the current program year plus any verified gross carryover savings from Phase II of Act 129. This is the best estimate of an EDC's progress toward the Phase III compliance targets.

5. **Phase III to Date Verified + Carryover (VTD + CO):** The sum of the verified gross savings recorded to date in Phase III plus any verified gross carryover savings from Phase II of Act 129.

1. INTRODUCTION

Pennsylvania Act 129 of 2008, signed on October 15, 2008, mandated energy savings and demand reduction goals for the largest electric distribution companies (EDCs) in Pennsylvania for Phase I (2008 through 2013). Phase II of Act 129 began in 2013 and concluded in 2016. In late 2015, each EDC filed a new energy efficiency and conservation (EE&C) plan with the Pennsylvania Public Utilities Commission (PA PUC) detailing the proposed design of its portfolio for Phase III. These plans were updated based on stakeholder input and subsequently approved by the PUC in 2016.

Implementation of Phase III of the Act 129 programs began on June 1, 2016. This report documents the progress and effectiveness of the Phase III EE&C accomplishments for PECO in Program Year 8 (PY8), as well as the cumulative accomplishments of the Phase III programs since inception. This report additionally documents the energy savings carried over from Phase II. The Phase II carryover savings count toward EDC savings compliance targets for Phase III.

This report details the participation, spending, reported gross, verified gross, and verified net impacts of the energy efficiency (EE) programs in PY8. Compliance with Act 129 savings goals are ultimately based on verified gross savings. This report also includes estimates of cost-effectiveness accorded to the Total Resource Cost (TRC) test.[1] PECO has retained Navigant Consulting, Inc. (Navigant) as an independent evaluation contractor for Phase III of Act 129. Navigant is responsible for the measurement and verification (M&V) of the savings and calculation of gross verified and net verified savings.

Navigant also performed a process evaluation to examine the design, administration, implementation, and market response to the EE&C programs. This report presents the key findings and recommendations identified by the process evaluation and documents any changes to EE&C program delivery considered based on the recommendations.

Phase III of Act 129 includes a demand response (DR) goal for PECO. DR events are limited to the months of June through September, which are the first 4 months of the Act 129 PY. Because the DR season is completed early in the PY, it is possible to complete the independent evaluation of verified gross savings for DR sooner than for the energy efficiency programs. PECO reported the verified gross demand response impacts for PY8 as well as the cumulative DR performance of the EE&C program to date for Phase III of Act 129 in the Preliminary Annual Report filed July 17, 2017. Sections 3.6, 3.7, and 3.8 of this report also include PECO's previously reported DR performance results for PY8.

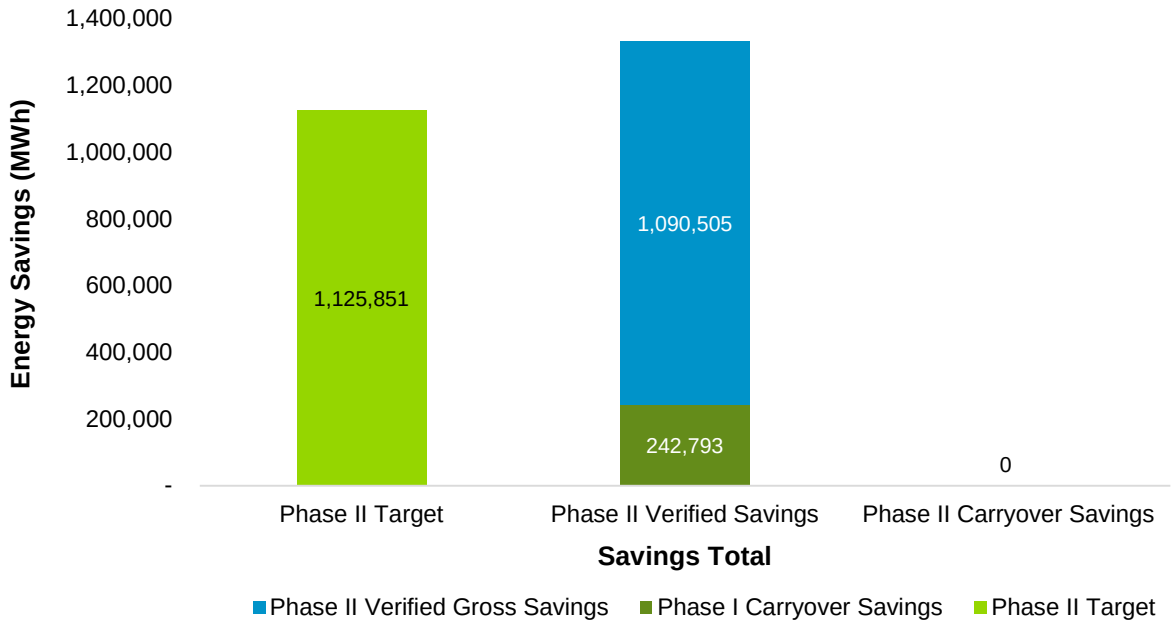
[1] The Pennsylvania TRC Test for Phase I was adopted by PUC order at Docket No. M-2009-2108601 on June 23, 2009 (*2009 PA TRC Test Order*). The TRC Test Order for Phase I later was refined in the same docket on August 2, 2011 (2011 PA TRC Test Order). The 2013 TRC Order for Phase II of Act 129 was issued on August 30, 2012. The 2016 TRC Test Order for Phase III of Act 129 was adopted by PUC order at Docket No. M-2015-2468992 on June 11, 2015.

2. SUMMARY OF ACHIEVEMENTS

2.1 Carryover Savings from Phase II of Act 129

PECO has reported zero portfolio-level carryover savings from Phase II to Phase III. The Commission's Phase III Implementation Order[2] allowed EDCs to carry over savings achieved within Phase II that were in excess of the Phase II portfolio savings target. Phase I carryover savings cannot be counted in calculation of Phase II carryover savings. Figure 2-1 compares PECO's Phase II verified gross savings total to the Phase II compliance target to illustrate the carryover calculation. Because PECO's Phase II verified gross savings did not exceed PECO's Phase II target, they were not eligible to carry over savings from Phase II toward their Phase III overall compliance target.[3]

Figure 2-1. Carryover Savings from Phase II of Act 129



Sources: Smart Ideas Data System (SIDS) database, Conservation Service Provider (CSP) tracking data

The Commission's Phase III Implementation Order[4] also allowed EDCs to carry over savings in excess of the Phase II government, educational, and non-profit (G/E/NP) savings goal and excess savings from the

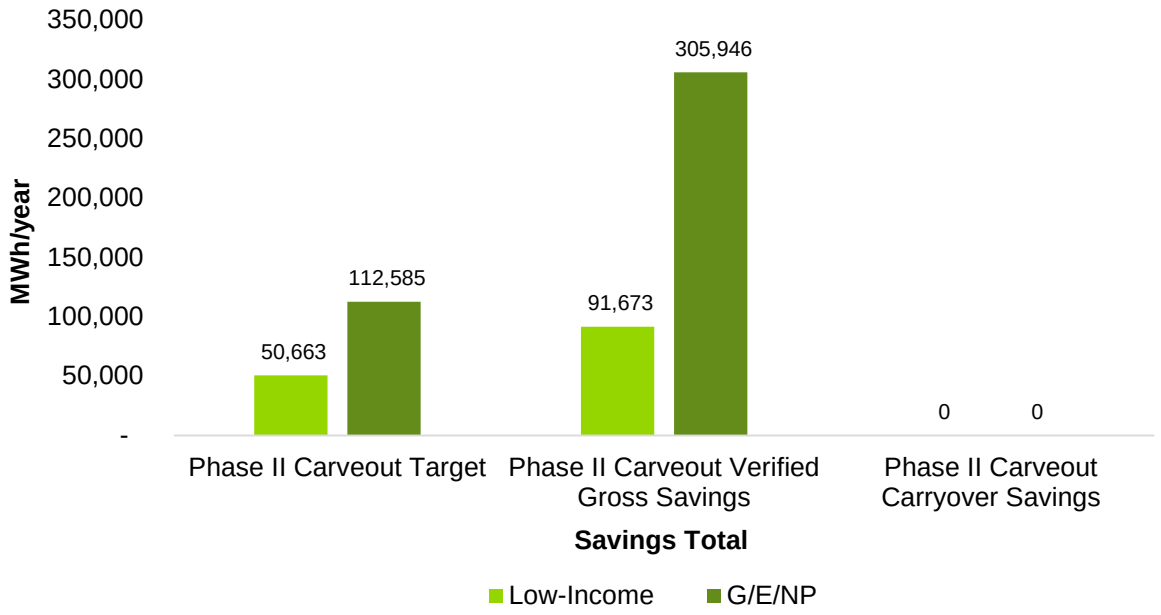
[2] Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program Implementation Order*, at Docket No. M-2014-2424864, (*Phase III Implementation Order*), entered June 11, 2015.

[3] Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program Compliance Order*, at Docket No. M-2012-2289411, (*Phase II Compliance Determination Order*), entered August 3, 2017.

[4] Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program Implementation Order*, at Docket No. M-2014-2424864, (*Phase III Implementation Order*), entered June 11, 2015.

low-income customer segment.[5] PECO carried over 0 MWh of G/E/NP and 0 MWh of low-income customer segment savings.[6] Figure 2-2 shows the calculation of carryover savings for the low-income and G/E/NP targets.[7]

Figure 2-2. Customer Segment-Specific Carryover from Phase II



Sources: SIDS database, CSP tracking data

2.2 Phase III Energy Efficiency Achievements to Date

Since the beginning of PY8 on June 1, 2016, PECO has claimed:

- 211,532.1 MWh of reported gross electric energy savings (PYRTD)
- 20.8 MW of reported gross peak demand savings (PYRTD) from energy efficiency programs
- 215,406.8 MWh of verified gross electric energy savings (PYVTD)
- 21.4 MW of verified gross peak demand savings (PYVTD) from energy efficiency programs

Since the beginning of Phase III of Act 129 on June 1, 2016, PECO has achieved:

- 211,532.1 MWh of reported gross electric energy savings (RTD)
- 20.8 MW of reported gross peak demand savings (RTD) from energy efficiency programs
- 215,406.8 MWh of verified gross electric energy savings (VTD)

[5] Proportionate to those savings achieved by dedicated low-income programs in Phase III.

[6] Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program Compliance Order*, at Docket No. M-2012-2289411, (*Phase II Compliance Determination Order*), entered August 3, 2017.

[7] Ibid.

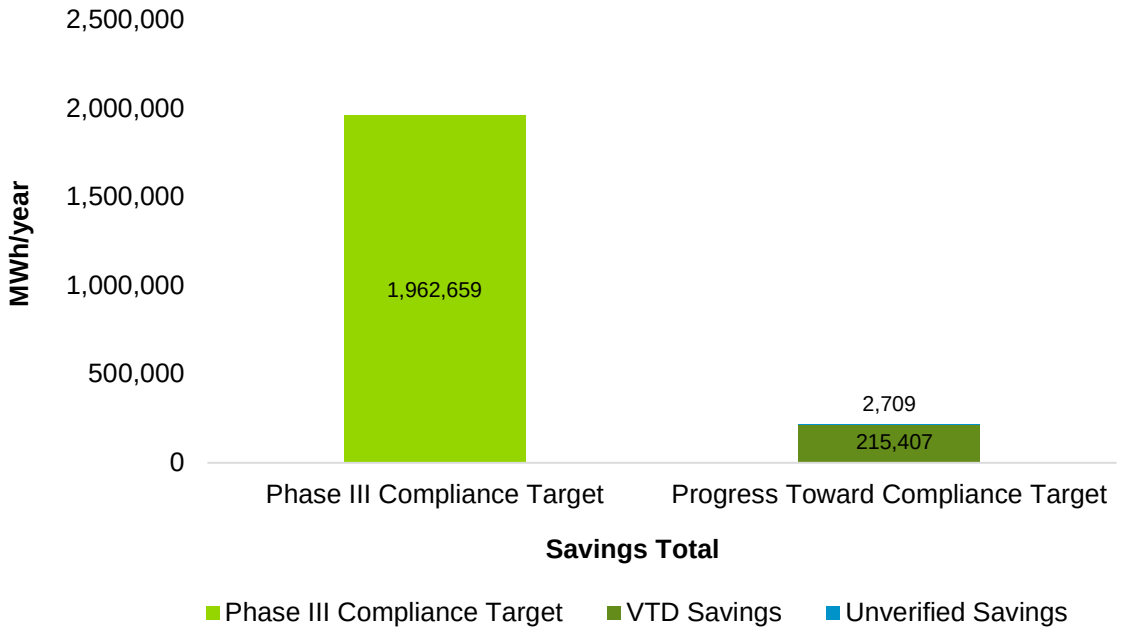
- 21.4 MW of verified gross peak demand savings (VTD) from energy efficiency programs

Including carryover savings from Phase II, PECO has achieved:

- 215,406.8 MWh of VTD + portfolio-level CO energy savings
    - This represents 10.9% of the May 31, 2021 energy savings compliance target of 1,962,659 MWh

Figure 2-3 summarizes PECO's progress toward the Phase III portfolio compliance target. The reader should note that the Whole Home Solution within the Residential Energy Efficiency Program is undergoing a 2-year evaluation across the combined participation from PY8 and PY9. Reported PY8 savings for this solution are being carried in this report as unverified savings. The combined PY8 and PY9 evaluation will result in total verified savings for the 2-year period ending in and reported during PY9. PY9 verified savings will be adjusted to incorporate the impact evaluation and net to gross (NTG) results for the combined period. Appendix D includes details on the Residential Whole Home Solution evaluation.

Figure 2-3. EE&C Plan Performance Toward Phase III Portfolio Compliance Target



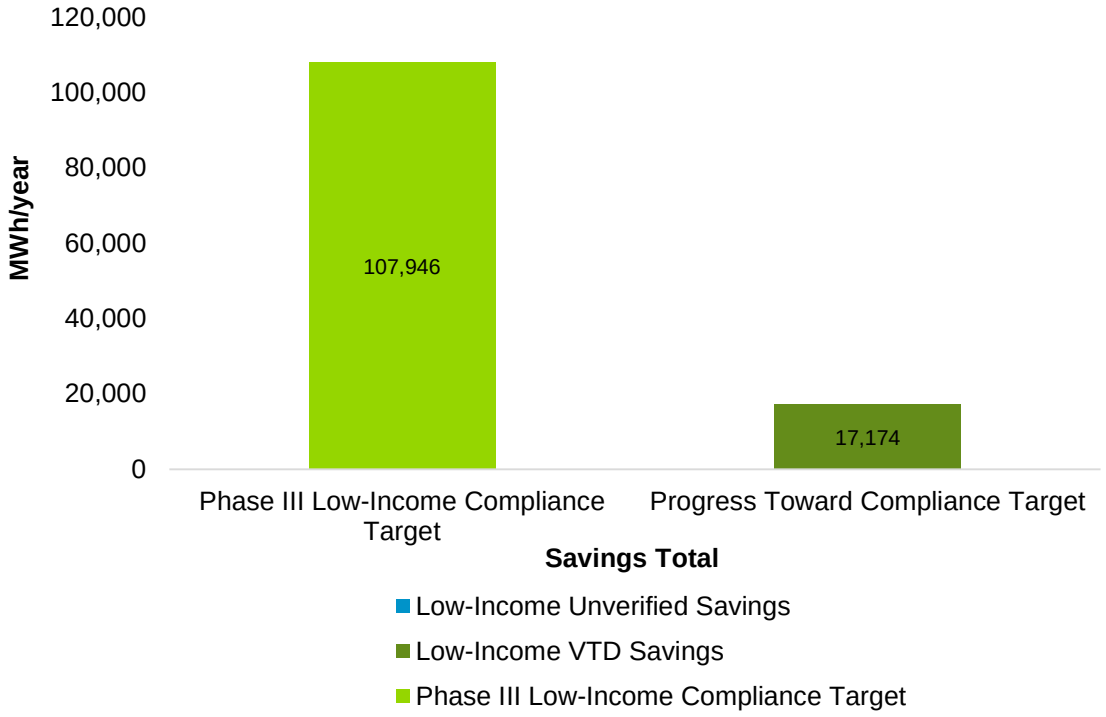
Source: Navigant analysis

The Phase III Implementation Order directed EDCs to offer conservation measures to the low-income customer segment based on the proportion of electric sales attributable to low-income households. The proportionate number of measures targeted for PECO is 8.8%. PECO offers a total of 269 EE&C measures to its residential and non-residential customer classes. There are 117 measures available to the low-income customer segment at no cost to the customer. This represents 43.5% of the total measures offered in the EE&C Plan and exceeds the proportionate number of measures targeted.

The PA PUC also established a low-income energy savings target of 5.5% of the portfolio savings goal. The low-income savings target for PECO is 107,946 MWh/yr and is based on verified gross savings.

Figure 2-4 compares the VTD performance for the low-income customer segment to the Phase III savings target. Based on the latest available information, PECO has achieved 15.9% of the Phase III low-income energy savings target.

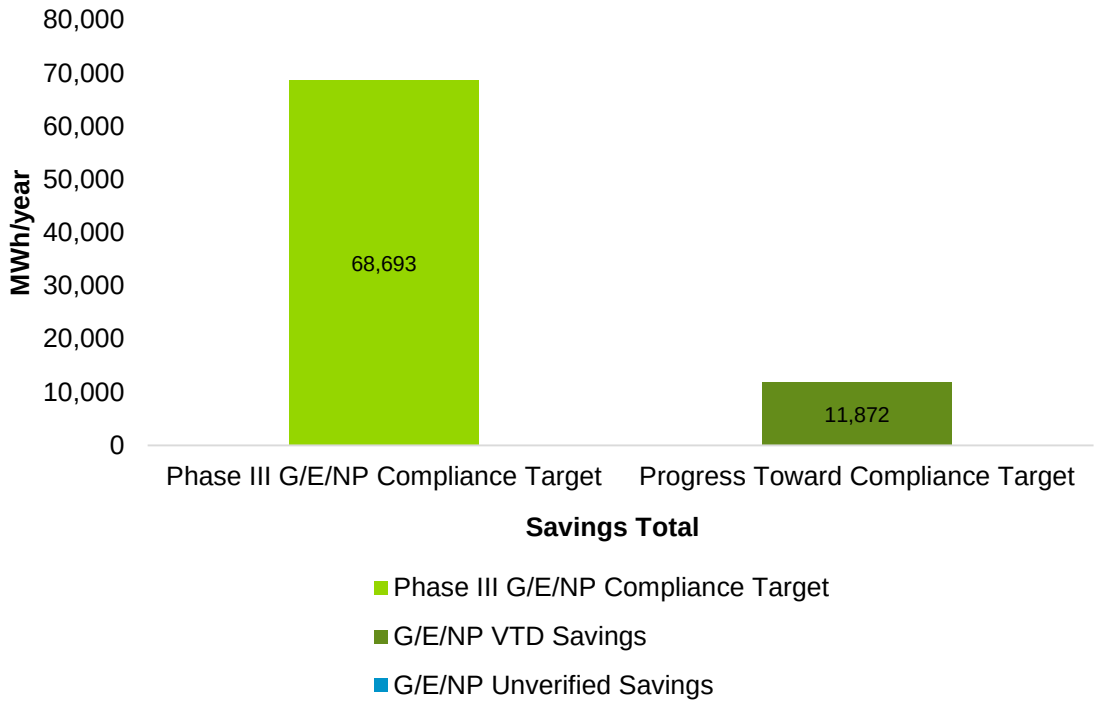
Figure 2-4. EE&C Plan Performance Toward Phase III Low-Income Compliance Target



Source: Navigant analysis

The Phase III Implementation Order established a G/E/NP energy savings target of 3.5% of the portfolio savings goal. The G/E/NP savings target for PECO is 68,693 MWh/yr and is based on verified gross savings. Figure 2-5 compares the VTD performance for the G/E/NP customer segment to the Phase III savings target. Based on the latest available information, PECO has achieved 17.3% of the Phase III G/E/NP energy savings target.

Figure 2-5. EE&C Plan Performance Against Phase III G/E/NP Compliance Target



Source: Navigant analysis

2.3 Phase III DR Achievements to Date

The Phase III DR performance target for PECO is 161 MW. Compliance targets for DR programs are based on average performance across events and are established at the system level, which means the load reductions measured at the customer meter must be escalated to reflect transmission and distribution losses.

Act 129 DR events are triggered by PJM's day-ahead load forecast. When the day-ahead forecast is above 96% of the peak load forecast for the year, a DR event is initiated for the following day.

Phase III DR programs will begin operating in PY9. Their performance targets and achievements will be reported in this section of next year's report.

2.4 Phase III Performance by Customer Segment

Table 2-1 through Table 2-3 present the participation, savings, and spending results by customer sector for PY8. The residential, small C&I, and large C&I sectors (also referred to as customer segments or rate classes) are defined by EDC tariff, and the residential low-income and G/E/NP customer segments (Table 2-4 through Table 2-6) were defined by statute (66 Pa. C.S. § 2806.1). The residential low-income segment is primarily a subset of the residential customer class; however, it also includes low-income-qualified residents in master-metered buildings in the small C&I and large C&I sectors. The G/E/NP segment is a subset of the small C&I and large C&I sectors.

Table 2-1 provides the participation counts and spending totals for PECO's EE programs for the three sectors: residential, small C&I, and large C&I, inclusive of all low-income and G/E/NP segments.

Table 2-1. Summary Statistics for EE Programs by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Residential	1,185,035	-	-	-	-	1,185,035
	Small C&I	880	-	-	-	-	880
	Large C&I	170	-	-	-	-	170
	Total	**1,186,085**	**-**	**-**	**-**	**-**	**1,186,085**
Incentive Spending ($1,000)	Residential	5,018	-	-	-	-	5,018
	Small C&I	657	-	-	-	-	657
	Large C&I	1,014	-	-	-	-	1,014
	Total	**6,689**	**-**	**-**	**-**	**-**	**6,689**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 2-2 provides a summary of reported and verified energy savings for PECO's EE programs across the three sectors.

Table 2-2. Summary of Energy Savings for EE Programs by Customer Segment[8]

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Residential	167,460.1	-	-	-	-	167,460.1
	Small C&I	18,102.9	-	-	-	-	18,102.9
	Large C&I	25,969.0	-	-	-	-	25,969.0
	Total	**211,532.1**	**-**	**-**	**-**	**-**	**211,532.1**
Verified Gross Energy Savings (MWh)	Residential	168,513.6	-	-	-	-	168,513.6
	Small C&I	20,924.5	-	-	-	-	20,924.5
	Large C&I	25,968.8	-	-	-	-	25,968.8
	Total	**215,406.8**	**-**	**-**	**-**	**-**	**215,406.8**
Energy Savings Realization Rate	Residential	1.01	-	-	-	-	1.01
	Small C&I	1.16	-	-	-	-	1.16
	Large C&I	1.00	-	-	-	-	1.00
	Total	**1.02**	**-**	**-**	**-**	**-**	**1.02**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

[8] Verified gross energy savings and realization rates do not include the unverified savings from the Whole Home Solution within the Residential EE Program. Verified solution savings will be reflected in the PY9 Annual Compliance Report upon completion of the 2-year evaluation.

Table 2-3 provides a summary of reported and verified demand savings for PECO's EE programs across the three sectors.

Table 2-3. Summary of Demand Savings for EE Programs by Customer Segment[9]

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Residential	13.9	-	-	-	-	13.9
	Small C&I	3.0	-	-	-	-	3.0
	Large C&I	3.9	-	-	-	-	3.9
	Total	**20.8**	**-**	**-**	**-**	**-**	**20.8**
Verified Gross Demand Savings (MW)	Residential	13.9	-	-	-	-	13.9
	Small C&I	3.6	-	-	-	-	3.6
	Large C&I	3.9	-	-	-	-	3.9
	Total	**21.4**	**-**	**-**	**-**	**-**	**21.4**
Demand Savings Realization Rate	Residential	1.00	-	-	-	-	1.00
	Small C&I	1.19	-	-	-	-	1.19
	Large C&I	1.01	-	-	-	-	1.01
	Total	**1.03**	**-**	**-**	**-**	**-**	**1.03**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 2-4 provides a summary of participation and incentive spending for PECO's EE programs by customer segment carve-out.

Table 2-4. Summary Statistics for EE Programs by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Low-Income	64,385	-	-	-	-	64,385
	G/E/NP	86	-	-	-	-	86
Incentive Spending ($1,000)	Low-Income	350	-	-	-	-	350
	G/E/NP	555	-	-	-	-	555

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

[9] Ibid.

Table 2-5 provides a summary of reported and verified energy savings for PECO's EE programs by customer segment carve-out.

Table 2-5. Summary of Energy Savings for EE Programs by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Low-Income	19,864.8	-	-	-	-	19,864.8
	G/E/NP	11,864.6	-	-	-	-	11,864.6
Verified Gross Energy Savings (MWh)	Low-Income	17,173.9	-	-	-	-	17,173.9
	G/E/NP	11,871.9	-	-	-	-	11,871.9
Energy Savings Realization Rate	Low-Income	0.86	-	-	-	-	0.86
	G/E/NP	1.00	-	-	-	-	1.00

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 2-6 provides a summary of reported and verified demand savings for PECO's EE programs by customer segment carve-out.

Table 2-6. Summary of Demand Savings for EE Programs by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Low-Income	2.2	-	-	-	-	2.2
	G/E/NP	1.9	-	-	-	-	1.9
Verified Gross Demand Savings (MW)	Low-Income	1.9	-	-	-	-	1.9
	G/E/NP	1.9	-	-	-	-	1.9
Demand Savings Realization Rate	Low-Income	0.85	-	-	-	-	0.85
	G/E/NP	0.99	-	-	-	-	0.99

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 2-7 summarizes the participation and spending for the DR program for the three sectors.

Table 2-7. Summary Statistics for DR Programs by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Residential	61,440	-	-	-	-	61,440
	Small C&I	1,586	-	-	-	-	1,586
	Large C&I	N/A	-	-	-	-	N/A
	Total	**63,026**	**-**	**-**	**-**	**-**	**63,026**
Incentive Spending ($1,000)	Residential	3,005	-	-	-	-	3,005
	Small C&I	122	-	-	-	-	122
	Large C&I	N/A	-	-	-	-	N/A
	Total	**3,127**	**-**	**-**	**-**	**-**	**3,127**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

There are no reported savings for DR programs in PY8.

2.5 Summary of Participation by Program

Participation is defined differently for each program depending on the program delivery channel and data tracking practices. Table 2-8 provides the current participation totals by program for each program year and for Phase III to date. Solution-level participation is captured in Appendix I.

Table 2-8. EE&C Portfolio Participation by Program

Parameter	Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Residential EE	1,120,885	-	-	-	-	1,120,885
	Low-Income EE	64,385	-	-	-	-	64,385
	Small C&I EE	656	-	-	-	-	656
	Large C&I EE	159	-	-	-	-	159
	CHP	0	-	-	-	-	0
	Residential DR	61,440	-	-	-	-	61,440
	Small C&I DR	1,586	-	-	-	-	1,586
	Large C&I DR	0	-	-	-	-	0
	Portfolio Total	**1,249,111**	**-**	**-**	**-**	**-**	**1,249,111**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The nuances of the participant definition vary by program or solution, and are summarized by program and solution as described here.

Residential EE Program

Five solutions and one targeted market segment make up the Residential EE Program: the Lighting, Appliances & HVAC Solution; the Appliance Recycling Solution; the Whole Home Solution; the New Construction Solution; the Behavioral Solution; and the Multifamily Targeted Market Segment. PECO defined participation counts in each solution as follows:

- For the Lighting, Appliances & HVAC Solution, upstream lighting participation is defined as the sum of stock keeping unit (SKU) sales. A SKU describes a sold lighting product that can be a single bulb or a multi-pack of bulbs. For appliance and HVAC participants, participation is defined as the total number of non-adjusted records in PECO's tracking data. A record may represent one or more rebated items (e.g., a single participant purchasing multiple thermostats during the same purchase event) as is roughly equivalent to all measures included on a single customer application.
- For the Appliance Recycling Solution, a participant is defined as a customer who schedules a pickup for one or more units. If the same customer initiates multiple pickup orders during the year, each order is counted as an individual participant. However, if a customer initiates more than one order in the same day it counts as a single participant.
- For the Residential Whole Home Solution, a participant is defined as a unique customer project listed in the database. In practice within the tracking system, this is equivalent to a project number for non-adjusted records with a project type that does not include "Other Installations" or "CAC Other Installations."
- For the Residential New Construction Solution, a participant is defined as a new home.
- For the Behavioral Solution, a participant is defined as a utility account included in the program's treatment group.
- For the Multifamily Targeted Market Segment, a participant is defined as a unique customer project. This is determined by identifying unique project numbers within the tracking data.

Low-Income EE Program

Two solutions make up the Low-Income EE Program: the Lighting Solution and the Whole Home Solution. Low-income participants are those participants with incomes at or below 150% of the Federal Poverty Level (FPL). PECO defined participation counts in each solution as follows:

- For the Lighting Solution, participation is defined as a package of one or more light bulbs identified by a unique SKU[10] number.
- For the Low-Income Whole Home Solution, a participant is defined as the following:
    - A unique audit number (for both multifamily and single-family audits).
    - A low-income appliance recycling customer who schedules a pickup for one or more units. If the same customer initiates multiple pickup orders during the year, each order is counted as an individual participant. However, if a customer initiates more than one order in the same day it counts as a single participant.
    - Product giveaways are also part of the Whole Home Solution but are not included in the participant count.

[10] A SKU describes a sold lighting product that can be a single bulb or a multi-pack of bulbs.

Small C&I EE Program
Four solutions and two targeted market segments make up the Small C&I EE Program: the Equipment and Systems Solution, the Whole Building Solution, the Behavioral Solution, the New Construction Solution, the Data Centers Targeted Market Segment, and the Multifamily Targeted Market Segment. The Behavioral Solution is not currently active. PECO defined participation counts in each active solution as follows:

- For the Small C&I Equipment and Systems Solution, participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level.
- For the Small C&I Whole Building Solution, participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level.
- For the Small C&I New Construction Solution, participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level.
- For the Data Centers Targeted Market Segment, participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level.
- For the Multifamily Targeted Market Segment, participation is defined as an activity with a unique account ID (meter number). More than one measure per participant is permitted, with the impact sample defined on the meter level.

Large C&I EE Program
Two solutions and two targeted market segments make up the Large C&I EE Program: the Equipment and Systems Solution, the New Construction Solution, the Data Centers Targeted Market Segment, and the Multifamily Targeted Market Segment. PECO defined participation counts in each solution as follows:

- For the Large C&I Equipment and Systems Solution, participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level.
- For the Large C&I New Construction Solution, participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level.
- For the Data Centers Targeted Market Segment, participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level.
- For the Multifamily Targeted Market Segment, participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level.

CHP Program
The CHP Program consists of the CHP Solution only. PECO defined participation counts in the solution as follows:

- For CHP, participation is defined as an activity with a unique project number.

Residential DR Program
Three solutions make up the Residential DR Program; however, only the DLC Solution is currently active. PECO defined participation counts in the solution as follows:

- For Residential DLC, a participant is defined as a unique account number where device status is install or swap, and the measure code is CACS (central air conditioner switch). One participant may have more than one direct load control (DLC) device installed at the home. The categories not included in the participant count include disconnect, opt-out, and removal.

Small C&I DR Program
The Small C&I DR Program consists of the Small C&I DLC Solution. PECO defined participation counts in the solution as follows:

- For Small C&I DLC, a participant is defined as a unique account number where device status is install or swap, and the measure code is PCT (program controlled thermostat). One participant may have more than one DLC device installed on the premise. The categories not included in the participant count include disconnect, opt-out, and removal.

2.6 Summary of Impact Evaluation Results

During PY8, Navigant completed impact evaluations for many of the EE programs in the portfolio. Table 2-9 summarizes the realization rates (RRs) and NTG ratios by program or evaluation initiative.

Table 2-9. Impact Evaluation Results Summary[11]

Program Name	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Residential EE	Energy RR	1.03	-	-	-	-	1.03
	Demand RR	1.07	-	-	-	-	1.07
	NTG Ratio	0.71	-	-	-	-	0.71
Low-Income EE	Energy RR	0.98	-	-	-	-	0.98
	Demand RR	0.97	-	-	-	-	0.97
	NTG Ratio	0.84	-	-	-	-	0.84
Small C&I EE	Energy RR	0.96	-	-	-	-	0.96
	Demand RR	0.94	-	-	-	-	0.94
	NTG Ratio	0.75	-	-	-	-	0.75
Large C&I EE	Energy RR	1.00	-	-	-	-	1.00
	Demand RR	1.01	-	-	-	-	1.01
	NTG Ratio	0.64	-	-	-	-	0.64

[11] Results at the program and portfolio level are drawn slightly downward due to the unverified savings from the Whole Home Solution within the Residential EE Program. Verified solution savings will be reflected in the PY9 Annual Compliance Report upon completion of the 2-year evaluation.

Program Name	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
CHP	Energy RR	N/A	-	-	-	-	N/A
	Demand RR	N/A	-	-	-	-	N/A
	NTG Ratio	N/A	-	-	-	-	N/A
Residential DR	Energy RR	N/A	-	-	-	-	N/A
	Demand RR	N/A	-	-	-	-	N/A
	NTG Ratio	N/A	-	-	-	-	N/A
Small C&I DR	Energy RR	N/A	-	-	-	-	N/A
	Demand RR	N/A	-	-	-	-	N/A
	NTG Ratio	N/A	-	-	-	-	N/A
Large C&I DR	Energy RR	N/A	-	-	-	-	N/A
	Demand RR	N/A	-	-	-	-	N/A
	NTG Ratio	N/A	-	-	-	-	N/A

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Findings from NTG research are not used to adjust compliance savings in Pennsylvania. Instead, NTG research provides directional information for program planning purposes. Table 2-10 presents NTG findings for high impact measures (HIMs) for the Residential EE Program studied in each PY.

Table 2-10. Residential EE Program HIM NTG Summary

Residential EE HIM	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Multifamily: LEDs [1]	Free Ridership	0.19	-	-	-	-	0.19
	Spillover	0.03	-	-	-	-	0.03
	NTG Ratio	0.84	-	-	-	-	0.84
Lighting, Appliances, & HVAC: Heat Pumps	Free Ridership	0.46	-	-	-	-	0.46
	Spillover	0.02	-	-	-	-	0.02
	NTG Ratio	0.56	-	-	-	-	0.56
Lighting, Appliances, & HVAC: Central Air Conditioners	Free Ridership	0.58	-	-	-	-	0.58
	Spillover	0.04	-	-	-	-	0.04
	NTG Ratio	0.45	-	-	-	-	0.45
Lighting, Appliances, & HVAC: High Efficiency Furnace Fan	Free Ridership	0.48	-	-	-	-	0.48
	Spillover	0.02	-	-	-	-	0.02
	NTG Ratio	0.53	-	-	-	-	0.53
Appliance Recycling: Refrigerator Recycling	Free Ridership	0.65	-	-	-	-	0.65
	Spillover	0.00	-	-	-	-	0.00
	NTG Ratio	0.35	-	-	-	-	0.35

Residential EE HIM	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Appliance Recycling: Freezer Recycling	Free Ridership	0.50	-	-	-	-	0.50
	Spillover	0.00	-	-	-	-	0.00
	NTG Ratio	0.50	-	-	-	-	0.50

[1] The NTG estimates provided for LEDs are based on findings from surveys conducted with tenants participating in the Multifamily Targeted Market Segment aligning with guidance provided in Section 3.4.1.4 of the Phase III Evaluation Framework indicating that HIM research should focus on measures in downstream programs only.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 2-11 presents NTG findings for HIMs for the Small C&I EE Program.

Table 2-11. Small C&I EE Program HIM NTG Summary

Small C&I EE HIM	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Multifamily: LEDs [1]	Free Ridership	0.35	-	-	-	-	0.35
	Spillover	0.00	-	-	-	-	0.00
	NTG Ratio	0.65	-	-	-	-	0.65

[1] The NTG estimates provided for LEDs are based on findings from interviews conducted with landlords participating in the Multifamily Targeted Market Segment aligning with guidance provided in Section 3.4.1.4 of the Phase III Evaluation Framework indicating that HIM research should focus on measures in downstream programs only.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 2-12 presents NTG findings for HIMs for the Large C&I EE Program.

Table 2-12. Large C&I EE Program HIM NTG Summary

Large C&I EE HIM	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Multifamily: LEDs [1]	Free Ridership	0.35	-	-	-	-	0.35
	Spillover	0.00	-	-	-	-	0.00
	NTG Ratio	0.65	-	-	-	-	0.65

[1] The NTG estimates provided for LEDs are based on findings from interviews conducted with landlords participating in the Multifamily Targeted Market Segment aligning with guidance provided in Section 3.4.1.4 of the Phase III Evaluation Framework indicating that HIM research should focus on measures in downstream programs only.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

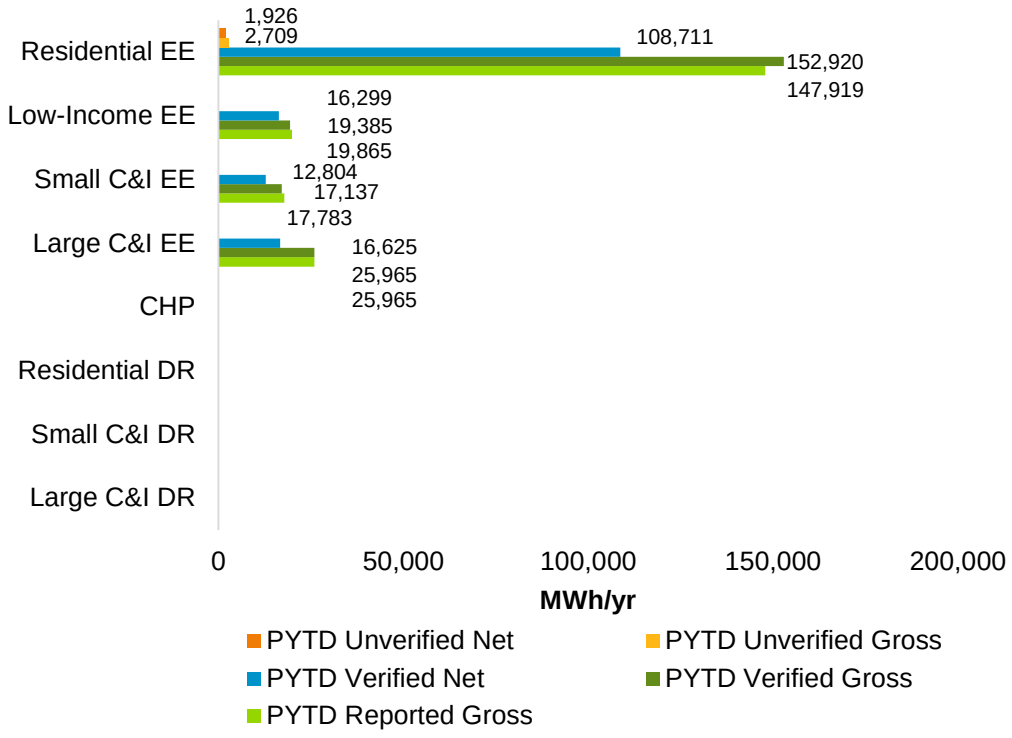
2.7 Summary of Energy Impacts by Program

Act 129 compliance targets are based on annualized savings estimates (MWh/year). Each PY, the annual savings achieved by EE&C program activity are recorded as incremental annual—or first-year—savings and are added to an EDC's progress toward compliance. Incremental annual savings estimates are presented in Section 2.7.1. Lifetime energy savings incorporate the effective useful life (EUL) of installed measures and estimate the total energy savings associated with EE&C program activity. Lifetime savings are used in the TRC test by program participants when assessing the economics of upgrades and by the Statewide Evaluator (SWE) when calculating the emissions benefits of Act 129 programs. Section 2.7.2 presents the lifetime energy savings by program.

2.7.1 Incremental Annual Energy Savings by Program

Figure 2-6 presents a summary of the PYTD energy savings by program for PY8. The energy impacts in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. The verified gross savings are adjusted by the energy recent RR, and the verified net savings are adjusted by both the RR and the NTG ratio.

Figure 2-6. PYTD Energy Savings by Program[12]

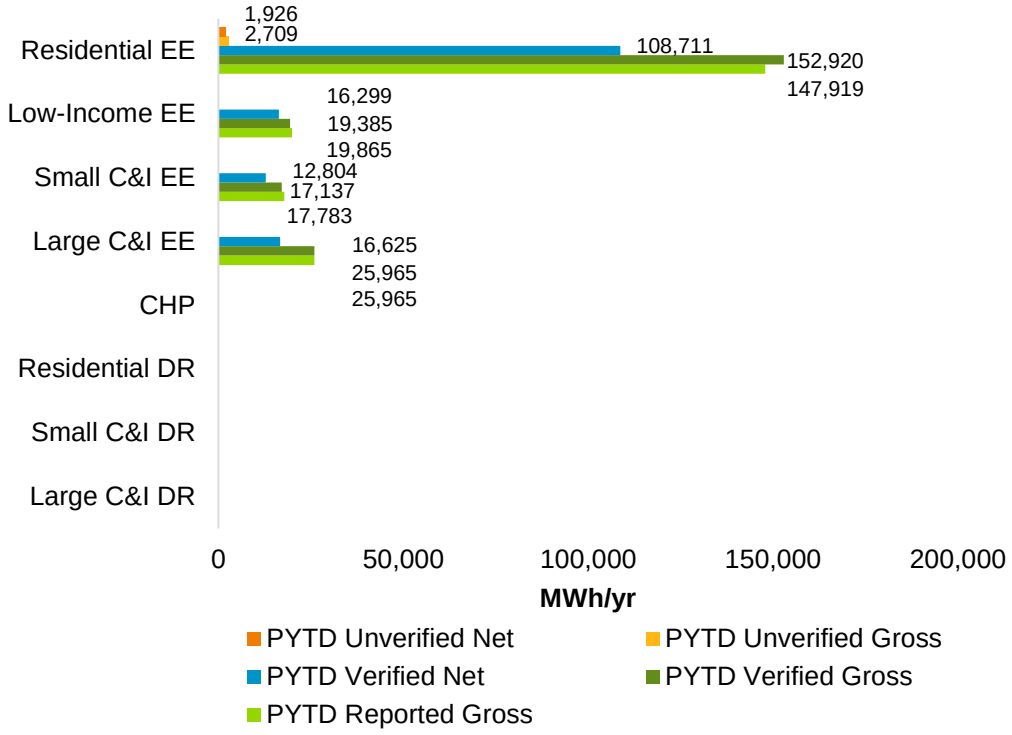


Source: Navigant analysis

[12] Verified gross energy savings do not include the unverified savings from the Whole Home Solution within the Residential EE Program. Verified solution savings will be reflected in the PY9 Annual Compliance Report upon completion of the 2-year evaluation.

Figure 2-7 presents a summary of the energy savings by program for Phase III of Act 129.

Figure 2-7. P3TD Energy Savings by Program[13]



Source: Navigant analysis

A summary of energy impacts by program through PY8 is presented in Table 2-13.

Table 2-13. Summary of Incremental Annual Energy Savings by EE Program[14]

Parameter	EE Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Residential EE	147,919.1	-	-	-	-	147,919.1
	Low-Income EE	19,864.8	-	-	-	-	19,864.8
	Small C&I EE	17,782.8	-	-	-	-	17,782.8
	Large C&I EE	25,965.5	-	-	-	-	25,965.5
	CHP	0.0	-	-	-	-	0.0
	Portfolio Total	**211,532.1**	**-**	**-**	**-**	**-**	**211,532.1**
Verified Gross Energy Savings	Residential EE	152,919.7	-	-	-	-	152,919.47
	Low-Income EE	19,385.1	-	-	-	-	19,385.1
	Small C&I EE	17,136.6	-	-	-	-	17,136.6

[13] Ibid.

[14] Ibid.

Parameter	EE Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
(MWh)	Large C&I EE	25,965.5	-	-	-	-	25,965.5
	CHP	0.0	-	-	-	-	0.0
	Portfolio Total	**215,406.8**	**-**	**-**	**-**	**-**	**215,406.8**
Relative Precision of Verified Gross Energy Savings at 90% Confidence Interval	Residential EE	0.01	-	-	-	-	N/A
	Low-Income EE	0.01	-	-	-	-	N/A
	Small C&I EE	0.05	-	-	-	-	N/A
	Large C&I EE	0.09	-	-	-	-	N/A
	CHP	N/A	-	-	-	-	N/A
	Portfolio Total	**N/A**	**-**	**-**	**-**	**-**	**N/A**
Verified Net Energy Savings (MWh)	Residential EE	108,711.2	-	-	-	-	108,711.2
	Low-Income EE	16,298.8	-	-	-	-	16,298.8
	Small C&I EE	12,804.0	-	-	-	-	12,804.0
	Large C&I EE	16,625.3	-	-	-	-	16,625.3
	CHP	0	-	-	-	-	0
	Portfolio Total	**154,439.3**	**-**	**-**	**-**	**-**	**154,439.3**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

2.7.2 Lifetime Energy Savings by Program

Table 2-14 presents the PYTD and P3TD lifetime energy savings by program. Lifetime energy savings are calculated by multiplying the annual energy savings by the efficient measure useful lifetime (EUL). Per the PA 2016 TRC Order, the measure EUL does not exceed 15 years for any measure in the portfolio. Additionally, early replacement measures are subject to a dual baseline calculation, leading to modified lifetime savings. For these measures, savings relative to the in place baseline equipment are used for the remaining useful lifetime (RUL) of the base equipment. After the RUL, savings relative to code equipment are utilized for the remainder of the efficient measure's EUL.

Table 2-14. Summary of Lifetime Energy Savings by EE Program[15]

Parameter	EE Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Gross Lifetime Energy Savings (MWh)	Residential EE	978,429.0	-	-	-	-	978,429.0
	Low-Income EE	141,886.4	-	-	-	-	141,886.4
	Small C&I EE	201,277.1	-	-	-	-	201,277.1
	Large C&I EE	309,580.6	-	-	-	-	309,580.6
	CHP	0	-	-	-	-	0

[15] Ibid.

Parameter	EE Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Portfolio Total	**1,631,173.1**	**-**	**-**	**-**	**-**	**1,631,173.1**
Verified Net Lifetime Energy Savings (MWh)	Residential EE	503,698.8	-	-	-	-	503,698.8
	Low-Income EE	119,720.1	-	-	-	-	119,720.1
	Small C&I EE	148,538.7	-	-	-	-	148,538.7
	Large C&I EE	196,843.5	-	-	-	-	196,843.5
	CHP	0	-	-	-	-	0
	Portfolio Total	**968,801.2**	**-**	**-**	**-**	**-**	**968,801.2**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

2.8 Summary of Demand Impacts by Program

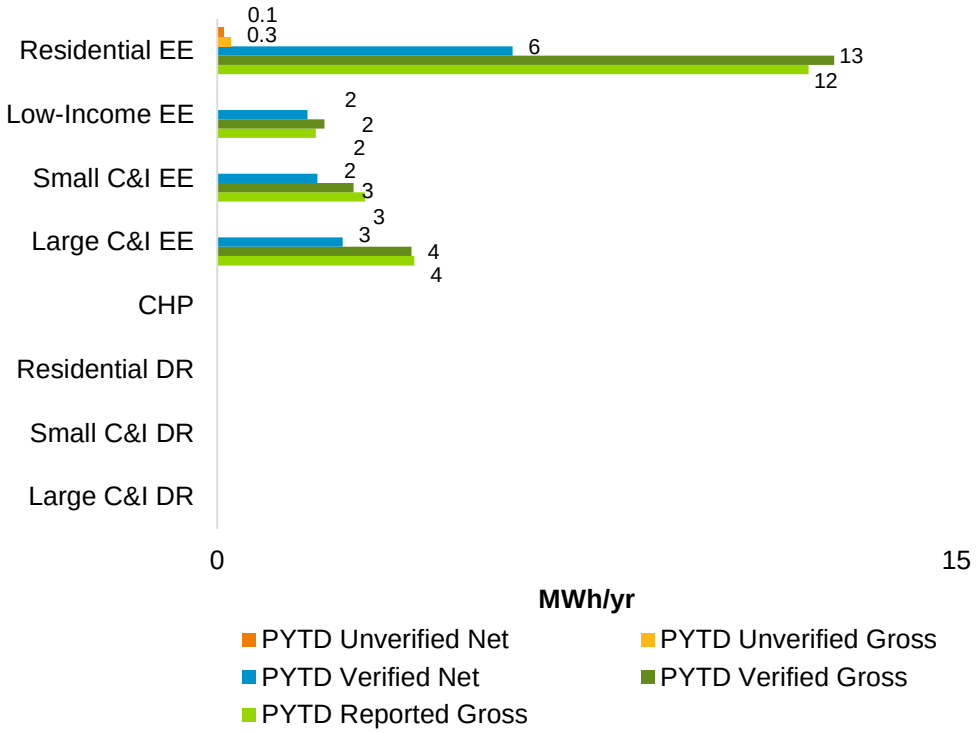
PECO's Phase III EE&C programs achieve peak demand reductions in two primary ways. The first is through coincident reductions from EE measures and the second is through dedicated DR offerings that exclusively target temporary demand reductions on peak days. EE reductions coincident with system peak hours are reported and used in the calculation of benefits in the TRC test but do not contribute to Phase III peak demand reduction compliance goals. Phase III peak demand reduction targets are exclusive to DR programs.

The two types of peak demand reduction savings are also treated differently for reporting purposes. Peak demand reductions from EE are generally additive across program years, meaning that the P3TD savings reflect the sum of the first-year savings in each PY. Conversely, DR goals are based on average portfolio impacts across all events, so cumulative DR performance is expressed as the average performance of each of the DR events called in Phase III to date. Because of these differences, demand impacts from EE and DR are reported separately in the following subsections.

2.8.1 Energy Efficiency

Act 129 defines peak demand savings from EE as the average expected reduction in electric demand from 2:00 p.m. to 6:00 p.m. EDT on non-holiday weekdays from June through August. Unlike Phase I and Phase II Act 129 reporting, the peak demand impacts from EE in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. Figure 2-8 presents a summary of the PYTD demand savings by EE program for PY8.

Figure 2-8. PYTD Demand Savings by EE Program[16]

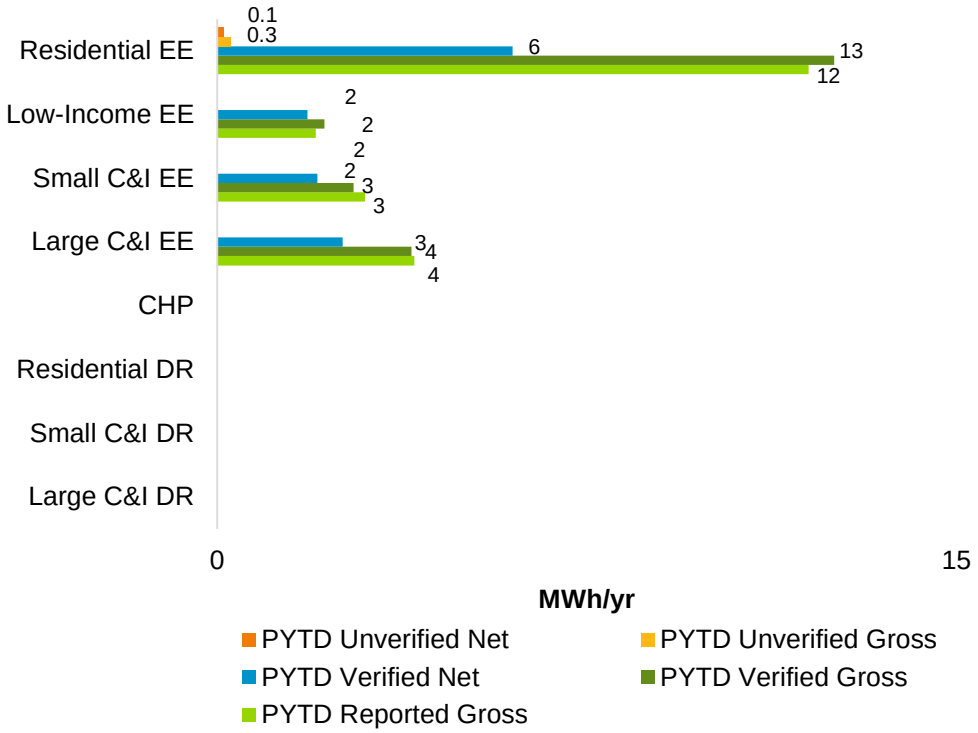


Source: Navigant analysis

Figure 2-9 presents a summary of the P3TD demand savings by EE program for Phase III of Act 129.

[16] Ibid.

Figure 2-9. P3TD Demand Savings by EE Program[17]



Source: Navigant analysis

A summary of the peak demand impacts by EE program through the current reporting period are presented in Table 2-15.

Table 2-15. Summary of Demand Savings by EE Program[18]

Parameter	EE Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Residential EE	11.7	-	-	-	-	11.7
	Low-Income EE	2.2	-	-	-	-	2.2
	Small C&I EE	2.9	-	-	-	-	2.9
	Large C&I EE	3.9	-	-	-	-	3.9
	CHP	0.0	-	-	-	-	0.0
	Portfolio Total	**20.8**	**-**	**-**	**-**	**-**	**20.8**
Verified Gross Demand Savings (MW)	Residential EE	12.5	-	-	-	-	12.5
	Low-Income EE	2.2	-	-	-	-	2.2
	Small C&I EE	2.8	-	-	-	-	2.8

[17] Ibid.

[18] Ibid.

Parameter	EE Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Large C&I EE	3.9	-	-	-	-	3.9
	CHP	0.0	-	-	-	-	0.0
	Portfolio Total	**21.4**	**-**	**-**	**-**	**-**	**21.4**
Relative Precision of Verified Gross Demand Savings at 90% Confidence Interval	Residential EE	0.04	-	-	-	-	0.04
	Low-Income EE	0.03	-	-	-	-	0.03
	Small C&I EE	0.06	-	-	-	-	0.06
	Large C&I EE	0.10	-	-	-	-	0.10
	CHP	N/A	-	-	-	-	N/A
	Portfolio Total	**N/A**	**-**	**-**	**-**	**-**	**N/A**
Verified Net Demand Savings (MW)	Residential EE	6.0	-	-	-	-	6.0
	Low-Income EE	1.8	-	-	-	-	1.8
	Small C&I EE	2.0	-	-	-	-	2.0
	Large C&I EE	2.5	-	-	-	-	2.5
	CHP	0.0	-	-	-	-	0.0
	Portfolio Total	**12.4**	**-**	**-**	**-**	**-**	**12.4**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

2.8.2 Demand Response

Act 129 defines peak demand savings from DR as the average reduction in electric demand during the hours when a DR event is initiated. Phase III DR events are initiated according to the following guidelines:

- Curtailment events shall be limited to the months of June through September.
- Curtailment events shall be called for the first 6 days of each program year (starting in PY9) in which the peak hour of PJM's day-ahead forecast for the PJM regional transmission organization (RTO) is greater than 96% of the PJM RTO summer peak demand forecast for the months of June through September.
- Each curtailment event shall last 4 hours.
- Each curtailment event shall be called such that it will occur during the day's forecasted peak hour(s) above 96% of the PJM RTO summer peak demand forecast.
- Once six curtailment events have been called in a PY, the peak demand reduction program shall be suspended for that PY.

Phase III DR programs will begin operating in PY9; therefore, no DR program savings are reported for PY8. The peak demand impacts from DR starting in PY9 will be presented at the system level and reflect

adjustments to account for transmission and distribution losses. PECO uses the following line loss percentages/multipliers by sector.[19]

- Residential = 107.99% or 1.0799
- Small C&I = 107.99% or 1.0799
- Large C&I = 107.99% or 1.0799

2.9 Summary of Fuel Switching Impacts

Act 129 allows EDCs to achieve electric savings by converting electric equipment to non-electric equipment. Table 2-16 lists the fuel switching measures offered in each year of Phase III, while Table 2-17 provides the key fuel switching metrics to date.

Table 2-16. List of Fuel Switching Measures

Name of Offered Fuel Switching Measure	Measures Implemented in Program Year (Yes/No)				
	PY8	PY9	PY10	PY11	PY12
Electric Water Heater to Gas Water Heater	Yes	-	-	-	-
Electric Furnace to Gas Furnace	Yes	-	-	-	-
Electric Clothes Dryer to gas Clothes Dryer	Yes	-	-	-	-
Electric Range to Gas Range	Yes	-	-	-	-
ASHP to Gas Furnace	Yes	-	-	-	-
Electric Baseboard to Fossil Fuel Furnace	Yes	-	-	-	-

Source: Navigant analysis

Table 2-17. Summary of Fuel Switching Measure Portfolio Impacts[20]

Parameter	Program Year					
	PY8	PY9	PY10	PY11	PY12	Phase III to Date
Total Number of Units Implemented	141	-	-	-	-	141
Incentive Spending ($1,000)	$44.45	-	-	-	-	$44.45
Verified Gross Energy Savings (MWh)	95	-	-	-	-	95
Fossil Fuel Consumption Change (MMBtu)	2,318	-	-	-	-	2,318

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

[19] Pennsylvania Public Utility Commission, *Technical Reference Manual; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program & Act 213 Alternative Energy Portfolio Standards*, dated June 2016, errata update February 2017. Section 1.14 Transmission and Distribution System Losses.

[20] Verified gross energy savings do not include the unverified savings from the Whole Home Solution within the Residential EE Program. Verified solution savings will be reflected in the PY9 Annual Compliance Report upon completion of the 2-year evaluation.

2.10 Summary of Cost-Effectiveness Results

TRC benefit-cost ratios are calculated by comparing total net present value (NPV) TRC benefits and total NPV TRC costs. It is important to note that TRC costs are materially different from the EDC spending and cost recovery tables presented in Section 4. TRC costs include estimates of the full cost incurred by program participants to install efficient equipment—not just the portion covered by the EDC rebate. Table 2-18 shows the TRC ratios by program and for the portfolio. The benefits in Table 2-18 were calculated using gross verified impacts. Costs and benefits are expressed in 2016 dollars.

Table 2-18. Summary of Gross TRC Results by Program[21]

Parameter	Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV Benefits ($1,000)	Residential EE	47,848	-	-	-	-	47,848
	Low-Income EE	6,310	-	-	-	-	6,310
	Small C&I EE	8,485	-	-	-	-	8,485
	Large C&I EE	12,450	-	-	-	-	12,450
	CHP	0	-	-	-	-	0
	Residential DR	0	-	-	-	-	0
	Small C&I DR	0	-	-	-	-	0
	Large C&I DR	0	-	-	-	-	0
	Portfolio Total	**75,093**	**-**	**-**	**-**	**-**	**75,093**
NPV Costs ($1,000)	Residential EE	26,927	-	-	-	-	26,927
	Low-Income EE	7,605	-	-	-	-	7,605
	Small C&I EE	7,805	-	-	-	-	7,805
	Large C&I EE	12,611	-	-	-	-	12,611
	CHP	15	-	-	-	-	15
	Residential DR	3,201	-	-	-	-	3,201
	Small C&I DR	75	-	-	-	-	75
	Large C&I DR	1,742	-	-	-	-	1,742
	Cross-Cutting	8,952	-	-	-	-	8,952
	Portfolio Total	**68,933**	**-**	**-**	**-**	**-**	**68,933**
TRC Ratio	Residential EE	1.78	-	-	-	-	1.78
	Low-Income EE	0.83	-	-	-	-	0.83
	Small C&I EE	1.09	-	-	-	-	1.09
	Large C&I EE	0.99	-	-	-	-	0.99
	CHP	0.00	-	-	-	-	0.00
	Residential DR	0.00	-	-	-	-	0.00

[21] NPV Benefits do not include the unverified savings from the Whole Home Solution within the Residential EE Program; however, costs from this solution are included in the NPV Costs. This lowers the Residential EE Program and portfolio TRC values for PY8. Verified solution savings will be reflected in the PY9 Annual Compliance Report upon completion of the 2-year evaluation.

Parameter	Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Small C&I DR	0.00	-	-	-	-	0.00
	Large C&I DR	0.00	-	-	-	-	0.00
	Portfolio Total	**1.09**	**-**	**-**	**-**	**-**	**1.09**
Net Benefits (Benefits – Costs) ($1,000)	Residential EE	20,921	-	-	-	-	20,921
	Low-Income EE	-1,295	-	-	-	-	-1,295
	Small C&I EE	680	-	-	-	-	680
	Large C&I EE	-161	-	-	-	-	-161
	CHP	-15	-	-	-	-	-15
	Residential DR	-3,201	-	-	-	-	-3,201
	Small C&I DR	-75	-	-	-	-	-75
	Large C&I DR	-1,742	-	-	-	-	-1,742
	Portfolio Total [1]	**6,160**	**-**	**-**	**-**	**-**	**6,160**

[1] The portfolio total net benefits include cross-cutting costs.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 2-19 presents PY8 cost-effectiveness using net verified savings to calculate benefits.

Table 2-19. Summary of Net TRC Results by Program[22]

Parameter	Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Net Present Value Benefits ($1,000)	Residential EE	24,455	-	-	-	-	24,455
	Low-Income EE	5,395	-	-	-	-	5,395
	Small C&I EE	6,274	-	-	-	-	6,274
	Large C&I EE	7,956	-	-	-	-	7,956
	CHP	0	-	-	-	-	0
	Residential DR	0	-	-	-	-	0
	Small C&I DR	0	-	-	-	-	0
	Large C&I DR	0	-	-	-	-	0
	Portfolio Total	**44,080**	**-**	**-**	**-**	**-**	**44,080**
Net Present Value Costs ($1,000)	Residential EE	20,748	-	-	-	-	20,748
	Low-Income EE	7,605	-	-	-	-	7,605
	Small C&I EE	6,536	-	-	-	-	6,536
	Large C&I EE	9,999	-	-	-	-	9,999
	CHP	15	-	-	-	-	15

[22] Ibid.

Parameter	Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Residential DR	3,201	-	-	-	-	3,201
	Small C&I DR	75	-	-	-	-	75
	Large C&I DR	1,742	-	-	-	-	1,742
	Cross-Cutting	8,952	-	-	-	-	8,952
	Portfolio Total	**58,873**	**-**	**-**	**-**	**-**	**58,873**
TRC Ratio	Residential EE	1.18	-	-	-	-	1.18
	Low-Income EE	0.71	-	-	-	-	0.71
	Small C&I EE	0.96	-	-	-	-	0.96
	Large C&I EE	0.80	-	-	-	-	0.80
	CHP	0.00	-	-	-	-	0.00
	Residential DR	0.00	-	-	-	-	0.00
	Small C&I DR	0.00	-	-	-	-	0.00
	Large C&I DR	0.00	-	-	-	-	0.00
	Portfolio Total	**0.75**	**-**	**-**	**-**	**-**	**0.75**
Net Benefits (Benefits – Costs) ($1,000)	Residential EE	3,707	-	-	-	-	3,707
	Low-Income EE	-2,210	-	-	-	-	-2,210
	Small C&I EE	-263	-	-	-	-	-263
	Large C&I EE	-2,043	-	-	-	-	-2,043
	CHP	-15	-	-	-	-	-15
	Residential DR	-3,201	-	-	-	-	-3,201
	Small C&I DR	-75	-	-	-	-	-75
	Large C&I DR	-1,742	-	-	-	-	-1,742
	Portfolio Total [1]	**-14,793**	**-**	**-**	**-**	**-**	**-14,793**

[1] The portfolio total net benefits include cross-cutting costs.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

2.11 Comparison of Performance to Approved EE&C Plan

Table 2-20 presents P3TD expenditures, by program, compared to the budget estimates set forth in the EE&C Plan through PY8. All dollars in Table 2-20 are presented in 2016 dollars.

Table 2-20. Comparison of Expenditures to Phase III EE&C Plan by Program

Parameter	Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
EE&C Plan Budget ($1,000)	Residential EE	19,700	19,700	19,900	20,300	20,400	100,100
	Low-Income EE	7,000	7,000	7,100	7,400	7,700	36,100
	Small C&I EE	8,900	9,000	9,000	9,000	8,600	44,500

Parameter	Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Large C&I EE	10,700	10,800	11,000	11,200	11,400	55,100
	CHP	5,300	5,600	5,800	6,100	2,200	24,900
	Residential DR	2,300	2,700	2,800	2,900	3,000	13,700
	Small C&I DR	200	200	200	200	200	900
	Large C&I DR	200	6,800	6,800	6,700	6,700	27,100
	Cross-Cutting	0	0	0	0	0	0
	Portfolio Total	**54,300**	**61,800**	**62,600**	**63,800**	**60,200**	**302,400**
Actual Expenditures ($1,000)	Residential EE	20,002	-	-	-	-	20,002
	Low-Income EE	7,015	-	-	-	-	7,015
	Small C&I EE	5,384	-	-	-	-	5,384
	Large C&I EE	5,057	-	-	-	-	5,057
	CHP	15	-	-	-	-	15
	Residential DR	3,953	-	-	-	-	3,953
	Small C&I DR	106	-	-	-	-	106
	Large C&I DR	1,742	-	-	-	-	1,742
	Cross-Cutting	8,952	-	-	-	-	8,952
	Portfolio Total	**52,225**	**-**	**-**	**-**	**-**	**52,225**
Ratio (Actual/ Planned Spending)	Residential EE	1.02	-	-	-	-	0.20
	Low-Income EE	1.00	-	-	-	-	0.19
	Small C&I EE	0.60	-	-	-	-	0.12
	Large C&I EE	0.47	-	-	-	-	0.09
	CHP	0.00	-	-	-	-	0.00
	Residential DR	1.72	-	-	-	-	0.29
	Small C&I DR	0.53	-	-	-	-	0.12
	Large C&I DR	8.71	-	-	-	-	0.06
	Cross-Cutting	0.00	-	-	-	-	0.00
	Portfolio Total	**0.96**	**-**	**-**	**-**	**-**	**0.17**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 2-21 compares Phase III verified gross program savings to the energy savings projections filed in the EE&C Plan.

Table 2-21. Comparison of Energy Savings to Phase III EE&C Plan by Program

Parameter	Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
EE&C Plan Verified Gross	Residential EE	128,166.0	139,740.0	148,876.0	154,269.0	156,144.0	727,195.0
	Low-Income EE	22,627.0	23,244.0	24,314.0	25,866.0	27,941.0	123,991.0

Parameter	Program Name	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Energy Savings (MWh)	Small C&I EE	73,843.0	79,613.0	85,681.0	86,907.0	79,236.0	405,280.0
	Large C&I EE	94,954.0	95,444.0	96,067.0	96,841.0	97,568.0	480,875.0
	CHP	78,710.0	81,806.0	85,057.0	88,471.0	29,490.0	363,534.0
	Portfolio Total	**398,299.0**	**419,848.0**	**439,995.0**	**452,355.0**	**390,378.0**	**2,100,875.0**
Actual Verified Gross Energy Savings (MWh)	Residential EE	152,919.7	-	-	-	-	152,919.7
	Low-Income EE	19,385.1	-	-	-	-	19,385.0
	Small C&I EE	17,112.9	-	-	-	-	17,112.9
	Large C&I EE	25,487.9	-	-	-	-	25,487.9
	CHP	0.0	-	-	-	-	0.0
	Portfolio Total	**214,905.6**	**-**	**-**	**-**	**-**	**214,905.6**
Ratio (Actual/ Planned Savings)	Residential EE	1.19	-	-	-	-	0.21
	Low-Income EE	0.86	-	-	-	-	0.16
	Small C&I EE	0.23	-	-	-	-	0.04
	Large C&I EE	0.27	-	-	-	-	0.05
	CHP	0.00	-	-	-	-	0.00
	Portfolio Total	**0.54**	**-**	**-**	**-**	**-**	**0.10**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The list below briefly discusses several key reasons why programs exceeded or fell short of projected gross energy savings in PY8.

- The Residential EE Program exceeded its projections due to the Lighting component of the Lighting, HVAC, and Appliance solution, and the Behavior solution. The remaining Residential EE Program solutions did not achieve their projected savings. At the writing of this report, Navigant and PECO are continuing to work through early and ongoing process evaluation results to identify the drivers of these solution-specific shortfalls; this work will stretch into PY9 research. At this time, Navigant is able to report that changes in the Phase III EE&C Plan from Phase II resulted in lags in implementation adjustments and participation rates. For example, changes in the incentive structure for some measures as well as changes in CSP roles resulted in a slow start to the program year. This is discussed in further detail in Section 3.1 of this report.
- The Low Income EE Program attained most (86%) of its planned savings in PY8, but neither of the program's solutions met their savings projections and the Low-Income carve-out forecast was not achieved. As with the Residential EE Program, early feedback process evaluation research indicates that the shortfall is likely a result of CSP and implementation plan changes. For example, in Phase II, the Low-Income CSP was solely responsible for outbound calling to generate site visits for LEEP. In PY8, the EEMF marketing plan called for increased promotional activities to generate customer interest, including promotional signs on buses and bus stations, direct mail, etc. This shift, in combination with a new portfolio-wide call center focused primarily on managing incoming calls rather than outbound calls for the Low-Income EE Program, caused

a delay in new customer enrollment and a slow start to the program year. These issues are discussed in further detail in Section 3.2 of this report.

- The Small and Large C&I Programs each fell short of projections across all solutions. Navigant and PECO are continuing to work through early and continuous process evaluation results to identify the drivers of these shortfalls; this work will stretch into PY9 research. At this time, Navigant is able to report that changes in the EE&C Plan design likely resulted in lags in implementation and participation. For example, the Phase III EE&C Plan resulted in significant changes in the incentive structure for most C&I measures as well as changes in CSP roles. These issues are discussed in further detail in Sections 3.3 and 3.4 of this report.
- The CHP program underwent a significant rebranding in PY8 with changes to its customer outreach and enrollment processes. The rebranding process took longer than expected delaying the program launch into the fourth quarter of PY8. The program successfully recruited participants in PY8 but was unable to complete the application and due diligence reviews in time to include these participants in PY leading to zero participation. Navigant will conduct targeted process evaluation research in PY9 to identify what is driving application delays and the lack of activity within the program.
- There are no reported savings for DR programs in PY8.

As mentioned, Navigant and PECO are currently working through continuous process evaluation discussions to identify potential changes to the Phase III programs. There are no official, significant changes to report at this time, however Navigant has made program specific recommendations as discussed in the subsequent sections of this report. See Table 2-22 for a summary of these recommendations.

2.12 Findings and Recommendations

The PY8 impact and early process evaluation activities completed by Navigant led to a variety of recommendations for program improvement. Table 2-22 lists the overarching recommendations that affect more than one program, the evaluation activity(s) that uncovered the finding, and Navigant's recommendation(s) to PECO to address the finding. Detailed findings and recommendations for each program and solution are discussed in subsequent sections of this report.

Table 2-22. Summary of Evaluation Recommendations

Evaluation Activity	Finding	Recommendation
All Programs, All Activities	As of the writing of this report, it is clear that PECO and its CSPs needed time in PY8 to adjust to new requirements and implementation changes and that some of the elements needed for success, such as supporting data , infrastructure, and collaboration required for success are still in progress.	Navigant should continue to work with PECO to conduct a targeted process evaluation to inform continuous improvement opportunities for the program and solutions.
Residential EE Program, Customer Survey	Survey findings indicate that PECO's marketing initiatives, home energy audits, and HERs sent via the Behavioral Solution are not yet top sources of information for customers. Advertising efforts and PECO's main channeling programs, while important to the implementation plan, may not yet be as memorable to customers compared to tangible, direct-to-the-customer bill inserts or personal word of mouth marketing channels, such as landlords, personal contacts, and contractors.	PECO should continue to closely monitor marketing alignment with solution CSPs to ensure customer awareness efforts are optimized. PECO should also look for ways to leverage the power of word of mouth and direct-to-customer marketing channels. Finally, Navigant should continue working with PECO to conduct a targeted process evaluation to inform continuous improvement opportunities for the program and solutions.
Residential EE Program, Customer Survey	In general, Residential EE Program participants are not learning about PECO's other offerings during the course of their experience within their respective solution, resulting in a missed opportunity to increase participation across the program.	PECO and Navigant should examine which solutions promote and increase awareness and are successfully channeling participants into other solutions and which are not. This will allow the team to identify best practices and barriers and to make further recommendations for improvements.

Evaluation Activity	Finding	Recommendation
Residential EE Program, Customer Survey	Participants across the three Residential EE Program solutions included in the survey said they were either likely or extremely likely to recommend the solution to another person.	As customer referrals and testimonials can be a powerful way to market programs and because this solution needs to increase participation moving forward, PECO should consider leveraging these customers by including quotes from them on marketing materials and perhaps by conducting a referral contest to encourage word of mouth marketing.
C&I Programs, Equipment and Systems and New Construction Solutions, Staff and CSP Interviews	Customer and incentive administrators have indicated that Appendix C is difficult to customize complete.	PECO and Navigant should explore and suggest improvements to Appendix C to allow for easier savings calculations and a better customer experience.
C&I Programs, Equipment and Systems, New Construction, Multifamily Targeted Market Segment, Phone Verification	Evaluating sites via phone verification may not be providing significant value to the evaluation of the program. Typical phone verification results do not differ greatly from the reported values and do not provide significant insight into individual projects or the program as a whole.	Navigant recommends shifting resources away from verifying projects via a phone conversation with the customer to doing more on-site and file review work. Specifically, Navigant sees value in shifting resources to doing on-site work for small stratum customers.

Source: Navigant analysis

3. EVALUATION RESULTS BY PROGRAM

This section documents the gross impact, net impact, and process evaluation activities conducted in PY8 along with the outcomes of those activities. Not every program receives an evaluation every PY. Table 3-1 shows a breakdown of the evaluation activity plan, with a check mark indicating the type of evaluation Navigant will conduct for each program over each year.

Table 3-1. Evaluation Activity Matrix

Program	Solution	PY8			PY9			PY10			PY11			PY12		
		Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process
Residential EE	Lighting, Appliances & HVAC	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Appliance Recycling	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
	Whole Home	√			√	√	√	√			√	√	√			
	New Construction				√	√	√	√			√	√	√	√		
	Multifamily Targeted	√	√	√	√			√	√	√	√			√	√	√
	Behavioral	√		√	√			√		√	√			√		√
Residential Low-Income EE	Whole Home	√		√				√		√				√		
	Lighting	√		√	√		√	√		√	√		√	√		√
Small C&I EE	Equipment and Systems	√			√	√	√	√			√	√	√	√		
	New Construction	√			√	√	√	√			√	√	√			
Small C&I EE	Whole Building				√	√	√				√	√	√			
	Behavioral	√		√	√			√		√	√			√		√
	Data Center Targeted	√			√	√	√	√			√	√	√	√		
	Multifamily Targeted	√	√	√	√			√	√	√	√				√	√
Large C&I EE	Equipment and Systems	√			√	√	√	√			√	√	√	√		
	New Construction	√			√	√	√	√			√	√	√			
	Data Center Targeted	√			√	√	√	√			√	√	√			

Program	Solution	PY8			PY9			PY10			PY11			PY12		
		Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process
	Multifamily Targeted	√	√	√	√			√	√	√	√					
Combined Heat and Power	Combined Heat and Power	√			√	√	√	√			√	√	√	√		
DR	Residential DR	√			√	√		√			√	√		√		
	Small C&I DR	√			√	√		√			√			√		
	Large C&I DR				√		√				√		√			

Source: Navigant analysis

3.1 Residential EE Program

The PECO Residential EE Program is designed to offer residential customers opportunities to save energy across all their electric end uses and to market those opportunities in ways that minimize lost savings opportunities. The program encompasses a comprehensive series of solutions designed to influence customer behavior and purchasing decisions.

The Residential EE Program represents 77% of PECO's PY8 portfolio reported energy savings and consists of six solutions or initiatives that contribute those savings. Savings are achieved through a range of delivery mechanisms and methods including upstream incentives (i.e., manufacturer buy downs), downstream incentives (i.e., mail-in rebates), appliance removal and recycling, in-home audits, direct install measures, efficient building construction, and changes in household behaviors. PECO relies on six CSPs to deliver the program savings, shown here with their corresponding solution:

1. Lighting, Appliances & HVAC Solution – Ecova
2. Appliance Recycling Solution – ARCA
3. Whole Home Solution – CLEAResult and Ecova
4. New Construction Solution – Performance Systems Development (PSD)
5. Multifamily Targeted Market Segment – Franklin
6. Behavioral Solution – Oracle

Marketing for the six solutions in the Residential EE Program is handled through a separate energy efficiency marketing firm (EEMF), ICF. The EEMF markets PECO's range of Residential EE Program offerings delivered through the six solutions with consistent and approaches and messaging. Marketing from a crosscutting perspective is intended to promote all savings opportunities available to residential customers.

Appendix D contains additional detail on the individual solutions, including descriptions of major measures, CSPs, and how participants are counted.

3.1.1 Participation and Reported Savings by Customer Segment

This section provides the total Residential EE Program results for PY8, including participation, energy and demand savings, and incentive costs.[23] Table 3-2 presents the participation counts and incentive payments for the Residential EE Program in PY8 by customer segment.

[23] Table 3-2 through Table 3-4 include all Residential EE Program results, including low-income carve-outs.

Table 3-2. Summary Statistics for Residential EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Residential	1,120,660	-	-	-	-	1,120,660
	Small C&I	214	-	-	-	-	214
	Large C&I	11	-	-	-	-	11
	Total	**1,120,885**	**-**	**-**	**-**	**-**	**1,120,885**
Incentive Spending ($1,000)	Residential	4,668	-	-	-	-	4,668
	Small C&I	7	-	-	-	-	7
	Large C&I	0	-	-	-	-	0
	Total	**4,675**	**-**	**-**	**-**	**-**	**4,675**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-3 provides a summary of reported, verified, and net energy savings results by customer sector for the Residential EE Program for PY8. Note that the Residential Whole Home Solution includes unverified savings that are not reflected in the RR. The Whole Home Solution is undergoing a 2-year evaluation, combining PY8 and PY9; hence, savings for PY8 are unverified. The combined PY8 and PY9 evaluation will result in total verified savings for the 2-year period ending in and reported during PY9. PY9 verified savings will be adjusted to incorporate the impact evaluation and NTG results for the combined period.

Table 3-3. Summary of Energy Savings for Residential EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Residential	147,799.1	-	-	-	-	147,799.1
	Small C&I	116.4	-	-	-	-	116.4
	Large C&I	3.6	-	-	-	-	3.6
	Total	**147,919.1**	**-**	**-**	**-**	**-**	**147,919.1**
Verified Gross Energy Savings (MWh)	Residential	149,128.5	-	-	-	-	149,128.5
	Small C&I	3,787.9	-	-	-	-	3,787.9
	Large C&I	3.3	-	-	-	-	3.3
	Total	**152,919.7**	**-**	**-**	**-**	**-**	**152,919.7**
Energy Savings RR	Residential	1.01	-	-	-	-	1.01
	Small C&I	32.55	-	-	-	-	32.55
	Large C&I	0.93	-	-	-	-	0.93
	Total	**1.03**	**-**	**-**	**-**	**-**	**1.03**
Verified Net Energy Savings (MWh)	Residential	106,900.1	-	-	-	-	106,900.1
	Small C&I	1,809.8	-	-	-	-	1,809.8
	Large C&I	1.3	-	-	-	-	1.3
	Total	**108,711.2**	**-**	**-**	**-**	**-**	**108,711.2**

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NTG Ratio	Residential	0.72	-	-	-	-	0.72
	Small C&I	0.48	-	-	-	-	0.48
	Large C&I	0.40	-	-	-	-	0.40
	Total	**0.71**	**-**	**-**	**-**	**-**	**0.71**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-4 provides the reported and verified demand savings results for the Residential EE Program for PY8.

Table 3-4. Summary of Demand Savings for Residential EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Residential	11.7	-	-	-	-	11.7
	Small C&I	0.0	-	-	-	-	0.0
	Large C&I	0.0	-	-	-	-	0.0
	Total	**11.7**	**-**	**-**	**-**	**-**	**11.7**
Verified Gross Demand Savings (MW)	Residential	11.7	-	-	-	-	11.7
	Small C&I	0.8	-	-	-	-	0.8
	Large C&I	0.0	-	-	-	-	0.0
	Total	**12.5**	**-**	**-**	**-**	**-**	**12.5**
Demand Savings RR	Residential	1.00	-	-	-	-	1.00
	Small C&I	40.48	-	-	-	-	40.48
	Large C&I	1.00	-	-	-	-	1.00
	Total	**1.07**	**-**	**-**	**-**	**-**	**1.07**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Unverified savings for the Whole Home Solution during PY8 are detailed in Table 3-5.

Table 3-5. PY8 Whole Home Unverified Savings

Solution	Unverified PYRTD MWh/yr	Unverified PYRTD MW/yr (EE)
Whole Home	2,709	0.3

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-6 shows the participation and incentive spending for the low-income and government/education/non-profit (G/E/NP) sector carve-outs.

Table 3-6. Summary Statistics for Residential EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Low-Income	0	-	-	-	-	0
	G/E/NP	0	-	-	-	-	0
Incentive Spending ($1,000)	Low-Income	0	-	-	-	-	0
	G/E/NP	0	-	-	-	-	0

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-7 shows the reported, verified, and net energy savings results for the sector carve-outs.

Table 3-7. Summary of Energy Savings for Residential EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	0.0	-	-	-	-	0.0
Verified Gross Energy Savings (MWh)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	0.0	-	-	-	-	0.0
Energy Savings RR	Low-Income	0.00	-	-	-	-	0.00
	G/E/NP	0.00	-	-	-	-	0.00
Verified Net Energy Savings (MWh)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	0.0	-	-	-	-	0.0
NTG Ratio	Low-Income	0.00	-	-	-	-	0.00
	G/E/NP	0.00	-	-	-	-	0.00

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-8 shows the reported and verified demand (MW) savings results for the sector carve-outs.

Table 3-8. Summary of Demand Savings for Residential EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	0.0	-	-	-	-	0.0
Verified Gross Demand Savings (MW)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	0.0	-	-	-	-	0.0
Demand Savings RR	Low-Income	0.00	-	-	-	-	0.00
	G/E/NP	0.00	-	-	-	-	0.00

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.1.2 Gross Impact Evaluation

The Residential EE Program gross impact evaluation activities involved different approaches tailored to each solution's unique characteristics to verify the reported gross savings values for PY8. First, each solution's program tracking data was reviewed to verify proper application of Pennsylvania Technical Reference Manual[24] (PA TRM or TRM) algorithms in reported savings values. Navigant completed these reviews for the full population of implemented PY8 Residential EE Program measures. Next, the team identified appropriate evaluation activities for each solution depending on the nature of the participants, implementation, and the level of information accompanying the reported savings. The goal of the evaluation activities included verifying the implementation of a given measure occurred. Additionally, for partially deemed measures, the evaluation also verified certain measure characteristics that inform the estimation of gross energy and demand impacts—in particular, those characteristics where the PA TRM does not provide default or deemed values for EDCs to use for savings estimations. The evaluation activities varied for each solution and for specific strata within some solutions. Activities included engineering file reviews of program applications and invoices, participant phone verifications, in-store intercept surveys, onsite field verifications, billing and regression analyses, or a combination of these activities.

Onsite verification field activities occurred for the upstream lighting component of the Lighting, Appliances & HVAC Solution where Navigant completed in-store intercepts. Master-metered non-residential projects within the Multifamily Targeted Market Segment also received onsite visits for verification. While the Multifamily Targeted Market Segment contributes savings to the Residential EE Program, savings from these particular master-metered projects receiving onsite verifications are reported within the Small C&I EE and Large C&I EE Programs.

Navigant then drew samples from each solution for these gross impact evaluation activities. The team developed and sought approval for representative samples that complied with the Phase III Evaluation Framework, the PA TRM, industry standards, and that helped PECO meet the SWE and Commission requirements.

[24] Pennsylvania Public Utility Commission, *Technical Reference Manual; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program & Act 213 Alternative Energy Portfolio Standards*, dated June 2016, errata update February 2017.

The following provides a summary of the activities conducted for each solution and for specific components or sampled strata within a given solution. Appendix D also contains additional detail on the gross impact evaluation approaches used for the individual solutions of the Residential EE Program.

- Lighting, Appliances & HVAC Solution
  - Lighting
    - In-store customer intercept surveys
    - Invoice reviews and record-level savings calculation
  - Appliances and HVAC
    - Engineering files reviews and phone verification (for HVAC measures)
    - Phone verification (for Appliance measures)
- Appliance Recycling Solution
  - Phone verification
  - Regression analysis
- Whole Home Solution[25]
  - Primary analysis activities are currently underway for a 2-year evaluation combining PY8 and PY9; activities include:
    - Engineering file reviews and onsite verification (projects with major measures)
    - Engineering file reviews and phone verification (projects with direct install measures only)
- New Construction Solution
  - Apply PY7 realization rates (primary analysis activities will occur in PY9)
- Multifamily Targeted Market Segment
  - Engineering file reviews and phone verification (residential projects that contribute to the Residential EE Program)
  - Engineering file reviews and onsite verification (master-metered non-residential projects that contribute to the Small C&I EE and Large C&I EE Programs)
- Behavioral Solution
  - Billing analysis
    - For home energy report (HER) program participants in the test and control groups using a lagged dependent variable (LDV) model
    - For AC Saver cohort recipients included within the Behavioral Solution that used a regression with pre-program matching (RPPM) method to estimate savings related to HERs
  - Double counted analysis
    - Accounting for Behavioral Solution participant activities within other PECO EE solutions

[25] The Whole Home Solution is undergoing a 2-year evaluation, combining PY8 and PY9; hence, savings for PY8 are unverified. The combined PY8 and PY9 evaluation will result in total verified savings for the 2-year period ending in and reported during PY9. PY9 verified savings will be adjusted to incorporate the impact evaluation and NTG results for the combined period.

Table 3-9 provides the sampling frame for the gross impact evaluation of the Residential EE Program in PY8.

Table 3-9. Residential EE Program Gross Impact Sample Design for PY8

Stratum Solution	Stratum Name	Percentage of Program Reported Savings	Population Size	Achieved Sample Size	Verification Method
Lighting, Appliances, and HVAC	Standard LED	17%	N/A	370	In-store intercept
	Specialty LED	25%	N/A	503	In-store intercept
	CFL	3%	N/A	146	PY7 analysis
	Appliances	1%	7,658	75	Phone survey
	HVAC	3%	9,303	40	Engineering file review and phone verification
	Solution Total	48%	16,961	1,134	
Appliance Recycling	Refrigerators	5%	7,235	164	Regression and phone verification
	Freezers	1%	1,569	47	Regression and phone verification
	Room Air Conditioners	0%	769	10	Regression and phone verification
	Solution Total	**6%**	**9,573**	**221**	
Whole Home	**Solution Total**	**2%**	**2,359**	**N/A**	**N/A**
New Construction	**Solution Total**	**0%**	**311**	**10**	PY7 analysis
Behavior	**Solution Total**	**42%**	**396,709**	**N/A**	Regression analysis
Multifamily Targeted	Large Residential	**1%**	865	31	Phone verification
	Small Residential	**1%**	3,377	33	Phone verification
	Solution Total	**1%**	**4,242**	**64**	
Total Program	**All**	**100%**	**430,155**	**1,429**	

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-10 provides a summary of reported and verified energy (MWh) savings results, along with the coefficient of variation (C_v) and relative precision for each stratum sampled for the Residential EE Program in PY8.

Table 3-10. Residential EE Program Gross Energy Savings Impact Evaluation Results for PY8

Stratum Solution	Stratum Name	Reported Gross Energy Savings (MWh)	Verified Gross Energy Savings (MWh)	Energy RR	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Lighting, Appliances, and HVAC	Standard LED	25,172.9	25,437.7	1.01	N/A	0.01	0.01
	Specialty LED	36,718.6	38,076.9	1.04	N/A	0.01	0.01
	CFL	4,621.7	5,467.2	1.18	N/A	0.11	0.11
	Appliances	1,010.9	1,010.9	1.00	0.07	0.01	0.01
	HVAC	4,015.5	4,170.3	1.04	0.13	0.03	0.03
	Solution Total	**71,539.7**	**74,163.2**	**1.04**	**0.31**	**0.01**	**0.01**
Appliance Recycling	Refrigerators	7,032.3	6,753.1	0.96	0.00	0.00	0.00
	Freezers	1,373.5	1,091.5	0.79	0.00	0.00	0.00
	Room Air Conditioners	124.3	124.3	1.00	0.00	0.00	0.00
	Solution Total	**8,530.2**	**7,967.9**	**0.93**	**0.00**	**0.00**	**0.00**
Whole Home	**Solution Total**	2,709.2	0.0	N/A	N/A	N/A	N/A
New Construction	**Solution Total**	737.9	730.5	0.99	0.05	0.02	0.02
Behavior	**Solution Total**	62,424.0	68,102.9	1.09	N/A	N/A	N/A
Multifamily Targeted	Large Residential	989.6	977.0	0.99	0.07	0.02	0.02
	Small Residential	988.6	978.2	0.99	0.08	0.02	0.02
	Solution Total	**1,978.2**	**1,955.2**	**0.99**	**0.10**	**0.01**	**0.02**
Total Program	**All**	**147,919.1**	**152,919.7**	**1.03**	**0.17**	**0.01**	**0.01**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-11 provides a summary of reported and verified demand (MW) savings results, along with the C_v and relative precision for each stratum sampled for the Residential EE Program in PY8.

Table 3-11. Residential EE Program Gross Demand Savings Impact Evaluation Results for PY8

Stratum Solution	Stratum Name	Reported Gross Demand Savings (MW)	Verified Gross Demand Savings (MW)	Demand RR	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Lighting, Appliances, and HVAC	Standard LED	3.0	3.0	1.02	N/A	0.01	0.01
	Specialty LED	4.3	4.7	1.08	N/A	0.01	0.01
	CFL	0.5	0.8	1.41	N/A	0.11	0.13
	Appliances	0.2	0.2	1.00	0.27	0.05	0.05
	HVAC	1.8	2.4	1.36	0.69	0.16	0.18
	Solution Total	**9.8**	**11.0**	**1.13**	**1.15**	**0.04**	**0.04**
Appliance Recycling	Refrigerators	0.8	0.8	0.93	0.00	0.00	0.00
	Freezers	0.2	0.1	0.78	0.00	0.00	0.00
	Room Air Conditioners	0.2	0.2	1.00	0.00	0.00	0.00
	Solution Total	**1.2**	**1.1**	**0.92**	**0.00**	**0.00**	**0.00**
Whole Home	**Solution Total**	**0.3**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
New Construction	**Solution Total**	**0.3**	**0.2**	**0.76**	**N/A**	**0.22**	**0.26**
Behavior	**Solution Total**	**0.0**	**0.0**	**N/A**	**N/A**	**N/A**	**N/A**
Multifamily Targeted	Large Residential	0.1	0.1	0.99	0.39	0..10	0.12
	Small Residential	0.1	0.1	0.99	0.46	0.12	0.14
	Solution Total	**0.2**	**0.2**	**0.99**	**0.60**	**0.08**	**0.09**
Total Program	**All**	**11.7**	**12.5**	**1.07**	**N/A**	**0.03**	**0.04**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Factors leading to variations between the reported and verified savings and the observed RRs for the Residential EE Program are detailed for each solution in Appendix D. Overall, the Lighting, Appliances & HVAC Solution and the Behavioral Solution are the most significant drivers of the program-level results and RRs, as these two solutions represent roughly 90% of the program savings.

3.1.3 Net Impact Evaluation

The Residential EE Program net impact evaluation activities used several methods to estimate free ridership, spillover, market effects, and NTG ratios for each solution. Navigant relied on consistent, crosscutting approaches as well as ones tailored to certain solutions' unique characteristics. The primary objective of the net savings analysis was to determine the program's net effect on customer electricity usage. Navigant derived net program impacts by estimating a NTG ratio that quantifies the percentage of the gross program impacts that can reliably be attributed to the program.

Free ridership is defined as those participants who would have implemented a measure or purchased equipment anyway, without program support or a rebate. The key questions determining free ridership focus on the influence of key program interventions. These interventions vary by solution but can include discounted prices, program information regarding efficient products, and placement of program-discounted products in stores, as well as the customer's perception of what they would most likely have done in the absence of the program.

Spillover is defined as those participants who were influenced by the program to purchase and install additional energy efficient equipment that saves electricity without a rebate or other program support. Navigant analyzed participant responses to a battery of spillover questions. The intent of these questions was to identify what types and amounts of equipment customers purchased and installed on their own to inform a quantitative estimate of program spillover within the overall NTG calculation.

Market effects represent a change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of EE products, services, or practices and is casually related to market intervention(s).

PECO program and solution participants were surveyed via phone to gather information about free ridership and spillover. Navigant developed survey instruments consistent with the Phase III Evaluation Framework's guidance on net impact evaluation techniques[26] and guidance from the Uniform Methods Project on estimating net savings.[27] The team carefully reviewed and managed samples across solutions to reduce the likelihood that a respondent participating in multiple solutions during PY8 would be called multiple times to respond to the survey. Survey instruments also captured feedback about customer experiences from participants to inform the process evaluation. Some solutions or strata within solutions (i.e., appliances from Lighting, Appliances & HVAC and Appliance Recycling) also added question batteries to the phone surveys to inform the gross impact verification. Finally, while most solutions and strata within solutions used a phone survey method, the upstream lighting component of the Lighting, Appliances & HVAC Solution (i.e., in-store intercepts) relied on onsite interview methods. These efforts used similar question batteries and techniques as previously described.

[26] Phase III Evaluation Framework. Section 3.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

[27] The Uniform Methods Project. *Estimating Net Savings: Common Practices.* NREL. https://www.nrel.gov/docs/fy14osti/62678.pdf

Appendix D contains additional detail on the net impact evaluation approaches used for the individual solutions of the Residential EE Program. Table 3-12 provides the sampling frame for the net impact evaluation of the Residential EE Program in PY8.

Table 3-12. Residential EE Program Net Impact Sample Design for PY8

Stratum Solution	Stratum Name	Percentage of Program Reported Savings	Population Size	Achieved Sample Size	Response Rate	Verification Method
Lighting, Appliances & HVAC [1]	Standard LEDs	17%	167,562	370 [2]	0.26%	In-store Intercepts
	Specialty LEDs	25%	152,760	503		
	CFLs	3%	13,509	0		
	Appliances	1%	7,026	75	0.93%	Phone Survey
	HVAC	3%	9,187	75		
	Solution Total	**48%**	**350,044**	**1,023**		
Appliance Recycling	Refrigerators	4%	7,235	164	3.2%	Phone Survey
	Freezers	1%	1,569	47		
	Room AC	0%	769	10		
	Solution Total	**5%**	**9,573**	**221**		
Whole Home	**Solution Total**	**2%**	**2,359**	**N/A**	N/A	PY7 Smart House Call NTGR
New Construction	**Solution Total**	**0%**	**311**	**N/A**	N/A	PY7 Smart Builder Rebates NTGR
Behavioral	**Solution Total**	**42%**	**0**	**N/A**	N/A	N/A
Multifamily Targeted Market Segment	Residential – Small	1%	3,377	35	2.0%	Phone Survey
	Residential - Large	1%	865	31		
	Solution Total	**1%**	**4,242**	**66**		
Total Program	**All**	**100%**	**366,529**	**1,310**		**N/A**

[1] Lighting in-store intercepts were conducted in 28 individual retailer locations and 83 visits were completed for this study. In total, 864 surveys were completed. Of those surveys, 487 were program bulb surveys with 218 including standard LEDs and 274 including specialty LEDs.

[2] This number represents the count of bulbs stock keeping units (SKUs), or bulb packages, sampled for this study.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-13 provides a summary of reported and verified energy (MWh) savings results, the calculated NTG results, and the C_v and relative precision for each stratum sampled for the Residential EE Program in PY8.

Table 3-13. Residential EE Program Net Energy Savings Impact Evaluation Results for PY8

Solution Name	Stratum Name	Verified Gross Energy Savings (MWh)	Verified Net Energy Savings (MWh)	Free Ridership Rate	Spillover Rate	NTG Ratio	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Lighting, Appliances & HVAC	Standard LEDs	25,437.7	12,971.5	0.53	0.04	0.51	0.37	0.03	0.04
	Specialty LEDs	38,076.9	17,483.8	0.58	0.04	0.46	0.40	0.03	0.03
	CFLs	5,467.2	2,186.9	0.61	0.01	0.40	1.01	0.18	N/A
	Appliances	1,010.9	663.3	0.55	0.21	0.66	1.63	0.29	0.33
	HVAC	4,170.3	2,351.1	0.46	0.03	0.56	0.30	0.05	0.05
	Solution Total	**74,163.2**	**35,656.5**	**0.56**	**0.04**	**0.48**	**0.58**	**0.02**	**0.02**
Appliance Recycling	Refrigerators	6,753.1	2,341.8	0.65	0.00	0.35	0.35	0.16	0.18
	Freezers	1,090.5	541.0	0.50	0.00	0.50	0.50	0.21	0.24
	Room AC	124.3	57.6	0.54	0.00	0.46	0.46	0.54	0.62
	Solution Total	**7,967.9**	**2,940.4**	**0.63**	**0.00**	**0.37**	**1.90**	**0.13**	**0.15**
Whole Home	**Solution Total**	**0.0**	**0.0**	**0.13**	**0.07**	**0.94**	**0.40**	**0.05**	**N/A**
New Construction	**Solution Total**	**730.5**	**365.3**	**0.50**	**0.00**	**0.50**	**0.48**	**0.17**	**N/A**
Behavioral	**Solution Total**	**68,102.9**	**68,102.9**	**0.00**	**0.00**	**1.00**	**N/A**	**N/A**	**N/A**
Multifamily Targeted Market Segment	Residential – Small	978.2	896.3	0.12	0.03	0.92	0.06	0.01	0.02
	Residential - Large	977.0	790.6	0.20	0.01	0.81	0.05	0.01	0.01
	Solution Total	**1,955.2**	**1,646.2**	**0.18**	**0.02**	**0.84**	**0.05**	**0.01**	**0.01**
Total Program	**All**	**152,919.7**	**108,719.0**	**0.31**	**0.02**	**0.71**	**0.25**	**0.01**	**0.01**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Factors leading to these verified energy savings and NTG ratios for the Residential EE Program are detailed in Appendix D for each solution. Overall and similar to the gross verified impact findings, the Lighting, Appliances & HVAC Solution and the Behavioral Solution are the most significant drivers of the program-level results and NTG ratios, as these two solutions represent roughly 90% of the program savings. Further, the nature of the Behavioral Solution's implementation and subsequent analysis result in the estimation of net impacts. In other words, there are no free riders or instances of spillover estimated for the Behavioral Solution.

3.1.3.1 High Impact Measure Research

HIMs represent measure categories or technologies of high importance. In Phase III, the SWE suggested EDCs oversample HIMs to help program planners make decisions concerning those measures for downstream programs only.[28] EDCs were to identify three to five measures for study within each program year based on energy impact, level of uncertainty, prospective value, funding, or other parameters. The SWE stated that HIMs should be sampled at 85% confidence and 15% absolute precision to ensure an adequate sample size for statistically valid, measure-level NTG estimates. Below is a description of the methodology used to determine the HIMs in PY8.

Navigant identified HIMs through several steps that involved careful review of program- and solution-level savings, energy impact, and value to PECO. In PY8, NTG research focused primarily on solutions in the Residential EE Program. Navigant reviewed savings across all sectors and solutions under the Residential EE Program and focused on measures based on both the measure category[29] and end-use subcategory to identify the types of measures falling under a certain category. Lighting, Appliances, and HVAC measure categories were flagged as HIMs, including the end-use subcategories of LEDs, refrigerators, freezers, furnace fans, heat pumps, and air conditioners. CFLs were excluded because PECO discontinued incentives for this measure as of January 1, 2017. Table 3-14 shows the measure and end-use subcategories identified as HIMs in PY8 based on PECO's Phase III planning. Table 3-15 also shows the summary results of the NTG research conducted for Residential EE Program HIMs. These details are also provided in Section 2.6.

[28] Phase III Evaluation Framework. Section 3.4.1.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

[29] PECO Phase III data refers to measure categories as the "Measure Name."

Table 3-14. Residential EE Program Savings by Measure Category and HIM End-Use Subcategory

Measure Names and End-Use Subcategories	Sum of kWh Savings	Percentage of Savings
Lighting	**68,981,927**	**84%**
LED	63,514,692	77%
Appliances	**9,108,986**	**11%**
Refrigerator	7,138,380	9%
Freezer	1,378,688	2%
HVAC	**4,327,333**	**5%**
Furnace Fan	1,338,059	2%
Heat Pump	1,228,804	1%
Air Conditioner	895,982	1%

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: PECO

Table 3-15. Residential EE Program HIM NTG Summary

Residential EE HIM	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Multifamily: LEDs	Free Ridership	0.19	-	-	-	-	0.19
	Spillover	0.03	-	-	-	-	0.03
	NTG Ratio	0.84	-	-	-	-	0.84
Lighting, Appliances, & HVAC: Heat Pumps	Free Ridership	0.46	-	-	-	-	0.46
	Spillover	0.02	-	-	-	-	0.02
	NTG Ratio	0.56	-	-	-	-	0.56
Lighting, Appliances, & HVAC: Central Air Conditioners	Free Ridership	0.58	-	-	-	-	0.58
	Spillover	0.04	-	-	-	-	0.04
	NTG Ratio	0.45	-	-	-	-	0.45
Lighting, Appliances, & HVAC: High Efficiency Furnace Fan	Free Ridership	0.48	-	-	-	-	0.48
	Spillover	0.02	-	-	-	-	0.02
	NTG Ratio	0.53	-	-	-	-	0.53
Appliance Recycling: Refrigerator Recycling	Free Ridership	0.65	-	-	-	-	0.65
	Spillover	0.00	-	-	-	-	0.00
	NTG Ratio	0.35	-	-	-	-	0.35
Appliance Recycling: Freezer Recycling	Free Ridership	0.50	-	-	-	-	0.50
	Spillover	0.00	-	-	-	-	0.00
	NTG Ratio	0.50	-	-	-	-	0.50

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.1.4 Verified Savings Summary by Solution

Table 3-16 shows the participation and incentive spending results for the Residential EE Program at the solution level.

Table 3-16. Summary Statistics for Residential EE Program by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Lighting, Appliances & HVAC	708,777	-	-	-	-	708,777
	Appliance Recycling	8,492	-	-	-	-	8,492
	Whole Home	2,359	-	-	-	-	2,359
	New Construction	311	-	-	-	-	311
	Behavioral	396,709	-	-	-	-	396,709
	Multifamily Targeted	4,237	-	-	-	-	4,237
	Program Total	**1,120,885**	**-**	**-**	**-**	**-**	**1,120,885**
Incentive Spending ($1,000)	Lighting, Appliances & HVAC	3,976	-	-	-	-	3,976
	Appliance Recycling	379	-	-	-	-	379
	Whole Home	117	-	-	-	-	117
	New Construction	204	-	-	-	-	204
	Behavioral	0	-	-	-	-	0
	Multifamily Targeted	0	-	-	-	-	0
	Program Total	**4,675**	**-**	**-**	**-**	**-**	**4,675**

Note: Costs associated with direct install measures are categorized as costs and not incentives for reporting purposes.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-17 shows the summary of reported and verified energy (MWh) savings results by solution.

Table 3-17. Summary of Residential EE Program Incremental Annual Gross Energy Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Lighting, Appliances & HVAC	71,539.7	-	-	-	-	71,539.7
	Appliance Recycling	8,530.2	-	-	-	-	8,530.2
	Whole Home	2,709.2	-	-	-	-	2,709.2
	New Construction	737.9	-	-	-	-	737.9
	Behavioral	62,424.0	-	-	-	-	62,424.0
	Multifamily Targeted	1,978.2	-	-	-	-	1,978.2

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Program Total	**147,919.1**	**-**	**-**	**-**	**-**	**147,919.1**
Verified Gross Energy Savings (MWh)	Lighting, Appliances & HVAC	74,163.2	-	-	-	-	74,163.2
	Appliance Recycling	7,967.9	-	-	-	-	7,967.9
	Whole Home	0.0	-	-	-	-	0.0
	New Construction	730.5	-	-	-	-	730.5
	Behavioral	68,102.9	-	-	-	-	68,102.9
	Multifamily Targeted	1,955.2	-	-	-	-	1,955.2
	Program Total	**152,919.7**	**-**	**-**	**-**	**-**	**152,919.7**
Energy RR	Lighting, Appliances & HVAC	1.04	-	-	-	-	1.04
	Appliance Recycling	0.93	-	-	-	-	0.93
	Whole Home	0.00	-	-	-	-	0.00
	New Construction	0.99	-	-	-	-	0.99
	Behavioral	1.09	-	-	-	-	1.09
	Multifamily Targeted	0.99	-	-	-	-	0.99
	Program Total	**1.03**	**-**	**-**	**-**	**-**	**1.03**
Relative Precision of Verified Gross Energy Savings at 90% Confidence Interval	Lighting, Appliances & HVAC	0.01	-	-	-	-	0.01
	Appliance Recycling	0.00	-	-	-	-	0.00
	Whole Home	0.00	-	-	-	-	0.00
	New Construction	0.02	-	-	-	-	0.02
	Behavioral	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.02	-	-	-	-	0.02
	Program Total	**0.01**	**-**	**-**	**-**	**-**	**0.01**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-18 shows the verified net energy (MWh) savings results by solution along with the calculated NTG results for PY8.

Table 3-18. Summary of Residential EE Program Incremental Annual Net Energy Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Net Energy Savings	Lighting, Appliances & HVAC	35,656.5	-	-	-	-	35,656.5
	Appliance Recycling	2,940.4	-	-	-	-	2,940.4

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
(MWh)	Whole Home	0.0	-	-	-	-	0.0
	New Construction	365.3	-	-	-	-	365.3
	Behavioral	68,102.9	-	-	-	-	68,102.9
	Multifamily Targeted	1,646.2	-	-	-	-	1,646.2
	Program Total	**108,711.2**	**-**	**-**	**-**	**-**	**108,711.2**
Free Ridership	Lighting, Appliances & HVAC	0.56	-	-	-	-	0.56
	Appliance Recycling	0.63	-	-	-	-	0.63
	Whole Home	0.13	-	-	-	-	0.13
	New Construction	0.50	-	-	-	-	0.50
	Behavioral	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.18	-	-	-	-	0.18
	Program Total	**0.31**	**-**	**-**	**-**	**-**	**0.31**
Spillover	Lighting, Appliances & HVAC	0.04	-	-	-	-	0.04
	Appliance Recycling	0.00	-	-	-	-	0.00
	Whole Home	0.07	-	-	-	-	0.07
	New Construction	0.00	-	-	-	-	0.00
	Behavioral	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.02	-	-	-	-	0.02
	Program Total	**0.02**	**-**	**-**	**-**	**-**	**0.02**
NTG Ratio	Lighting, Appliances & HVAC	0.48	-	-	-	-	0.48
	Appliance Recycling	0.37	-	-	-	-	0.37
	Whole Home	0.94	-	-	-	-	0.94
	New Construction	0.50	-	-	-	-	0.50
	Behavioral	1.00	-	-	-	-	1.00
	Multifamily Targeted	0.84	-	-	-	-	0.84
	Program Total	**0.71**	**-**	**-**	**-**	**-**	**0.71**
Relative Precision of Verified Net Energy Savings at 90% Confidence Interval	Lighting, Appliances & HVAC	0.02	-	-	-	-	0.02
	Appliance Recycling	0.15	-	-	-	-	0.15
	Whole Home	N/A	-	-	-	-	N/A
	New Construction	N/A	-	-	-	-	N/A
	Behavioral	N/A	-	-	-	-	N/A
	Multifamily Targeted	0.01	-	-	-	-	0.01
	Program Total	**0.01**	**-**	**-**	**-**	**-**	**0.01**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-19 shows the summary of reported and verified demand (MW) savings results by solution.

Table 3-19. Summary of Residential EE Program Demand Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Lighting, Appliances & HVAC	9.8	-	-	-	-	9.8
	Appliance Recycling	1.2	-	-	-	-	1.2
	Whole Home	0.3	-	-	-	-	0.3
	New Construction	0.2	-	-	-	-	0.2
	Behavioral	0.0	-	-	-	-	0.0
	Multifamily Targeted	0.2	-	-	-	-	0.2
	Program Total	**11.7**	**-**	**-**	**-**	**-**	**11.7**
Verified Gross Demand Savings (MW)	Lighting, Appliances & HVAC	11.0	-	-	-	-	11.0
	Appliance Recycling	1.1	-	-	-	-	1.1
	Whole Home	0.0	-	-	-	-	0.0
	New Construction	0.2	-	-	-	-	0.2
	Behavioral	0.0	-	-	-	-	0.0
	Multifamily Targeted	0.2	-	-	-	-	0.2
	Program Total	**12.5**	**-**	**-**	**-**	**-**	**12.5**
Demand Savings RR	Lighting, Appliances & HVAC	1.13	-	-	-	-	1.13
	Appliance Recycling	0.92	-	-	-	-	0.92
	Whole Home	0.00	-	-	-	-	0.00
	New Construction	0.76	-	-	-	-	0.76
	Behavioral	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.99	-	-	-	-	0.99
	Program Total	**1.07**	**-**	**-**	**-**	**-**	**1.07**
Relative Precision of Verified Gross Demand Savings at 90% Confidence Interval	Lighting, Appliances & HVAC	0.04	-	-	-	-	0.04
	Appliance Recycling	0.00	-	-	-	-	0.00
	Whole Home	0.00	-	-	-	-	0.00
	New Construction	0.26	-	-	-	-	0.26
	Behavioral	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.09	-	-	-	-	0.09
	Program Total	**0.04**	**-**	**-**	**-**	**-**	**0.04**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-20 provides a summary of the verified lifetime energy (MWh) savings results by solution.

Table 3-20. Summary of Residential EE Program Lifetime Energy Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Lifetime Gross Energy Savings (MWh)	Lighting, Appliances & HVAC	822,837.1	-	-	-	-	822,837.1
	Appliance Recycling	63,278.9	-	-	-	-	63,278.9
	Whole Home	0.0	-	-	-	-	0.0
	New Construction	10,958.0	-	-	-	-	10,958.0
	Behavioral	68,102.9	-	-	-	-	68,102.9
	Multifamily Targeted	13,252.2	-	-	-	-	13,252.2
	Program Total	**978,429.0**	**-**	**-**	**-**	**-**	**978,429.0**
Verified Lifetime Net Energy Savings (MWh)	Lighting, Appliances & HVAC	395,607.0	-	-	-	-	395,607.0
	Appliance Recycling	23,352.1	-	-	-	-	23,352.1
	Whole Home	0.0	-	-	-	-	0.0
	New Construction	5,479.0	-	-	-	-	5,479.0
	Behavioral	68,102.9	-	-	-	-	68,102.9
	Multifamily Targeted	11,157.8	-	-	-	-	11,157.8
	Program Total	**503,698.8**	**-**	**-**	**-**	**-**	**503,698.8**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.1.5 Process Evaluation

Due to significant change in the PECO portfolio design for Phase III, Navigant performed early feedback process evaluation tasks for the Residential EE Program and its solutions during PY8 to assess how the program started the phase. The objective was to provide PECO with rapid and specific feedback about the program design and to inform targeted process evaluation objectives for subsequent evaluation years. The PY8 process evaluation efforts included in-depth interviews with key PECO and CSP staff and a detailed review of program materials, including program databases, tracking systems, and other documents across all solutions. The PY8 evaluation also included residential participant in-store intercept and phone surveys for specific solutions including Lighting, Appliances & HVAC and Appliance Recycling Solutions, as well as the Multifamily Targeted Market Segment.[30] This section summarizes the evaluation methods, data collection techniques, sample design, and key results related to these PY8 activities.

PECO and CSP staff provided essential information about the program design and how the program experience on the ground compares with the EE&C Plan. The Navigant team conducted in-depth

[30] At the writing of this report, Navigant was still conducting phone surveys of Behavioral Solution participants. Due to timing and per discussion with the SWE, results from the Behavioral survey will be provided via memo at a later date.

interviews with all PECO solution leads and CSPs at the beginning of the PY8 evaluation and communicated with staff on an ongoing basis as needed. The team developed interview instruments to include questions of interest for the evaluation and to allow for free-flowing conversations to obtain candid feedback from the interviewees.

In addition to interviews with staff and CSPs, Navigant conducted a phone survey of a sample of participants in the Appliances and HVAC component (i.e., the non-lighting components of the Lighting, Appliances & HVAC Solution) and Appliance Recycling Solution, as well as the Multifamily Targeted Market Segment to support savings verification, explore customer satisfaction and experience with the program, and to inform the NTG analysis, as discussed earlier in Section 3.1.2. For the lighting component of the Lighting, Appliances & HVAC Solution, Navigant used the same in-store survey previously described in Section 3.1.2 to gather information about customer experience with the solution. All survey instruments were developed according to SWE requirements and were reviewed and approved by the SWE in advance of fielding.[31] In general, the team defined the survey population for each solution's participants based on the program tracking databases provided by PECO. In some cases, demographic and geographic information, data on installed measures, installation dates, and estimated savings were used for sample design and the subsequent analysis of results. Navigant developed a sample sufficient to provide 85/15 confidence/precision for the survey results.

The team developed the various in-depth interview and participant survey instruments first by creating crosscutting, generic instruments intended to capture general information consistently. For example, the generic participant survey instrument contained a battery of satisfaction questions so that sentiments across solutions could be compared. Next, instruments were augmented and customized to meet the specific research needs of each solution.

As of the writing of this report, Navigant is still in the process of developing program process and customer journey maps for the Appliances and HVAC component and Appliance Recycling Solution, in alignment with the Evaluation Plan. These process and journey maps will document the intent of the program and compare the intended plan to current program activities based on data collected via the surveys. Process and customer journey maps for the other solutions will be completed in future program years.

The following provides a summary of the process evaluation activities conducted for each Residential EE solution.

- Lighting, Appliances & HVAC Solution
    - Lighting
        - PECO and CSP staff interviews
        - Program materials review
        - In-store intercepts: Navigant used the same in-store survey previously described in Section 3.1.2 to gather information about customer experience with the solution
    - Non-Lighting Appliances and HVAC component

[31] The survey instruments included more questions than are presented in this compliance report. Navigant and PECO are analyzing findings from these additional questions to inform continuous process improvements to the programs, solutions, and customer experience, and will include relevant results in subsequent reports as findings and recommendations are formalized.

        - PECO and CSP staff interviews
        - Solution materials review
        - Phone survey: Navigant used phone surveys to assess how customers heard about the Appliances and HVAC component, their satisfaction with the solution and PECO overall, and their awareness of other PECO solutions. Navigant stratified the survey sample by the two non-lighting measure categories (Appliances and HVAC).
- Appliance Recycling Solution
    - PECO and CSP staff interviews
    - Solution materials review
    - Phone survey: Navigant used phone surveys to assess how customers heard about the Appliance Recycling Solution, their satisfaction with the solution and PECO overall, and their awareness of other PECO solutions. Navigant segmented the survey sample according to participation type:
        - Refrigerator(s) only
        - Freezer(s) only
        - Refrigerator and Freezer
        - Refrigerator and Room AC
        - Freezer and Room AC
- Whole Home Solution
    - PECO and CSP staff interviews
    - Solution materials review
- New Construction Solution
    - PECO and CSP staff interviews
    - Solution materials review
- Multifamily Targeted Market Segment (Tenant Focus)
    - PECO and CSP staff interviews
    - Solution materials review
    - Phone survey: Navigant used phone surveys to assess how condo owners and building tenants in residentially metered apartment units heard about the Multifamily Targeted Market Segment, their satisfaction with the program and PECO overall, and their awareness of other PECO solutions. The survey sample was stratified by project size (large and small).
- Behavioral Solution
    - PECO and CSP staff interviews

Table 3-21 provides the customer phone survey sample details for each Residential EE solution.

Table 3-21. Residential EE Program Customer Phone Survey Sample Design for PY8[32]

Solution	Stratum	Population Size	Target Sample Size	Achieved Sample Size
Lighting, Appliances & HVAC Solution (Appliances and HVAC Component)	Appliance Measures	7,026	75	75
	HVAC Measures	9,187	75	75
	Solution Total	**16,213**	**150**	**150**
Appliance Recycling Solution	Refrigerator(s) Only	6,431	145	145
	Freezer(s) Only	1,227	35	35
	Refrigerator(s) and Freezer(s)	208	10	8
	Refrigerator(s) and Room AC(s)	505	5	5
	Freezer and Room AC	102	5	5
	Refrigerator(s), Freezer(s), and Room AC(s)	23	N/A	N/A
	Solution Total	**8,496**	**200**	**198**
Multifamily Targeted Market Segment (Tenants)	Small	2,898	35	35
	Large	767	40	31
	Solution Total	**3,665**	**75**	**66**
Total Program		**28,374**	**425**	**414**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.1.5.1 Key Findings from Process Evaluation

PECO made significant changes to the Residential EE Program and solutions for Phase III to ensure an improved customer experience and to drive deeper energy savings across the portfolio. The most substantial changes were an increase in participation needed to achieve the plan's kilowatt-hour (kWh) goals, a need to target deeper penetration of previously- offered measures, and an expansion of offered measures. Other changes included a shift from solution-specific marketing to a centralized marketing entity, the EEMF, and a move to handle application processes online.

As of the writing of this report and based on the PY8 impact evaluation results, it is clear that PECO and its CSPs needed time in PY8 to adjust to these new requirements and implementation changes and that some of the elements needed for success, such as supporting data and infrastructure are still in progress. In short, besides the Lighting (i.e., the lighting component of the Lighting, Appliances & HVAC Solution) and Behavioral Solutions, not one Residential EE Program solution met its PY8 participation and savings projections. The Navigant early feedback process evaluation research indicates that the participation shortfalls are a result of several complex factors that are sometimes, but not always,

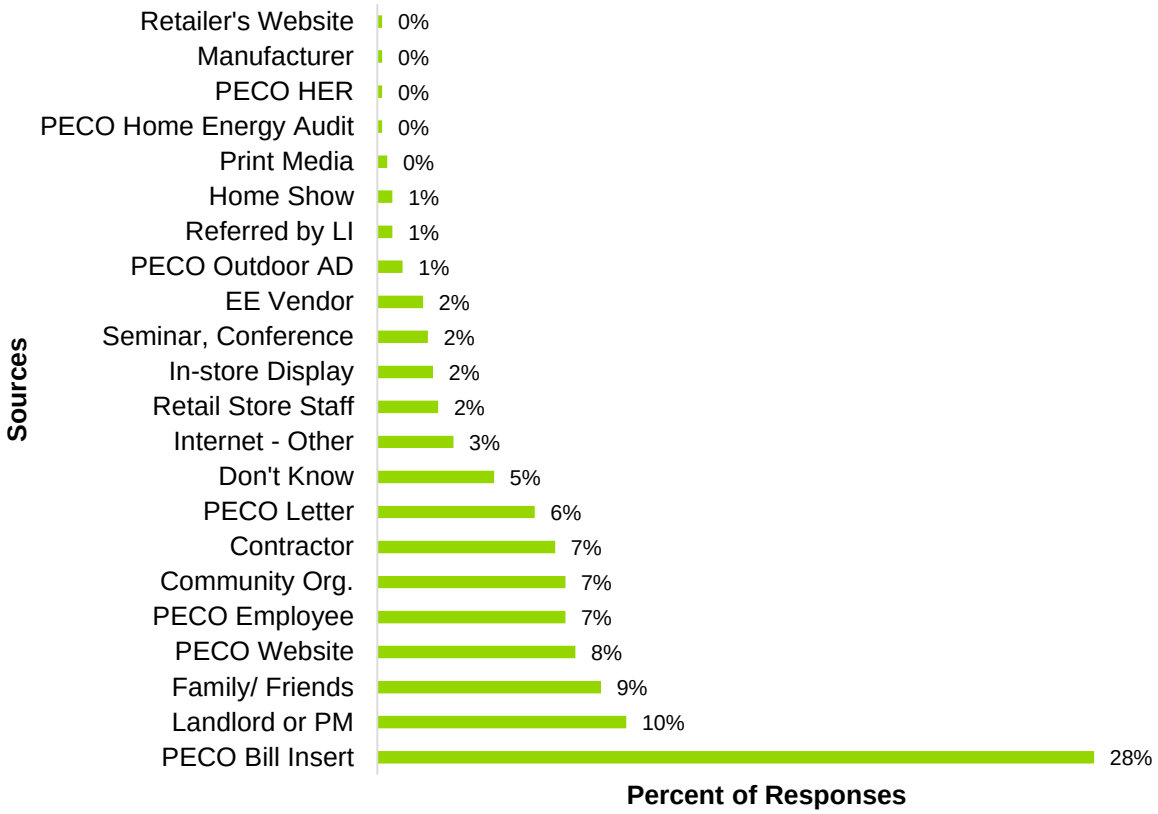
[32] Survey samples were designed to achieve 15% relative precision at the 85% confidence level at the solution level for NTG ratios and satisfaction ratings.

solution-specific. The team has included some immediate recommendations for program and solution improvements in this report where possible but is still working with PECO to explore in-depth findings and identify next steps for targeted, continuous process evaluation.

Navigant examined several aspects of participant awareness to assess the PECO Residential EE Program's effectiveness at encouraging the participation needed to achieve the plan's kWh goals. As seen in Figure 3-1, 28% of residential participants learned about their respective solution from PECO bill inserts received in the mail. Word of mouth from landlords or property managers (10%) and family and friends (9%) were also effective sources of information. PECO's website was also cited by 8% of participants as a main source of information about PECO's program offerings.

These findings indicate that the EEMF's marketing initiatives, PECO's home energy audits, and the HERs sent via the Behavioral Solution are not yet top sources of information for customers; at a minimum, these sources do not appear to stand out in customers' eyes as top of mind. The EEMF's advertising efforts and PECO's main channeling programs, the home audits, and HERs, while important to the implementation plan, may not be as memorable to customers compared to tangible, direct-to-the-customer bill inserts or personal word of mouth marketing channels, such as landlords, personal contacts, and contractors. PECO should continue to closely monitor EEMF alignment with solution CSPs to ensure customer awareness efforts are optimized. PECO should also look for ways to leverage the power of word of mouth and direct-to-customer marketing channels. Finally, Navigant should continue working with PECO to conduct a targeted process evaluation to inform continuous improvement opportunities for the program and solutions.

Figure 3-1. Sources of Residential EE Solution Awareness, n=510

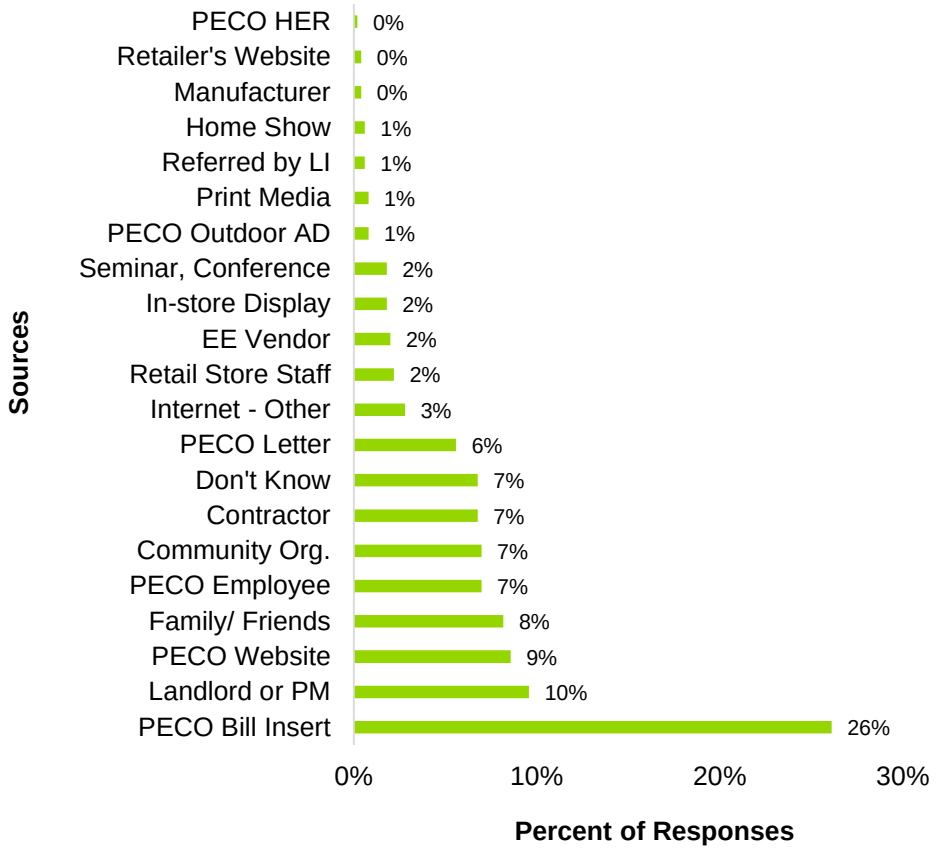


Question: "How did you learn about the [SOLUTION] program?" Multiple responses allowed; sum of percentages will not add up to 100%.

Source: Navigant analysis

Corresponding directly with the previous results, PECO bill inserts (26%) were cited by participants as the most significant informational source contributing to their decision to participate, as seen in Figure 3-2. Word of mouth through landlords or property managers and PECO's website were the second and third most influential responses, respectively. The PECO website (9%) was slightly more influential than word of mouth from friends and family (8%). Again, PECO's home energy audit and HERs were not mentioned as influential sources of information.

Figure 3-2. Awareness Source Influence on Residential EE Participation, n=500

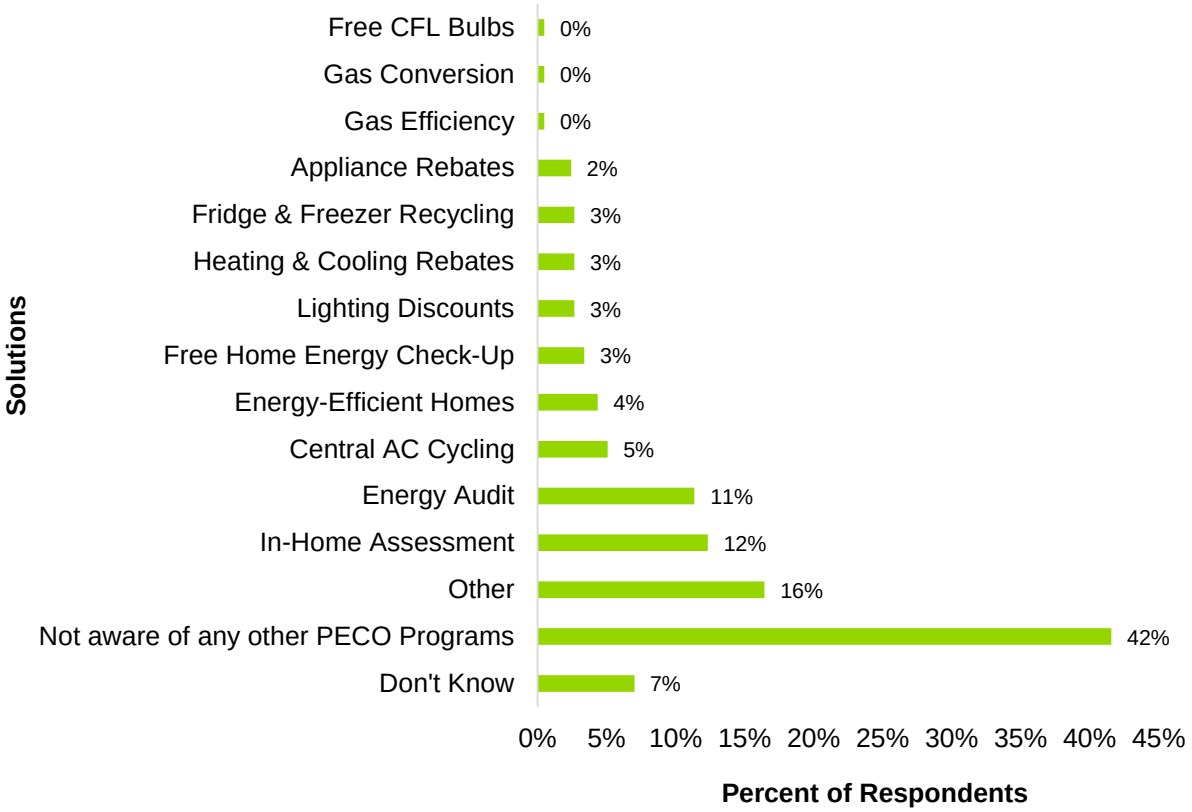


Question: "Thinking of the ways you heard about the [SOLUTION] program, which one was most influential in your decision to participate in the program?" One response allowed.

Source: Navigant analysis

The customer survey also investigated program participant awareness of other PECO solutions to understand various channeling pathways throughout the portfolio. Participants were asked via an open-ended question whether they had heard of any other PECO solutions. The largest portion (42%) indicated they had not heard of a solution other than the one in which they participated, as seen in Figure 3-3, while 12% recalled hearing of the in-home assessments. The "Other" category includes various responses, including mentions of the AC Saver program. These findings indicate that, in general, Residential EE Program participants are not learning about PECO's other offerings during the course of their experience within their respective solution, resulting in a missed opportunity to increase participation across the program. A future targeted evaluation research objective is to examine which solutions promote and increase awareness and are successfully channeling participants into other solutions and which are not. This will allow the team to identify best practices and barriers and to make recommendation for improvements.

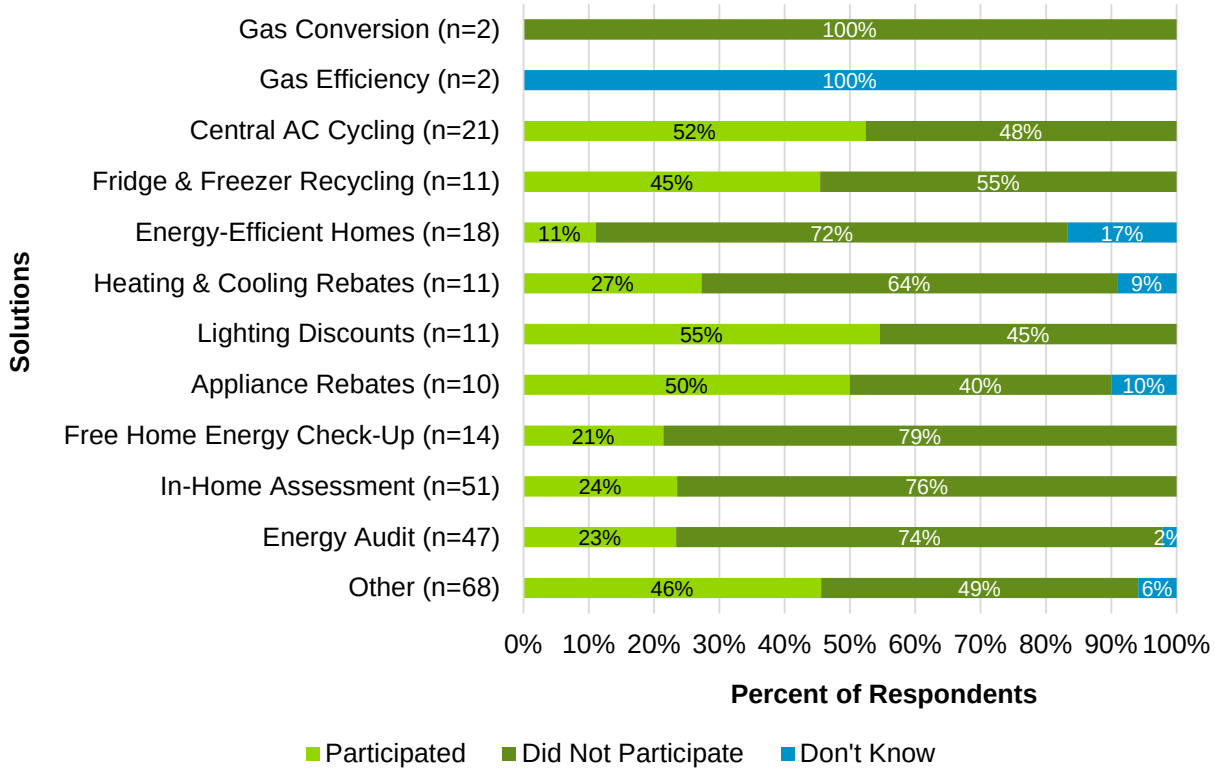
Figure 3-3. Residential EE Participant Awareness of Other Solutions, n=627



Question: ""Have you heard of any of PECOs other solutions to help you save energy and money in your home?"
Multiple responses allowed; sum of percentages will not add up to 100%. "Other" category includes individual mentions of the AC Saver program, the CAP and LIHEAP programs, renewable energy rebates, and the shade tree program.
Source: Navigant analysis

Of the customers that recalled a solution other than the one in which they participated, generally half said they had participated in the second solution, as seen in Figure 3-4. A future targeted research objective under consideration is to analyze the customer flow between programs using program tracking data to understand any patterns that may help inform program implementation.

Figure 3-4. Residential EE Solution Participation Conditional on Awareness

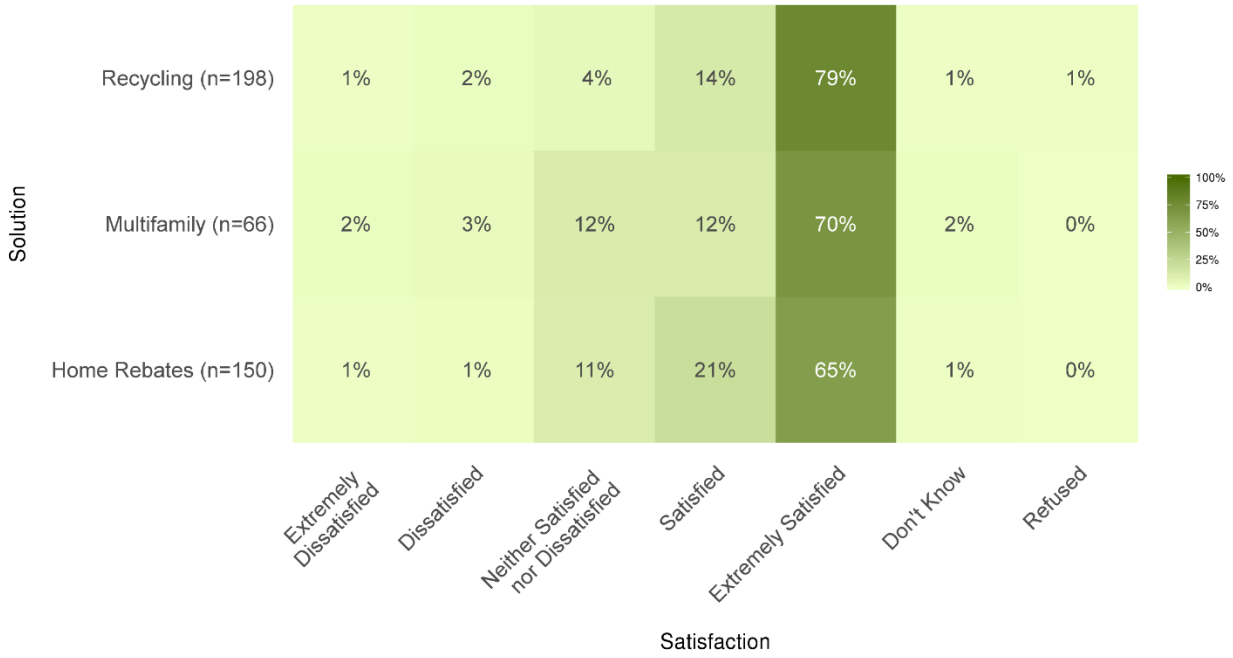


Question: "Have you participated in PECO's [PREVIOUS RESPONSE] solution?" Percentages may not add up to 100% due to rounding.

Source: Navigant analysis

As shown in Table 3-7, customers who participated in a Residential EE Solution were generally satisfied or extremely satisfied with the program. However, satisfaction with Appliances and HVAC (i.e., the non-lighting component of the Lighting, Appliances & HVAC Solution) was rated slightly lower in comparison to Recycling and Multifamily (i.e., the Multifamily Targeted Market Segment). Multifamily also had the highest percentage of dissatisfaction compared to the other two solutions. Further discussion about these results is included in Appendix D.

Figure 3-5. Overall Satisfaction by Residential EE Solution

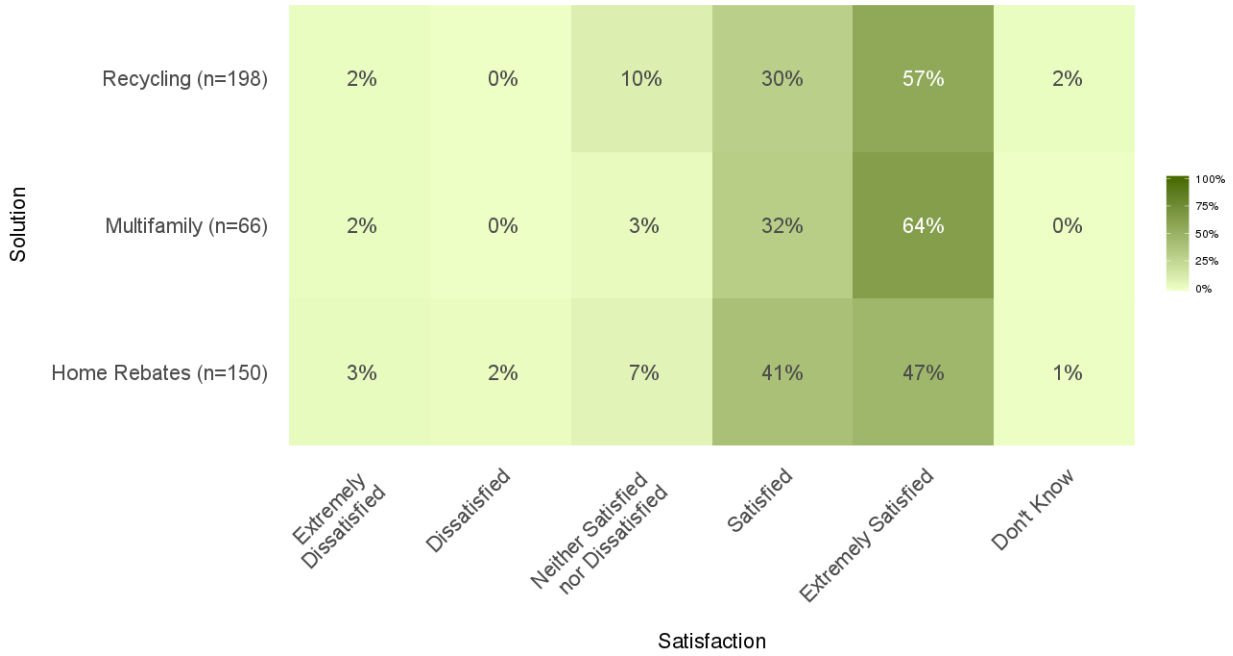


Question: "Using a scale of 1 to 5, with 5 meaning extremely satisfied and 1 meaning extremely dissatisfied, how would you rate your OVERALL satisfaction with the [Solution] program?"

Source: Navigant analysis

As shown in Figure 3-6, PECO overall received lower satisfaction ratings than the solutions. Comparing these results to those shown in Figure 3-5 reveals that the solutions are likely good for the overall PECO customer relationship as customers are having a positive experience with PECO by participating. Should the evaluation require a non-participant survey in the future, the survey should include this satisfaction question to compare participant satisfaction with PECO to non-participant satisfaction to explore this finding further.

Figure 3-6. Residential EE Program Participant Satisfaction with PECO by Solution

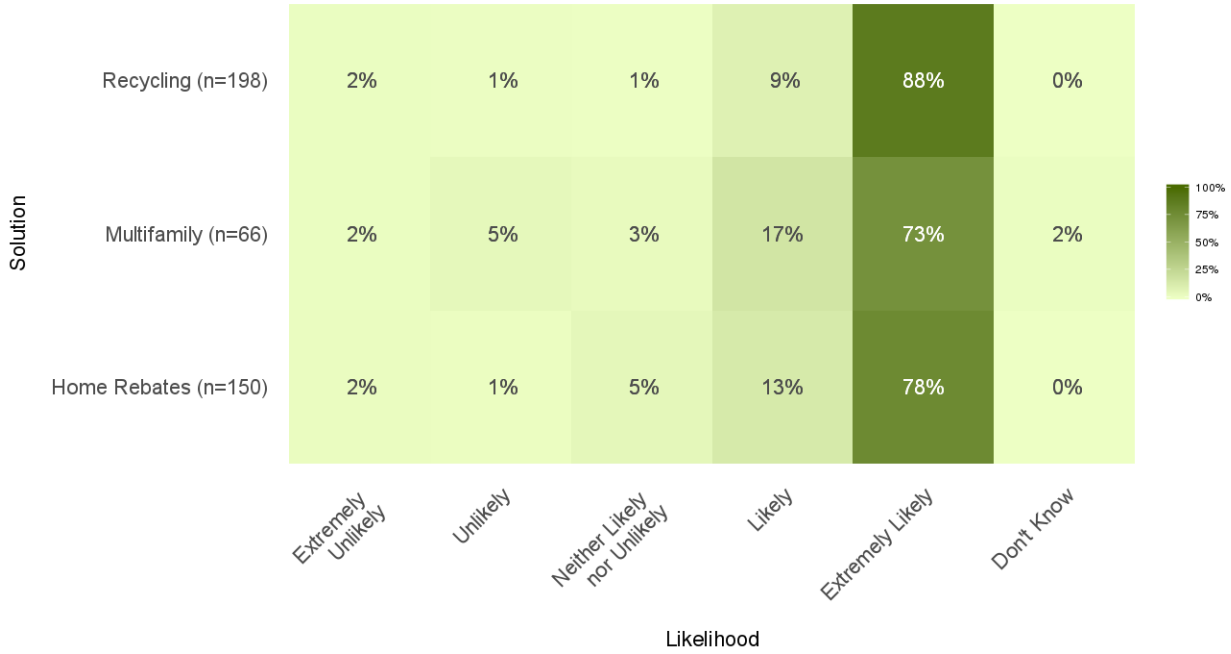


Question: "Thinking now about PECO the utility, and not just the [Solution] program, on a scale of 1 to 5, with 5 meaning extremely satisfied and 1 meaning extremely dissatisfied, how satisfied are you with PECO in general?"

Source: Navigant analysis

Participants across the three Residential EE Program solutions included in the survey said they were either likely or extremely likely to recommend the solution to another person. As customer referrals and testimonials can be a powerful way to market programs and because this solution needs to increase participation moving forward, PECO should consider leveraging these customers by including quotes from them on marketing materials and perhaps by conducting a referral contest to encourage word of mouth marketing. Figure 3-7 summarizes respondents' likelihood to recommend the program to others.

Figure 3-7. Residential EE Participant Likelihood to Recommend to Others



Question: "On a scale of 1-5, with 5 meaning extremely likely and 1 meaning extremely unlikely, overall, how likely are you to recommend PECO's [Solution] program to others?"

Source: Navigant analysis

3.1.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-22. TRC benefits were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 3-22. Summary of Residential EE Program Finances – Gross Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	5,205	-	-	-	-	5,205
	EDC Incentives to Trade Allies	0	-	-	-	-	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	7,470	-	-	-	-	7,470
	Cost Subtotal	**12,676**	**-**	**-**	**-**	**-**	**12,676**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	-	-	-	-	0
	Design and Development (CSP Costs) [2]	0	-	-	-	-	0

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Administration, Management, and Technical Assistance (EDC Costs) [3]	369	-	-	-	-	369
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	-	-	-	-	0
	Marketing (EDC Costs) [4]	4,445	-	-	-	-	4,445
	Marketing (CSP Costs) [4]	0	-	-	-	-	0
	Program Delivery (EDC Costs) [5]	0	-	-	-	-	0
	Program Delivery (CSP Costs) [5]	9,338	-	-	-	-	9,338
	EDC Evaluation Costs	0	-	-	-	-	0
	SWE Audit Costs	0	-	-	-	-	0
	Cost Subtotal	**14,152**	**-**	**-**	**-**	**-**	**14,152**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	100	-	-	-	-	100
	Cost Subtotal	**100**	**-**	**-**	**-**	**-**	**100**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**26,927**	**-**	**-**	**-**	**-**	**26,927**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	28,081	-	-	-	-	28,081
	Lifetime Electric Capacity Benefits	9,460	-	-	-	-	9,460
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	10,307	-	-	-	-	10,307
	Benefits Total	**47,848**	**-**	**-**	**-**	**-**	**47,848**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**1.78**	**-**	**-**	**-**	**-**	**1.78**

[1] Includes direct install equipment costs and costs for EE&C kits.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management, legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

*Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-23 presents program financials and cost-effectiveness on a net savings basis.

Table 3-23. Summary of Residential EE Program Finances – Net Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	5,205	-	-	-	-	5,205
	EDC Incentives to Trade Allies	0	-	-	-	-	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	1,304	-	-	-	-	1,304
	Cost Subtotal	**6,509**	**-**	**-**	**-**	**-**	**6,509**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	-	-	-	-	0
	Design and Development (CSP Costs) [2]	0	-	-	-	-	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	369	-	-	-	-	369
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	-	-	-	-	0
	Marketing (EDC Costs) [4]	4,445	-	-	-	-	4,445
	Marketing (CSP Costs) [4]	0	-	-	-	-	0
	Program Delivery (EDC Costs) [5]	0	-	-	-	-	0
	Program Delivery (CSP Costs) [5]	9,338	-	-	-	-	9,338
	EDC Evaluation Costs	0	-	-	-	-	0
	SWE Audit Costs	0	-	-	-	-	0
	Cost Subtotal	**14,152**	**-**	**-**	**-**	**-**	**14,152**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	87	-	-	-	-	87
	Cost Subtotal	**87**	**-**	**-**	**-**	**-**	**87**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**20,748**	**-**	**-**	**-**	**-**	**20,748**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	14,851	-	-	-	-	14,851
	Lifetime Electric Capacity Benefits	4,528.1	-	-	-	-	4,528.1
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	5,076	-	-	-	-	5,076
	Benefits Total	**24,455**	**-**	**-**	**-**	**-**	**24,455**

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**1.18**	**-**	**-**	**-**	**-**	**1.18**

[1] Includes direct install equipment costs and costs for EE&C kits.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

*Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.1.7 Status of Recommendations

The impact and process evaluation activities in PY8 led to the following findings and recommendations from Navigant to PECO, along with a summary of how PECO plans to address the recommendation in program delivery. For further discussion about each solution-level finding and recommendation, see Appendix D.

Table 3-24. Summary of Findings and Recommendations for Residential EE Program

Solution	Finding	Recommendation	EDC Status
All Residential EE Program Solutions	As of the writing of this report and based on the PY8 impact evaluation results, it is clear that PECO and its CSPs needed time in PY8 to adjust to new requirements and implementation changes and that some of the elements needed for success, such as supporting data and infrastructure are still in progress.	Navigant should continue to work with PECO to conduct a targeted process evaluation to inform continuous improvement opportunities for the program and solutions.	Implemented. PECO is actively working with Navigant to conduct a targeted process evaluation for select programs and solutions.

Solution	Finding	Recommendation	EDC Status
All Residential EE Program Solutions	Survey findings indicate that the EEMF's marketing initiatives, PECO's home energy audits, and the HERs sent via the Behavioral Solution are not yet top sources of information for customers. The EEMF's advertising efforts and PECO's main channeling programs, while important to the implementation plan, may not yet be as memorable to customers compared to tangible, direct-to-the-customer bill inserts or personal word of mouth marketing channels, such as landlords, personal contacts, and contractors.	PECO should continue to closely monitor EEMF alignment with solution CSPs to ensure customer awareness efforts are optimized. PECO should also look for ways to leverage the power of word of mouth and direct-to-customer marketing channels. Finally, Navigant should continue working with PECO to conduct a targeted process evaluation to inform continuous improvement opportunities for the program and solutions.	Being implemented. EEMF is assessing its marketing strategy and working very closely with the implementation team to evaluate PY8 results and pull levers, were necessary to meet the expected plan targets and gear up for the next program year.
All Residential EE Program Solutions	In general, Residential EE Program participants are not learning about PECO's other offerings during the course of their experience within their respective solution, resulting in a missed opportunity to increase participation across the program.	PECO and Navigant should examine which solutions promote and increase awareness and are successfully channeling participants into other solutions and which are not. This will allow the team to identify best practices and barriers and to make further recommendations for improvements.	Being implemented. PECO is working with Navigant to implement targeted process evaluations for select programs and solutions and utilize customer journeys to leverage existing program marketing strategies
All Residential EE Program Solutions	Participants across the three Residential EE Program solutions included in the survey said they were either likely or extremely likely to recommend the solution to another person.	As customer referrals and testimonials can be a powerful way to market programs and because this solution needs to increase participation moving forward, PECO should consider leveraging these customers by including quotes from them on marketing materials and perhaps by conducting a referral contest to encourage word of mouth marketing.	Implemented. PECO is actively engaging existing customers and capturing their experiences to build awareness and generate deeper participation across the board.
Lighting, Appliances & HVAC Solution (Lighting Component)	Some bulb types found in Ecova's tracking data do not map well to tables in TRM Section 2.1.1 for assigning baseline wattages. Therefore, assigning savings is not straightforward and relies on analyses that can result in different baseline wattage assumptions between the evaluator and the CSP.	PECO should request an accompanying file from the CSP that provides bulb-specific information for each program bulb's model number. The file would include information on model number, bulb type, baseline/efficient wattage, with sources listed for baseline wattages to enable verification.	PECO is able to request logic models from the vendor at any time. Each lighting model number has a dropdown in the vendor's system to dictate baseline methodology based on bulb qualities.

Solution	Finding	Recommendation	EDC Status
Lighting, Appliances & HVAC Solution (Lighting Component)	Navigant conducted a pricing review to compare the per-bulb incentives with the manufacturer suggested retail price (MSRP) and the expected retail price. Navigant expected that the MSRP less the per-package incentive equals the expected retail price. However, this equation does not compute for 883 out of 118,649 records (0.7% of records). Furthermore, there were 15,226 cases where the expected retail price is higher than the MSRP (12.8% of 118,649 records).	PECO should continue to work with the CSP and manufacturers to encourage maintenance of accurate inputs, communication of other manufacturer rebates, and updates to prices as often as possible. Navigant also recommends that they institute a quality control check as part of data processing that would indicate an error when the MSRP is lower than the expected retail price, which should never be the case.	MSRP and Retail prices can fluctuate weekly and are often subsidized not only by the Program, but also sometimes by manufacturer and retailer promotions. PECO can look into the feasibility of the QC check on whether the MSRP is lower than retail.
Lighting, Appliances & HVAC Solution (Lighting Component)	Customer preferences and experience with non-discounted models were the main reasons that customers purchased non-discounted LEDs over PECO-discounted bulbs.	PECO might encourage more efficient lighting purchases by increasing the number of brands/manufacturers they carry in participating stores or by talking to customers on event days about the concerns customers have with switching to new products/brands.	Brands/Manufacturers are chosen via annual RFP process and review of past performance. When a manufacturer is unable to provide data either accurately or in a timely manner, they are often not considered valid to participate in the program. The program performs the formal RFP process annually, but is in communication with many more manufacturers throughout the year. Field coordinators host retail events regularly in retail lighting aisles where there is an educational table setup, but the field coordinator is in the aisle to answer direct customer questions.
Lighting, Appliances & HVAC Solution (Lighting Component)	The survey indicated that homeowners buy LEDs more frequently than renters, and single-family residents are more likely to buy LEDs than multifamily residents. Specifically, 83% of discounted bulb purchasers and 88% of non-discounted LED purchasers are homeowners compared to 64% of standard efficiency purchasers. Additionally, 72% of LED purchasers have single-family homes, compared to 46% of standard efficiency purchasers.	PECO could consider additional marketing and education for multifamily residents if they would like to increase participation for this segment.	PECO will discuss additional marketing opportunities for multifamily residents when making decisions about the 2018 Marketing Plan.

Solution	Finding	Recommendation	EDC Status
Lighting, Appliances & HVAC Solution (Lighting Component)	The survey responses revealed that low-income customers are more likely to buy standard efficiency bulbs than program-discounted LEDs. Specifically, 5% of discounted LED purchasers were low-income customers, compared to 14% of standard efficiency purchasers that were low-income customers. This finding shows that the Residential Lighting Program is generally not reaching low-income customers with incentives for program-discounted LEDs.	PECO should continue to provide enhanced incentives through the Low-Income Lighting Solution to reach a greater penetration of low-income customers.	Implemented. PECO intends to continue providing incentives through the Low Income Lighting Solution in PY9.
Lighting, Appliances & HVAC Solution (Appliances and HVAC Component)	Navigant found that 13% of respondents reported a neutral or dissatisfying experience with the program. The majority of this group (11% of the 13%) said their satisfaction was neutral. However, the remainder of respondents voiced frustration with Appliance and HVAC rebate delays and difficulties with filling out the rebate application.	PECO and Navigant should research ways to improve the functionality of the online rebate application form to streamline the process for customers.	PECO is currently working with the CSP to overhaul the functionality of the online rebate platform in PY9. (intent to launch: 1/1/2018)
Lighting, Appliances & HVAC Solution (Appliances and HVAC Component)	The majority (78%) of respondents said they were extremely likely to recommend the Appliance and HVAC solution to others.	PECO and Navigant should investigate ways to incentivize program participants to get friends and family to participate in the Appliance and HVAC program. For example, consider a referral reward system.	PECO will take this into consideration and discuss with Navigant and the Marketing Firm.
Lighting, Appliances & HVAC Solution (Appliances and HVAC Component)	The trade ally network of installation contractors is a key pathway for marketing PECO's portfolio of EE programs.	PECO should continue to provide the trade ally network with consistent marketing materials that send a unified message to customers and offer PECO as a one-stop-shop solution for a customer's EE needs.	Under consideration. PECO continues to improve marketing materials and contractor/customer education through the Marketing Firm. This recommendation will be discussed in the CY2018 Marketing Plan meetings.

Solution	Finding	Recommendation	EDC Status
Appliance Recycling	Satisfaction is highly positive; however 7% of respondents reported a neutral or dissatisfying experience. Reasons generally included a desire for faster rebates. The CSP's monthly reports to PECO include incentive check processing time as a key performance metric, but Navigant was unable to verify the claim that 100% of checks are processed within 15 business days.	PECO and Navigant should review the CSP's process for monitoring check issuance timing as part of the PY9 evaluation. PECO should continue to enforce acceptable rebate processing times as one of the CSP's key performance metrics.	Under consideration. This metric is part of the contract and the rebate processing time, per agreed terms is 4 weeks. However, in January 2017, the CSP changed rebate processing companies and the rebates are now being processed faster (3 weeks). 10 days after the unit is collected, the customer gets an email that the rebate is on its way.
Appliance Recycling	An overwhelming majority (88%) of respondents said they were extremely likely to recommend the Appliance Recycling solution to another person.	PECO should consider leveraging these customers by including quotes from them on marketing materials, and by conducting a referral contest to encourage word of mouth marketing.	Under consideration. PECO realizes this program is an attractive program and will implement the testimonials for this program in other marketing materials as well as leverage the existing customer base to recruit participation in this and other PECO programs.
Appliance Recycling	Induced replacements are up from the previous year. In PY7, Navigant found that 2% of refrigerator and 3% of freezer replacements were driven by customer participation in the program. In PY8, those numbers increased to 4% and 8%, respectively.	PECO and Navigant should monitor this inducement rate throughout the Phase. Specific marketing that highlights the benefits of recycling without replacement may positively impact this rate.	PECO will consider highlighting the benefits of recycling w/o replacement and monitor the inducement rate.
Whole Home	Customer-facing program materials describe the monetary value of audit participation rather than the financial and comfort benefits of completing efficiency projects through the solution. In addition, PECO staff reports that customer satisfaction and motivation to participate are driven by factors that are not promoted in program materials.	PECO should adjust customer-facing promotional materials to describe benefits in terms of completed project results, provide a strong call to action, and encourage completed project conversion. Messaging should use themes that customers have reported as core drivers of satisfaction and motivation to promote participation and project completion.	Under consideration. PECO is currently working on messaging to adapt to the strategies in place by the EEMF marketing team.

Solution	Finding	Recommendation	EDC Status
Whole Home	PECO does not track the conversion rate from audit recommendations of major mechanical measures (heat pumps, water heaters, pool pumps, etc.) to customer project completions. This is due, in part, to the complexities of multiple CSPs implementing the solution. This is expected to change in January 2018, when a single CSP, CLEAResult, will be responsible for implementing the entire solution.	PECO and the CSP should develop a tracking system to record major measure recommendations at the time of audit and monitor conversion rates to major measure installations. They should use data to determine the success rate of audit recommendations and identify potential areas where customers may get dropped between audit and major measure installations.	Being implemented. PECO is partnering with CLEAResult to streamline the auditing process.
Whole Home	In PY8, the Whole Home Solution allowed certified contractors to bring their customers into the program rather than requiring an in-home assessment first.	PECO, the CSP, and Navigant should monitor and compare satisfaction and conversion rates for customers who enter the solution through the traditional phone center and PECO marketing outreach as compared to those customers entering directly through Whole Home certified contractors.	Being Implemented. PECO is investigating the best approach to assess the satisfaction of the pathway of entry into the program.
Whole Home	The project database does not identify key date fields to track customer progress through the program. This is due, in part, to the complexities of a separate call center and implementation CSPs.	PECO should develop tracking data fields to monitor elapsed time between: • Customer inquiry to PECO and the audit site visit • Audit site visit to major measure installation • Major measure installation to incentive payment completed	PECO is actively working to develop a solution for tracking data and establishing key performance indicators.

Solution	Finding	Recommendation	EDC Status
Multifamily Targeted (Tenant-Focused)	Tenants are generally not aware of other PECO program and solution offerings. In addition, the measure mix in PY8 only included direct install lighting and water conservation measures.	PECO should explore strategies to more effectively channel participants to appropriate programs based on their need. For example, the energy advisors could provide printed material about the other solutions, leave behind appropriate contact information for the PECO call center and relevant CSP(s), and share customer contact information with relevant CSPs for follow up. Channeling efforts should explain the benefits of prescriptive measures like high efficiency HVAC and shell improvements to property owners. The CSP should also focus on signing service agreements for prescriptive measures that are deemed beneficial to the property by the energy advisor, and include a breakdown of available incentives, the cost to the customer, and the payback period in the energy assessment to make the decision-making process easier for the customer.	PECO will consider additional marketing strategies to generate more awareness among the multifamily customer universe. We already have leave behinds and surveys for every customer. There is complementary marketing for other In-unit direct installs as well as prescriptive recommendations and the associated benefits and costs. Decision makers are not always involved.

Source: Navigant analysis

3.2 Residential Low-Income EE Program

The Residential Low-Income Energy Efficiency (Low-Income EE) Program offers a comprehensive array of participant solutions and activities to achieve PECO's goal of helping low-income customers save energy. The Low-Income EE Program targets PECO residential electric customers with a household income of less than or equal to 150% of the FPL to meet the 5.5% low-income energy saving carve-out requirement.

The Low-Income EE Program consists of two solutions:

- Whole Home Solution
- Lighting Solution

Savings are achieved through a range of delivery mechanisms and methods including midstream incentives (i.e., retailer buy downs), product giveaways, in-home audits, and direct install measures. PECO relies on two CSPs to deliver the program savings.

PECO's Low-Income EE Program refers eligible customers to the Residential EE Program's Appliance Recycling Solution when appropriate. Appliance Recycling Solution savings from customers who are on the CAP rate and at or below 150% of the Federal Poverty Level are applied toward the Low-Income carve-out requirement.

PECO's income-qualified customers are also eligible to benefit from the Residential EE Program's Behavioral Solution. Low-income participation in the Behavioral Solution and associated savings are reported through the Residential EE Program and are not applied toward the Low-Income carve-out requirement.

Appendix E contains additional detail on the individual solutions.

3.2.1 Participation and Reported Savings by Customer Segment

This section provides the Low-Income EE Program results for PY8, including participation, energy and demand savings, and incentive costs. Table 3-25 presents the participation counts and incentive payments for the Low-Income EE Program in PY8 by customer segment.

Table 3-25. Summary Statistics for Low-Income EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Residential	64,375	-	-	-	-	64,375
	Small C&I	10	-	-	-	-	10
	Large C&I	0	-	-	-	-	0
	Total	**64,385**	**-**	**-**	**-**	**-**	**64,385**
Incentive Spending ($1,000)	Residential	350	-	-	-	-	350
	Small C&I	0	-	-	-	-	0
	Large C&I	0	-	-	-	-	0
	Total	**350**	**-**	**-**	**-**	**-**	**350**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-26 provides a summary of reported and verified energy (MWh) savings results by customer sector for the Low-Income EE Program for PY8. The Low-Income EE Program evaluation did not include NTG research.

Table 3-26. Summary of Energy Savings for Low-Income EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings	Residential	19,661.0	-	-	-	-	19,661.0
	Small C&I	203.8	-	-	-	-	203.8
	Large C&I	0.0	-	-	-	-	0.0

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
(MWh)	**Total**	**19,864.8**	**-**	**-**	**-**	**-**	**19,864.8**
Verified Gross Energy Savings (MWh)	Residential	19,385.1	-	-	-	-	19,385.1
	Small C&I	0.0	-	-	-	-	0.0
	Large C&I	0.0	-	-	-	-	0.0
	Total	**19,385.1**	**-**	**-**	**-**	**-**	**19,385.1**
Energy Savings RR	Residential	0.99	-	-	-	-	0.99
	Small C&I	0.00	-	-	-	-	0.00
	Large C&I	0.00	-	-	-	-	0.00
	Total	**0.98**	**-**	**-**	**-**	**-**	**0.98**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-27 provides the reported and verified demand (MW) savings results for the Low-Income EE Program for PY8.

Table 3-27. Summary of Demand Savings for Low-Income EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Residential	2.2	-	-	-	-	2.2
	Small C&I	0.0	-	-	-	-	0.0
	Large C&I	0.0	-	-	-	-	0.0
	Total	**2.2**	**-**	**-**	**-**	**-**	**2.2**
Verified Gross Demand Savings (MW)	Residential	2.2	-	-	-	-	2.2
	Small C&I	0.0	-	-	-	-	0.0
	Large C&I	0.0	-	-	-	-	0.0
	Total	**2.2**	**-**	**-**	**-**	**-**	**2.2**
Demand Savings RR	Residential	0.98	-	-	-	-	0.98
	Small C&I	0.00	-	-	-	-	0.00
	Large C&I	0.00	-	-	-	-	0.00
	Total	**0.97**	**-**	**-**	**-**	**-**	**0.97**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-28 shows the participation and incentive spending for the sector carve-outs of low-income and government/education/non-profit (G/E/NP).

Table 3-28. Summary Statistics for Low-Income EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Low-Income	64,385	-	-	-	-	64,385
	G/E/NP	0	-	-	-	-	0
Incentive Spending ($1,000)	Low-Income	350	-	-	-	-	350
	G/E/NP	0	-	-	-	-	0

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-29 shows the reported and verified, energy (MWh) savings results for the sector carve-outs. The Low-Income EE Program evaluation did not include net to gross research.

Table 3-29. Summary of Energy Savings for Low-Income EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Low-Income	19,864.8	-	-	-	-	19,865
	G/E/NP	0.0	-	-	-	-	0
Verified Gross Energy Savings (MWh)	Low-Income	17,173.9	-	-	-	-	17,173.9
	G/E/NP	0.0	-	-	-	-	0.0
Energy Savings RR	Low-Income	0.86	-	-	-	-	0.86
	G/E/NP	0.00	-	-	-	-	0.00
Verified Net Energy Savings (MWh)	Low-Income	14,087.5	-	-	-	-	14,087.5
	G/E/NP	0.0	-	-	-	-	0.0

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-30 shows the reported and verified demand (MW) savings results for the sector carve-outs.

Table 3-30. Summary of Demand Savings for Low-Income EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Low-Income	2.2	-	-	-	-	2.2
	G/E/NP	0.0	-	-	-	-	0.0
Verified Gross Demand Savings (MW)	Low-Income	1.9	-	-	-	-	1.9
	G/E/NP	0.0	-	-	-	-	0.0
Demand Savings RR	Low-Income	0.85	-	-	-	-	0.85
	G/E/NP	0.00	-	-	-	-	0.00

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.2.2 Gross Impact Evaluation

The Low-Income EE Program's gross impact evaluation activities relied on different approaches tailored to each solution's unique characteristics to verify the reported PY8 gross savings values. First, each solution's program tracking data was reviewed to verify proper application of TRM algorithms in reported savings values. The Navigant team completed these reviews for the full population of implemented PY8 Low-Income EE Program measures. Next, the team identified appropriate evaluation activities for each solution depending on the nature of the participants, implementation strategies, and the level of information accompanying the reported savings. The goal of the evaluation activities included verifying the implementation of a given measure occurred.

The evaluation activities varied for each solution and for specific strata within some solutions. Activities included engineering file reviews of program applications and invoices, participant phone verifications, Geographic Information Systems (GIS) surveys, billing and regression analyses, or a combination of these activities. Consistent with PECO's Phase III Evaluation Plan, there were no Low-Income EE Program site visits in PY8; there will be site visits for the Whole Home Solution in PY9.

Navigant then drew samples from each solution for these gross impact evaluation activities. The team developed and sought approval for representative samples that complied with the Phase III Evaluation Framework, the PA TRM, and industry standards, and that helped PECO meet the SWE and Commission requirements.

The following provides a summary of the activities conducted for each solution and for specific components or sampled strata within a given solution. Appendix D also contains additional detail on the gross impact evaluation approaches used for the individual solutions of the Low-Income EE Program.

- Whole Home Solution
    - Engineering file reviews

  - Phone verification (for projects with direct installation measures only)
- Lighting Solution
  - Invoice reviews and record-level savings calculations
  - GIS analysis to assess customer income level

Table 3-31 provides the sampling frame for the gross impact evaluation of the Low-Income EE Program in PY8.

Table 3-31. Low-Income EE Program Gross Impact Sample Design for PY8

Stratum Solution	Stratum Name	Percentage of Program Reported Savings	Population Size	Achieved Sample Size	Verification Method
Whole Home	Giveaways	27%	N/A	10	Phone Verification
	Small Direct Install	18%	7,279	12	Phone Verification
	Large Direct Install	15%	1,466	13	Phone Verification
	Multifamily	2%	40	5	Phone Verification
	Swaps	0%	N/A	1,500	Phone Verification
	LIURP	18%	N/A	25	Phone Verification
	Refrigerator	3%	556	164	Phone Verification
	Freezer	0%	83	47	Phone Verification
	Room Air Conditioner	0%	52	10	Phone Verification
	Solution Total	**84%**	**9,476**	**1,786**	**Phone Verification**
Lighting	**Solution Total**	**16%**	**N/A**	**100,000**	**Phone Verification**
Total Program	**All**	**100%**	**N/A**	**101,786**	**Phone Verification**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-32 provides a summary of reported and verified energy (MWh) savings results, along with the C_v and relative precision for each stratum sampled for the Low-Income EE Program in PY8.

Table 3-32. Low-Income EE Program Gross Energy Savings Impact Evaluation Results for PY8

Stratum Solution	Stratum Name	Reported Gross Energy Savings (MWh)	Verified Gross Energy Savings (MWh)	Energy RR	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Whole Home	Giveaways	5,393	5,393	1.00	N/A	0.00	0.00
	Small Direct Install	3,567	3,567	1.00	0.08	0.03	0.04
	Large Direct Install	3,061	2,973	0.97	0.04	0.02	0.02
	Multifamily	465	404	.87	0.23	0.17	0.20
	Swaps	4	4	1.00	N/A	1.00	1.00
	LIURP	3,620	3,325	0.92	N/A	0.00	0.00
	Refrigerator	533	512	0.96	N/A	0.00	0.00
	Freezer	72	57	0.79	N/A	0.00	0.00
	Room Air Conditioner	8	8	1.00	N/A	0.00	0.00
	Solution Total	**16,723**	**16,244**	**0.97**	**0.35**	**0.01**	**0.01**
Lighting	**Solution Total**	**3,141**	**3,141**	**1.00**	**N/A**	**N/A**	**N/A**
Total Program	**All**	**19,865**	**19,384**	**0.98**	**N/A**	**0.01**	**0.01**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-33 provides a summary of reported and verified demand (MW) savings results, along with the C_v and relative precision for each stratum sampled for the Low-Income EE Program in PY8.

Table 3-33. Low-Income EE Program Gross Demand Savings Impact Evaluation Results for PY8

Stratum Solution	Stratum Name	Reported Gross Demand Savings (MW)	Verified Gross Demand Savings (MW)	Demand RR	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Whole Home	Giveaways	0.6	0.6	1.00	N/A	0.00	0.00
	Small Direct Install	0.4	0.4	1.00	0.37	0.17	0.19
	Large Direct Install	0.3	0.3	0.98	0.03	0.01	0.02
	Multifamily	0.1	0.0	0.84	0.40	0.30	0.36
	Swaps	0.0	0.0	1.00	N/A	1.00	1.00
	LIURP	0.4	0.4	0.89	N/A	0.00	0.00
	Refrigerator	0.1	0.1	0.93	N/A	0.00	0.00
	Freezer	0.0	0.0	0.78	N/A	0.00	0.00
	Room Air Conditioner	0.0	0.0	1.00	N/A	0.00	0.00
	Solution Total	**1.9**	**1.8**	**0.96**	**N/A**	**0.04**	**0.04**
Lighting	**Solution Total**	**0.4**	**0.4**	**1.00**	**N/A**	**0.00**	**0.00**
Total Program	**All**	2.2	2.2	**0.97**	**N/A**	**0.03**	**0.03**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The overall evaluation resulted in small adjustments to reported savings. Additionally, the Lighting Solution evaluation resulted in a reduction in Low-Income EE Program savings allocated to the Low-Income carve-out. Specific factors leading to variations between the reported and verified savings and the observed realization rates for the Low-Income EE Program are detailed in Appendix E for each solution.

3.2.3 Net Impact Evaluation

Net impacts were not assessed for the Low-Income EE Program.

3.2.3.1 High Impact Measure Research

HIMs represent measure categories or technologies of high importance. In Phase III, the SWE suggested EDCs oversample HIMs to help program planners make decisions concerning those measures for downstream programs only. EDCs are to identify three to five measures for study each program year based on energy impact, level of uncertainty, prospective value, funding, or other parameters.

There were no HIM measures included in the Low-Income EE Program evaluation.

3.2.4 Verified Savings Summary by Solution

Table 3-34 shows the participation and incentive spending results for the Low-Income EE Program at the solution level.

Table 3-34. Summary Statistics for Low-Income EE Program by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Lighting	56,327	-	-	-	-	56,327
	Whole Home	8,058	-	-	-	-	8,058
	Program Total	**64,385**	**-**	**-**	**-**	**-**	**64,385**
Incentive Spending ($1,000)	Lighting	323	-	-	-	-	323
	Whole Home	27	-	-	-	-	27
	Program Total	**350**	**-**	**-**	**-**	**-**	**350**

Note: Costs associated with direct install measures are categorized as costs and not incentives for reporting purposes.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-35 shows the summary of reported and verified energy (MWh) savings results by solution.

Table 3-35. Summary of Low-Income EE Program Incremental Annual Gross Energy Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Lighting	3,141.3	-	-	-	-	3,141.3
	Whole Home	16,723.5	-	-	-	-	16,723.5
	Program Total	**19,864.8**	**-**	**-**	**-**	**-**	**19,864.8**
Verified Gross Energy Savings (MWh)	Lighting	3,141.3	-	-	-	-	3,141.3
	Whole Home	16,243.8	-	-	-	-	16,243.8
	Program Total	**19,385.1**	**-**	**-**	**-**	**-**	**19,385.1**
Energy RR	Lighting	1.00	-	-	-	-	1.00
	Whole Home	0.97	-	-	-	-	0.97
	Program Total	**0.98**	**-**	**-**	**-**	**-**	**0.98**
Relative Precision of Verified Gross Energy Savings at 90% Confidence Interval	Lighting	0.00	-	-	-	-	0.00
	Whole Home	0.01	-	-	-	-	0.01
	Program Total	**0.01**	**-**	**-**	**-**	**-**	**0.01**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-36 shows the summary of reported and verified demand (MW) savings results by solution.

Table 3-36. Summary of Low-Income EE Program Demand Savings by Solution

Parameter	Solution/ Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Lighting	0.4	-	-	-	-	0.4
	Whole Home	1.9	-	-	-	-	1.9
	Program Total	**2.2**	**-**	**-**	**-**	**-**	**2.2**
Verified Gross Demand Savings (MW)	Lighting	0.4	-	-	-	-	0.4
	Whole Home	1.8	-	-	-	-	1.8
	Program Total	**2.2**	**-**	**-**	**-**	**-**	**2.2**
Demand Savings RR	Lighting	1.00	-	-	-	-	1.00
	Whole Home	0.96	-	-	-	-	0.96
	Program Total	**0.97**	**-**	**-**	**-**	**-**	**0.97**

Parameter	Solution/ Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Relative Precision of Verified Gross Demand Savings at 90% Confidence Interval	Lighting	0.00	-	-	-	-	0.00
	Whole Home	0.04	-	-	-	-	0.04
	Program Total	**0.03**	**-**	**-**	**-**	**-**	**0.03**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-37 provides a summary of the verified lifetime energy (MWh) savings results by solution.

Table 3-37. Summary of Low-Income EE Program Lifetime Energy Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Lifetime Gross Energy Savings (MWh)	Lighting	25,221.5	-	-	-	-	25,221.5
	Whole Home	116,664.9	-	-	-	-	116,664.9
	Program Total	**141,886.4**	**-**	**-**	**-**	**-**	**141,886.4**
Verified Lifetime Net Energy Savings (MWh)	Lighting	25,221.5	-	-	-	-	25,221.5
	Whole Home	94,498.6	-	-	-	-	94,498.6
	Program Total	**119,720.1**	**-**	**-**	**-**	**-**	**119,720.1**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.2.5 Process Evaluation

Due to significant change in the PECO portfolio design for Phase III, Navigant performed early feedback process evaluation tasks for the Low-Income EE Program and its solutions during PY8 to capture a clear assessment of how the program started the phase. The objective was to provide PECO with rapid and specific feedback about the program design and to inform targeted process evaluation objectives for subsequent evaluation years. This included in-depth interviews with key PECO and CSP staff and a detailed review of program materials including program databases, tracking systems, and other documents. The PY8 evaluation also included residential participant phone surveys for the Whole Home Solution. This section summarizes the evaluation methods, data collection techniques, sample design, and key results related to these PY8 activities.

The PECO and CSP staff provided essential information about the program design and how the program experience on the ground compares with the EE&C Plan. The Navigant team conducted in-depth interviews at the beginning of the PY8 evaluation and communicated with staff on an ongoing basis as

needed. The team developed interview instruments to include questions of interest for the evaluation and to allow for free-flowing conversations to obtain candid feedback from the interviewees.

In addition to interviews with staff and CSPs, Navigant conducted a phone survey of a sample of participants to support savings verification, explore customer satisfaction and experience with the program, and to inform the NTG analysis. The survey instrument was developed according to SWE requirements and was reviewed and approved by the SWE in advance of fielding. Navigant developed a sample sufficient to provide 85/15 confidence/precision at the solution level for the survey results.

As of the writing of this report, Navigant is in the process of developing program process and customer journey maps for the Whole Home Solution to document the program's intended approach and to help assess customer experiences.

The following provides a summary of the process evaluation activities conducted for both Low-Income EE solutions.

- Lighting Solution
    - PECO and CSP staff interviews
    - Program materials review
    - GIS analysis to assess customer income level
- Whole Home Solution
    - PECO and CSP staff interviews
    - Program materials review
    - Phone survey: Navigant used phone surveys to assess how customers heard about the PECO Low-Income EE Program and Whole Home Solution, their satisfaction with the program, solution, and PECO overall, and awareness of other PECO solutions. Additionally, PECO participants were surveyed to identify variances in customer experiences between the Free CFL and Free Home Energy Check-Up activities within the Whole Home Solution. Net impacts were not calculated for the Low-Income EE Program.

Table 3-38. Low-Income EE Program Customer Phone Survey Sample Design for PY8

Low-Income EE Program Component	Stratum	Population Size	Target Sample Size	Achieved Sample Size
Free Home Energy Checkup	Comprehensive: Very Small Single-Family (<350 kWh)	2,893	10	5
	Comprehensive: Small Single-Family (350-1,250 kWh)	4,386	40	41
	Comprehensive: Large Single-Family (>1,250 kWh)	1,466	40	47
	Comprehensive: Multifamily (all)	40	10	20
Free CFL Bulb	Giveaway (all)	8,074	100	100
	Total	**16,859**	**200**	**213**

Survey samples were designed to achieve 15% relative precision at the 85% confidence level at the solution level for NTG ratios and satisfaction ratings.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.2.5.1 Key Findings from Process Evaluation

PECO made significant changes to the Low-Income EE Program and solutions for Phase III to ensure an improved program experience for low-income customers. The most significant change was adding an upstream Lighting Solution to reach customers in neighborhoods with high participation in the Customer Assistance Program (CAP). Other changes included the following:

- Shift from program-/solution-specific marketing and phone support to a centralized marketing entity—the EEMF and call center for managing Whole Home Solution outreach and scheduling activities.
- The Phase II Low-Income Energy Efficiency Program (LEEP) components were replaced with an umbrella Whole Home Solution, which coordinates a set of activities in support of low-income customers. These activities include the following:
    - Free Home Energy Check-Ups, providing site visits, education, and direct installation of energy efficient products
    - Collaboration with property owners to deliver services to low-income customers living in multifamily buildings, consistent with the Home Energy Check-Up
    - CFL and LED lighting giveaways through community events in collaboration with community partner organizations
    - Collaboration with the Low-Income Usage Reduction Program (LIURP), providing complementary lighting products to the LIURP service offering
    - Direct referrals to the Appliance Recycling Solution

Neither of the Low-Income EE Program solutions met their PY8 savings goals, nor was the Low-Income carve-out forecast achieved. Early feedback process evaluation research indicates that the shortfall is

likely a result of several complex factors that are sometimes, but not always, solution specific. For example, in Phase II, the Low-Income CSP was solely responsible for outbound calling to generate site visits for LEEP. In PY8, the EEMF marketing plan called for increased promotional activities to generate customer interest, including promotional signs on buses and bus stations, direct mail, etc. This shift, in combination with a new portfolio-wide call center focused primarily on managing incoming calls rather than outbound calls for the Low-Income EE Program, caused a delay in new customer enrollment. See Appendix E for more discussion of solution-level findings, including results from the Whole Home Solution survey.

3.2.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-39. TRC benefits were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 3-39. Summary of Low-Income EE Finances – Gross Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	4,100	-	-	-	-	4,100
	EDC Incentives to Trade Allies	0	-	-	-	-	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	-55	-	-	-	-	-55
	Cost Subtotal	**4,045**	**-**	**-**	**-**	**-**	**4,045**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	-	-	-	-	0
	Design and Development (CSP Costs) [2]	0	-	-	-	-	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	75	-	-	-	-	75
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	-	-	-	-	0
	Marketing (EDC Costs) [4]	645	-	-	-	-	645
	Marketing (CSP Costs) [4]	0	-	-	-	-	0
	Program Delivery (EDC Costs) [5]	0	-	-	-	-	0
	Program Delivery (CSP Costs) [5]	2,840	-	-	-	-	2,840
	EDC Evaluation Costs	0	-	-	-	-	0
	SWE Audit Costs	0	-	-	-	-	0
	Cost Subtotal	**3,560**	**-**	**-**	**-**	**-**	**3,560**

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	-	-	-	-	0
	Cost Subtotal	**0**	**-**	**-**	**-**	**-**	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**7,605**	**-**	**-**	**-**	**-**	**7,605**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	4,260	-	-	-	-	4,260
	Lifetime Electric Capacity Benefits	1,183	-	-	-	-	1,183
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	867	-	-	-	-	867
	Benefits Total	**6,310**	**-**	**-**	**-**	**-**	**6,310**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.83**	**-**	**-**	**-**	**-**	**0.83**

[1] Includes direct install equipment costs and costs for EE&C kits.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

*Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-40 presents program financials and cost-effectiveness on a net savings basis.

Table 3-40. Summary of Low-Income EE Finances – Net Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	4,100	-	-	-	-	4,100
	EDC Incentives to Trade Allies	0	-	-	-	-	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	-55	-	-	-	-	-55
	Cost Subtotal	**4,045**	**-**	**-**	**-**	**-**	**4,045**

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	-	-	-	-	0
	Design and Development (CSP Costs) [2]	0	-	-	-	-	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	75	-	-	-	-	75
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	-	-	-	-	0
	Marketing (EDC Costs) [4]	645	-	-	-	-	645
	Marketing (CSP Costs) [4]	0	-	-	-	-	0
	Program Delivery (EDC Costs) [5]	0	-	-	-	-	0
	Program Delivery (CSP Costs) [5]	2,840	-	-	-	-	2,840
	EDC Evaluation Costs	0	-	-	-	-	0
	SWE Audit Costs	0	-	-	-	-	0
	Cost Subtotal	**3,560**	**-**	**-**	**-**	**-**	**3,560**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	-	-	-	-	0
	Cost Subtotal	**0**	-	-	-	-	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**7,605**	**-**	**-**	**-**	**-**	**7,605**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	3,593	-	-	-	-	3,593
	Lifetime Electric Capacity Benefits	1,001	-	-	-	-	1,001
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	802	-	-	-	-	802
	Benefits Total	**5,395**	**-**	**-**	**-**	**-**	**5,395**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.71**	**-**	**-**	**-**	**-**	**0.71**

[1] Includes direct install equipment costs and costs for EE&C kits.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at

marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

*Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.2.7 Status of Recommendations

The impact and process evaluation activities in PY8 led to the following findings and recommendations from Navigant to PECO, along with a summary of how PECO plans to address the recommendation in program delivery. For further discussion about each solution-level finding and recommendation, see Table 3-31.

Table 3-41. Summary of Findings and Recommendations for Residential Low-Income EE Program

Solution	Finding	Recommendation	EDC Status
Lighting	The concentration of low-income households in PECO territory is not uniform and not all retailer participants are well positioned geographically to deliver savings to qualifying households.	PECO and the CSP should shift low performing retailers (in terms of low-income participation, shown in red dots in Figure E-1 to the Residential EE Program Lighting Solution.	PECO will identify low performing stores and allocate the savings to the Residential Program Lighting.
Lighting	There are likely unidentified retailers that are not program participants but are well positioned to reach low-income populations.	PECO and the CSP should update the process for choosing low-income retailer participants to incorporate the most recent census data and GIS methods.	PECO will work with CSP to update process using the latest census data.
Lighting	Some participating retailers are well positioned to deliver increased savings to low-income households.	The CSP should consider how to drive more savings through high performing participating retailers by increasing awareness of program activities among customers through marketing and in-store implementation tactics.	PECO will work with CSP to allocate more savings to the higher performing stores through marketing tactics.
Whole Home	Free CFL activity participants are not aware of other PECO programs, including the Free Energy Check-Up activity.	The CSP should increase education for Free CFL Bulb Activity customers to inform them of PECO programs, particularly the Free Home Energy Check-Up.	PECO has implemented this recommendation and increased customer education.

Solution	Finding	Recommendation	EDC Status
Whole Home	Multifamily buildings are not identified in the tracking database.	PECO and the CSP should assign a multifamily building ID for projects that are in the same multifamily building.	Being implemented. PECO is investigating a variety of ways to identify multifamily customers and their residencies more easily. We have implemented a tracking mechanism of flagging all multifamily projects undergoing treatment in our tracking database.
Whole Home	255 Job_IDs in the measure table (Audit and Added Measures) have no associated customer information in the customer table.	The CSP should develop quality assurance processes to ensure data is complete and accurate.	PECO is implementing QC processes to ensure data validations.
Whole Home	Tracking database date entries are either erroneous or are unnecessary.	PECO and the CSP should review and update the database "Date" field inputs for relevance to individual projects and program management.	PECO is implementing QC processes to ensure data validations.
Whole Home	The Phase III customer marketing campaign has not generated the volume of incoming customer calls needed, and the call center has not prioritized outbound calls for this market.	PECO should continue to conduct outbound calling to customers and clarify responsibilities among stakeholders (CSP and call center).	PECO is already implementing this recommendation.
Whole Home	Program staff has identified opportunities to collaborate with complementary programs and initiatives to increase participation.	PECO and the CSP should continue to be innovative in identifying opportunities to collaborate with community, non-profit, governmental, and utility organizations to identify and encourage low-income household participation.	PECO is proactively working with PGW, PWD, and PEA to collaborate in delivering the customers one stop shop opportunities to lower their utility bills.

Source: Navigant analysis

3.3 Small C&I EE Program

The Small C&I EE Program offers a comprehensive and cross-cutting array of opportunities to assist small C&I customers in reducing their energy consumption and costs. The program encompasses a variety of energy solutions and measures to achieve this goal. The Small C&I EE Program is made up of four solutions and two targeted market segments, shown with the solution and segment implementers below:

- Equipment and Systems Solution – ICF
- New Construction Solution – ICF
- Whole Building Solution – SmartWatt
- Behavioral Solution – not implemented in PY8

- Data Centers Targeted Market Segment – ICF
- Multifamily Targeted Market Segment – Franklin

The Behavioral Solution was not implemented in PY8 and had no corresponding evaluation activities. The Data Centers Targeted Market Segment had no participation in PY8.

Common measures within the Small C&I EE Program include efficient lighting equipment, lighting controls, HVAC equipment, variable frequency drives (VFDs), refrigeration, and building automation systems, among others. Several solutions cut across multiple programs, and participation rules vary according to program rules. Appendix F contains additional detail on the individual solutions including descriptions of major measures, CSPs, and how participants are counted.

3.3.1 Participation and Reported Savings by Customer Segment

This section provides the Small C&I EE Program results for PY8, including participation, energy and demand savings, and incentive costs. Table 3-42 presents the participation counts and incentive payments for the Small C&I EE Program in PY8 by customer segment.

Table 3-42. Summary Statistics for Small C&I EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Residential	0	-	-	-	-	0
	Small C&I	656	-	-	-	-	656
	Large C&I	0	-	-	-	-	0
	Total	**656**	**-**	**-**	**-**	**-**	**656**
Incentive Spending ($1,000)	Residential	0	-	-	-	-	0
	Small C&I	650	-	-	-	-	650
	Large C&I	0	-	-	-	-	0
	Total	**650**	**-**	**-**	**-**	**-**	**650**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-43 provides a summary of reported, verified, and net energy (MWh) savings results by customer sector for the Small C&I EE Program for PY8.

Table 3-43. Summary of Energy Savings for Small C&I EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Residential	0.0	-	-	-	-	0.0
	Small C&I	17,782.8	-	-	-	-	17,782.8
	Large C&I	0.0	-	-	-	-	0.0
	Total	**17,782.8**	**-**	**-**	**-**	**-**	**17,782.8**

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Gross Energy Savings (MWh)	Residential	0.0	-	-	-	-	0.0
	Small C&I	17,136.6	-	-	-	-	17,136.6
	Large C&I	0.0	-	-	-	-	0.0
	Total	**17,136.6**	**-**	**-**	**-**	**-**	**17,136.6**
Energy Savings RR	Residential	0.00	-	-	-	-	0.00
	Small C&I	0.96	-	-	-	-	0.96
	Large C&I	0.00	-	-	-	-	0.00
	Total	**0.96**	**-**	**-**	**-**	**-**	**0.96**
Verified Net Energy Savings (MWh)	Residential	0.0	-	-	-	-	0.0
	Small C&I	12,804.0	-	-	-	-	12,804.0
	Large C&I	0.0	-	-	-	-	0.0
	Total	**12,804.0**	**-**	**-**	**-**	**-**	**12,804.0**
NTG Ratio	Residential	0.00	-	-	-	-	0.00
	Small C&I	0.75	-	-	-	-	0.75
	Large C&I	0.00	-	-	-	-	0.00
	Total	**0.75**	**-**	**-**	**-**	**-**	**0.75**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-44 provides the reported and verified demand (MW) savings results for the Small C&I EE Program for PY8.

Table 3-44. Summary of Demand Savings for Small C&I EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Residential	0.0	-	-	-	-	0.0
	Small C&I	2.9	-	-	-	-	2.9
	Large C&I	0.0	-	-	-	-	0.0
	Total	**2.9**	**-**	**-**	**-**	**-**	**2.9**
Verified Gross Demand Savings (MW)	Residential	0.0	-	-	-	-	0.0
	Small C&I	2.8	-	-	-	-	2.8
	Large C&I	0.0	-	-	-	-	0.0
	Total	**2.8**	**-**	**-**	**-**	**-**	**2.8**
Demand Savings RR	Residential	0.00	-	-	-	-	0.00
	Small C&I	0.94	-	-	-	-	0.94
	Large C&I	0.00	-	-	-	-	0.00
	Total	**0.94**	**-**	**-**	**-**	**-**	**0.94**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-45 shows the participation and incentive spending for the low-income and government/education/non-profit (G/E/NP) sector carve-outs.

Table 3-45. Summary Statistics for Small C&I EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Low-Income	0	-	-	-	-	0
	G/E/NP	44	-	-	-	-	44
Incentive Spending ($1,000)	Low-Income	0	-	-	-	-	0
	G/E/NP	84	-	-	-	-	84

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-46 shows the reported, verified, and net energy (MWh) savings results for the sector carve-outs.

Table 3-46. Summary of Energy Savings for Small C&I EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	1,673.9	-	-	-	-	1,673.9
Verified Gross Energy Savings (MWh)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	1,597.2	-	-	-	-	1,597.2
Energy Savings RR	Low-Income	0.00	-	-	-	-	0.00
	G/E/NP	0.95	-	-	-	-	0.95
Verified Net Energy Savings (MWh)	Low-Income	0.0	-	-	-	-	0
	G/E/NP	1,148.4	-	-	-	-	1,148.4
NTG Ratio	Low-Income	0.00	-	-	-	-	0.00
	G/E/NP	0.72	-	-	-	-	0.72

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-47 shows the reported and verified demand (MW) savings results for the sector carve-outs.

Table 3-47. Summary of Demand Savings for Small C&I EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	0.0	-	-	-	-	0.0
Verified Gross Demand Savings (MW)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	0.0	-	-	-	-	0.0
Demand Savings RR	Low-Income	0.00	-	-	-	-	0.00
	G/E/NP	0.89	-	-	-	-	0.89

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.3.2 Gross Impact Evaluation

In PY8, the Small C&I gross impact evaluation consisted of a combination of desk reviews, phone verifications, onsite verifications, and onsite metering for a sample of projects. Summaries of verification activities for each solution and targeted market segment follow:

Equipment and Systems. The evaluation team conducted ex post verification for 43 projects in the Small C&I Equipment and Systems PY8 evaluation sample. The verification of these 43 projects aligns with the Small C&I Evaluation Plan for Phase III, which called for a total Small C&I Equipment and Systems sample of 40 projects.

New Construction. The evaluation team conducted ex post verification for 17 projects in the New Construction Solution. The New Construction sample includes a combination of both Small C&I and Large C&I projects, and a combined sample will be conducted across PY8 and PY9. The PY8 sample includes seven Small C&I projects and 10 Large C&I projects. The verification of these 17 projects aligns with the Small and Large C&I Evaluation Plans for Phase III, which calls for a total New Construction sample of 36 projects across the 2-year period.

Multifamily Targeted Market Segment. The evaluation team conducted ex post verification for 70 projects in the Multifamily Targeted Market Segment PY8 evaluation sample. The Evaluation Plan for Phase III called for a total Multifamily targeted sample of 89 projects. Due to limited access at certain sites, 19 projects were not verified.

Whole Building, Behavioral, and Data Centers. There were no impact verification activities for the Whole Building Solution, Data Centers Targeted Market Segment, or Behavioral Solution in PY8. The Behavioral Solution was not implemented in PY8, and there was no participation in the Data Centers Targeted Market Segment in PY8. Whole Building impact verification is set to begin in PY9.

Appendix F contains additional details on the gross impact evaluation process and methodology for individual solutions.

Table 3-48. Small C&I EE Program Gross Impact Sample Design for PY8

Stratum Solution	Stratum Name	Percentage of Program Reported Savings	Population Size	Achieved Sample Size	Verification Method
Equipment and Systems	Large Projects	27%	20	12	Onsite Verification and/or Onsite Metering
	Medium Projects	29%	58	17	Onsite Verification or Phone Verification
	Small Projects	26%	257	14	Phone Verification
	Very Small Projects	1%	99	0	None
	Solution Total	**84%**	**434**	**43**	
New Construction	Large Projects	3%	1	1	Onsite Verification and/or Onsite Metering
	Medium Projects	0%	0	0	Onsite Verification or Phone Verification
	Small Projects	8%	14	6	Phone Verification

Stratum Solution	Stratum Name	Percentage of Program Reported Savings	Population Size	Achieved Sample Size	Verification Method
	Very Small Projects	1%	8	0	None
	Solution Total	**12%**	**23**	**7**	
Multifamily Targeted	Large – Small and Large C&I Projects	1%	250	13	Onsite Verification
	Small – Small and Large C&I Projects	2%	199	2	Onsite Verification
	Solution Total	**4%**	**496**	**24**	
Total Program	**All**	**100%**	**-**	**-**	

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-49 provides a summary of reported and verified energy (MWh) savings results, along with the C_v and relative precision for each stratum sampled for the Small C&I EE Program in PY8.

Overall, the Small C&I EE Program achieved PY8 gross realization rates of 0.96 for energy and 0.94 for demand. The program-level relative precision was 5.1% at 90% confidence for energy and 5.8% at 90% confidence for demand. The goal of 15% precision at 85% confidence was met for both energy and demand. Some solutions within the Small C&I program involve evaluations over a two-year sampling period. Navigant will follow its predefined sampling plan to ensure the two-year goals for relative precision are also achieved.

Table 3-49. Small C&I EE Program Gross Energy Savings Impact Evaluation Results for PY8

Stratum Solution	Stratum Name	Reported Gross Energy Savings (MWh)	Verified Gross Energy Savings (MWh)	Energy RR	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Equipment and Systems	Large Projects	4,165.3	3,227.5	0.77	0.56	0.16	0.18
	Medium Projects	4,502.6	4,775.1	1.06	0.26	0.08	0.09
	Small and Very Small Projects	4,262.5	4,405.2	1.03	0.24	0.10	0.11
	Solution Total	**12,930.4**	**12,407.8**	**0.96**	**N/A**	**0.06**	**0.07**
New Construction	Large Projects	525.5	525.5	1.00	N/A	0.00	0.00
	Medium Projects	-	-	-	-	-	-
	Small and Very Small Projects	1,296.5	1,348.0	1.04	0.12	0.07	0.08
	Solution Total	**1,822.1**	**1,873.5**	**1.03**	**N/A**	**0.05**	**0.06**
Multifamily Targeted	Large – Small and Large C&I Projects	150.2	141.7	0.94	0.00	0.00	0.00
	Small – Multisector, Large and Small C&I Projects	336.1	232.0	0.69	0.69	0.61	0.74
	Small – Small and Large C&I Projects	192.8	200.9	1.04	0.01	0.01	0.02
	Solution Total	**679.1**	**574.6**	**0.85**	**N/A**	**0.21**	**0.25**
Whole Building	**Solution Total**	**2,351.2**	**2,280.6**	**0.97**	**N/A**	**0.10**	**0.12**
Total Program	**All**	**17,782.8**	**17,136.6**	**0.96**	**N/A**	**0.05**	**0.05**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-50 provides a summary of reported and verified demand (MW) savings results, along with the C_v and relative precision for each stratum sampled for the Small C&I EE Program in PY8.

Table 3-50. Small C&I EE Program Gross Demand Savings Impact Evaluation Results for PY8

Stratum Solution	Stratum Name	Reported Gross Demand Savings (MW)	Verified Gross Demand Savings (MW)	Demand RR	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Equipment and Systems	Large Projects	0.8	0.6	0.75	0.67	0.19	0.22
	Medium Projects	0.8	0.8	1.07	0.28	0.09	0.10
	Small and Very Small Projects	0.5	0.5	0.98	0.25	0.10	0.12
	Solution Total	**2.1**	**1.9**	**0.92**	**N/A**	**0.07**	**0.08**
New Construction	Large Projects	0.1	0.1	1.00	N/A	0.00	0.00
	Medium Projects	-	-	-	-	-	-
	Small and Very Small Projects	0.3	0.3	1.01	0.17	0.10	0.12
	Solution Total	**0.4**	**0.4**	**1.01**	**N/A**	**0.07**	**0.09**
Multifamily Targeted	Large – Small and Large C&I Projects	0.0	0.0	0.94	N/A	0.00	0.00
	Small – Multisector, Large and Small C&I Projects	0.0	0.0	0.71	1.11	0.97	1.18
	Small – Small and Large C&I Projects	0.0	0.0	1.20	0.06	0.15	0.23
	Solution Total	**0.1**	**0.1**	**0.91**	**N/A**	**0.32**	**0.38**
Whole Building	**Solution Total**	**0.4**	**0.4**	**0.97**	**N/A**	**0.07**	**0.08**
Total Program	**All**	**2.9**	**2.8**	**0.94**	**NA**	**0.05**	**0.06**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The majority of the 43 Small C&I Equipment and Systems projects and seven New Construction projects achieved RRs for both demand and energy within 20% of the expected values. Seventeen projects had verified savings values fall above 120% or below 80% of the reported values, either for energy or demand savings. Navigant analyzed these projects to capture any trends in the verified data. The following factors led to variation between the reported and verified savings and to the observed RRs.

- The most significant change between ex ante and ex post calculations was in annual hours of use. Five of the 17 flagged projects reported annual runtime that was significantly different from the reported values. In many cases, ex ante calculations reported a deemed savings value based on building type, but ex post verification revealed runtime that was more than 10% different. Navigant uncovered discrepancies both higher and lower than reported.
- The second most important factor causing RR discrepancies was inaccurate pre- or post-retrofit lighting equipment specified in ex ante TRM Appendix C documentation. In several cases, Navigant found strong evidence to suggest that baseline lighting equipment was of a different (typically more efficient) type, leading to greatly reduced realization rates in some cases. Five flagged projects had discrepancies between ex ante and ex post equipment specifications, while five had discrepancies in equipment quantities.
- Seven of the 17 flagged projects had different space conditioning types, either by reported values being incorrect or values reported as unknown at the time of ex ante analysis. While this was a common occurrence, a change in space conditioning type typically does not have a large impact upon savings values.
- Other minor Equipment and Systems or New Construction discrepancies were found but were either limited to one or two projects or their impacts were too minor to reflect upon the overall population.
- The most common discrepancy for Multifamily Targeted Market Segment projects was a mismatch in the quantities of expected and verified lighting measures. Navigant found anecdotal and visual evidence that the efficient bulbs were out of operation in a matter of days or a few months and were not found in the sockets during onsite evaluation.

3.3.3 Net Impact Evaluation

The Small C&I EE Program net impact evaluation activities used several methods to estimate free ridership, spillover, market effects, and NTG ratios for each solution. Navigant relied on consistent, crosscutting approaches as well as ones tailored to certain solutions' unique characteristics. The primary objective of the net savings analysis was to determine the program's net effect on customer electricity usage. Navigant derived net program impacts by estimating a NTG ratio that quantifies the percentage of the gross program impacts that can reliably be attributed to the program.

Free ridership is defined as those participants who would have implemented a measure or purchased equipment anyway, without program support or a rebate. The key questions determining free ridership focus on the influence of key program interventions. These interventions vary by solution but can include discounted prices and program information regarding efficient products, as well as the customer's perception of what they would most likely have done in the absence of the program.

Spillover is defined as those participants who were influenced by the program to purchase and install additional energy efficient equipment that saves electricity without a rebate or other program support. The evaluation team analyzed participant responses to a battery of spillover questions. The intent of these

questions was to identify what types and amounts of equipment customers purchased and installed on their own to inform a quantitative estimate of program spillover within the overall NTG calculation.

Market effects represent a change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of EE products, services, or practices and is casually related to market intervention(s).

PECO program and solution participants were surveyed in-person or via phone to gather information about free ridership and spillover. Navigant developed survey instruments consistent with the Phase III Evaluation Framework's guidance on net impact evaluation techniques[33] and guidance from the Uniform Methods Project on estimating net savings.[34] The team carefully reviewed and managed samples across solutions to reduce the likelihood that a respondent participating in multiple solutions during PY8 would be called multiple times to respond to the survey. Survey instruments also captured feedback about customer experiences from participants to inform the process evaluation. Many solutions or strata within solutions also added question batteries to the phone surveys or site visits to inform the gross impact verification.

The only Small C&I component to conduct a NTG evaluation in PY8 was the Multifamily Targeted Market Segment, whose NTG process is detailed in Section 3.1.3 in Table 3-13. In the case of the Equipment and Systems Solution, the C&I New Construction Solution, and the Whole Building Solution, NTG ratio values from PY7 were applied to PY8 gross impact evaluation results to calculate net savings. These solutions will conduct full NTG ratio calculations in PY9.

Details of the PY7 NTG methodology and calculations can be found in Sections 11.3 and 12.3 for the Equipment and Systems Solution, Section 13.2 for the New Construction Solution, and Section 16.3 for the Whole Building Solution of the PY7 annual report.

Table 3-51 provides the sampling frame for the net impact evaluation of the Small C&I EE Program in PY8.

[33] Phase III Evaluation Framework. Section 3.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

[34] The Uniform Methods Project. *Estimating Net Savings: Common Practices.* NREL. https://www.nrel.gov/docs/fy14osti/62678.pdf

Table 3-51. Small C&I EE Program Net Impact Sample Design for PY8

Stratum Solution	Stratum Name	Percentage of Program Reported Savings	Population Size	Achieved Sample Size	Response Rate	Verification Method
Equipment and Systems	Small C&I	64%	N/A	N/A	N/A	PY7 Smart Equipment Incentives NTGR
	Small G/E/NP	8%				
	Solution Total	**72%**	**N/A**	**N/A**	**N/A**	
New Construction	**Solution Total**	**11%**	**N/A**	**N/A**	**N/A**	PY7 Smart Construction Incentives NTGR
Whole Building	**Solution Total**	**13%**	**N/A**	**N/A**	**N/A**	PY7 Smart Business Solutions NTGR
Multifamily Targeted Market Segment	Landlord/Owners	3%	32	7	22.0%	Phone Survey
	Solution Total	**3%**	**32**	**7**	**22.0%**	Phone Survey
Total Program	**All**	**100%**	**32**	**7**	**-**	**-**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-52 provides a summary of reported and verified energy (MWh) savings results, the calculated NTG results, and the C_v and relative precision for each stratum sampled for the Small C&I EE Program in PY8.

Table 3-52. Small C&I EE Program Net Energy Savings Impact Evaluation Results for PY8

Solution Name	Stratum Name	Verified Gross Energy Savings (MWh)	Verified Net Energy Savings (MWh)	Free Ridership Rate	Spillover Rate	NTG Ratio	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Equipment and Systems	Small C&I	10,996.5	8,797.2	0.22	0.02	0.80	0.28	0.07	N/A
	Small G/E/NP	1,411.3	1,002.0	0.29	0.00	0.71	0.32	0.09	N/A
	Solution Total	**12,407.8**	**9,798.0**	**0.23**	**0.02**	**0.79**	**0.49**	**0.06**	**N/A**
New Construction	**Solution Total**	**1,873.5**	**580.8**	**0.69**	**0.00**	**0.31**	**0.50**	**0.10**	**N/A**
Whole Building	**Solution Total**	**2,280.6**	**2,052.6**	**0.10**	**0.00**	**0.90**	**N/A**	**0.03**	**N/A**
Multifamily Targeted Market Segment	Landlord/Owners	574.6	371.3	0.35	0.00	0.65	0.02	0.0	0.01
	Solution Total	**574.6**	**371.3**	**0.35**	**0.00**	**0.65**	**0.02**	**N/A**	**N/A**
Total Program	**All**	**17,136.6**	**12,813.1**	**0.27**	**0.01**	**0.75**	**N/A**	**0.05**	**0.05**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.3.3.1 High Impact Measure Research

HIMs represent measure categories or technologies of high importance. In Phase III, the SWE suggested EDCs oversample HIMs to help program planners make decisions concerning those measures for downstream programs only.[35] EDCs were to identify three to five measures for study within each program year based on energy impact, level of uncertainty, prospective value, funding, or other parameters. The SWE stated that HIMs should be sampled at 85% confidence and 15% absolute precision to ensure an adequate sample size for statistically valid, measure-level NTG estimates. Below is a description of the methodology used to determine the HIMs in PY8.

Navigant identified HIMs through several steps that involved careful review of program- and solution-level savings, energy impact, and value to PECO. In PY8, NTG research focused on the Multifamily Targeted Market Segment. The team reviewed savings across this segment and focused on measures based on both the measure category[36] and end-use subcategory to identify the types of measures falling under a category. The lighting measure category was flagged as a HIM, including the end-use subcategory of LEDs as shown in Table 3-53.

Table 3-53. Small C&I EE Program Savings by Measure Category and HIM End-Use Subcategory

Measure Names and End-Use Subcategories	Sum of kWh Savings	Percentage of Savings
Lighting	**15,253,281**	**91.0%**
LED	12,609,642	75.2%

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-54 presents NTG findings for HIMs for the Small C&I EE Program.

Table 3-54. Small C&I EE Program HIM NTG Summary

Small C&I HIM	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Multifamily: LEDs [1]	Free Ridership	0.35	-	-	-	-	0.35
	Spillover	0.00	-	-	-	-	0.00
	NTG Ratio	0.65	-	-	-	-	0.65

[1] The NTG estimates provided for LEDs are based on findings from interviews conducted with landlords participating in the Multifamily Targeted Market Segment aligning with guidance provided in Section 3.4.1.4 of the Phase III Evaluation Framework indicating that HIM research should focus on measures in downstream programs only.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

[35] Phase III Evaluation Framework. Section 3.4.1.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

[36] PECO Phase III data refers to measure categories as the "Measure Name."

3.3.4 Verified Savings Summary by Solution

Table 3-55 shows the participation and incentive spending results for the Small C&I Program at the solution level.

Table 3-55. Summary Statistics for Small C&I EE Program by Solution

Parameter	Solution/ Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Equipment and Systems	434	-	-	-	-	434
	New Construction	23	-	-	-	-	23
	Whole Building	136	-	-	-	-	136
	Behavioral	0	-	-	-	-	0
	Data Centers Targeted	0	-	-	-	-	0
	Multifamily Targeted	63	-	-	-	-	63
	Program Total	**656**	**-**	**-**	**-**	**-**	**656**
Incentive Spending ($1,000)	Equipment and Systems	542	-	-	-	-	542
	New Construction	108	-	-	-	-	108
	Whole Building	0	-	-	-	-	0
	Behavioral	0	-	-	-	-	0
	Data Centers Targeted	0	-	-	-	-	0
	Multifamily Targeted	0	-	-	-	-	0
	Program Total	**650**	**-**	**-**	**-**	**-**	**650**

Note: Costs associated with direct install measures are categorized as costs and not incentives for reporting purposes.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-56 shows the summary of reported and verified energy (MWh) savings results by solution.

Table 3-56. Summary of Small C&I EE Program Incremental Annual Gross Energy Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Equipment and Systems	12,930.4	-	-	-	-	12,930.4
	New Construction	1,822.1	-	-	-	-	1,822.1
	Whole Building	2,351.2	-	-	-	-	2,351.2
	Behavioral	0.0	-	-	-	-	0.0
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	679.1	-	-	-	-	679.1
	Program Total	**17,782.8**	**-**	**-**	**-**	**-**	**17,782.8**
Verified Gross Energy Savings (MWh)	Equipment and Systems	12,407.8	-	-	-	-	12,407.8
	New Construction	1,873.5	-	-	-	-	1,873.5
	Whole Building	2,280.6	-	-	-	-	2,280.6
	Behavioral	0.0	-	-	-	-	0.0
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	574.6	-	-	-	-	574.6
	Program Total	**17,136.6**	**-**	**-**	**-**	**-**	**17,136.6**
Energy RR	Equipment and Systems	0.96	-	-	-	-	0.96
	New Construction	1.03	-	-	-	-	1.03
	Whole Building	0.97	-	-	-	-	0.97
	Behavioral	0.00	-	-	-	-	0.00
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.85	-	-	-	-	0.85
	Program Total	**0.96**	**-**	**-**	**-**	**-**	**0.96**
Relative Precision of Verified Gross Energy Savings at 90% Confidence Interval	Equipment and Systems	0.07	-	-	-	-	0.07
	New Construction	0.06	-	-	-	-	0.06
	Whole Building	0.12	-	-	-	-	0.12
	Behavioral	0.00	-	-	-	-	0.00
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.25	-	-	-	-	0.25
	Program Total	**0.05**	**-**	**-**	**-**	**-**	**0.05**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-57 shows the verified net energy (MWh) savings results by solution along with the calculated NTG results for PY8.

Table 3-57. Summary of Small C&I EE Program Incremental Annual Net Energy Savings by Solution

Parameter	Solution/ Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Net Energy Savings (MWh)	Equipment and Systems	9,799.2	-	-	-	-	9,799.2
	New Construction	580.8	-	-	-	-	580.8
	Whole Building	2,052.6	-	-	-	-	2,052.6
	Behavioral	0.0	-	-	-	-	0.0
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	371.3	-	-	-	-	371.3
	Program Total	**12,804.0**	**-**	**-**	**-**	**-**	**12,804.0**
Free Ridership	Equipment and Systems	0.23	-	-	-	-	0.23
	New Construction	0.69	-	-	-	-	0.69
	Whole Building	0.10	-	-	-	-	0.10
	Behavioral	0.00	-	-	-	-	0.00
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.35	-	-	-	-	0.35
	Program Total	**0.27**	**-**	**-**	**-**	**-**	**0.27**
Spillover	Equipment and Systems	0.02	-	-	-	-	0.02
	New Construction	0.00	-	-	-	-	0.00
	Whole Building	0.00	-	-	-	-	0.00
	Behavioral	0.00	-	-	-	-	0.00
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.00	-	-	-	-	0.00
	Program Total	**0.01**	**-**	**-**	**-**	**-**	**0.01**
NTG Ratio	Equipment and Systems	0.79	-	-	-	-	0.79
	New Construction	0.31	-	-	-	-	0.31
	Whole Building	0.90	-	-	-	-	0.90
	Behavioral	1.00	-	-	-	-	1.00
	Data Centers Targeted	1.00	-	-	-	-	1.00
	Multifamily Targeted	0.65	-	-	-	-	0.65
	Program Total	**0.75**	**-**	**-**	**-**	**-**	**0.75**
Relative Precision of Verified Net Energy Savings at 90% Confidence Interval	Equipment and Systems	0.06	-	-	-	-	0.06
	New Construction	0.00	-	-	-	-	0.00
	Whole Building	0.00	-	-	-	-	0.00
	Behavioral	0.00	-	-	-	-	0.00
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.01	-	-	-	-	0.01
	Program Total	**0.05**	**-**	**-**	**-**	**-**	**0.05**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-58 shows the summary of reported and verified demand (MW) savings results by solution.

Table 3-58. Summary of Small C&I EE Program Demand Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Equipment and Systems	2.1	-	-	-	-	2.1
	New Construction	0.4	-	-	-	-	0.4
	Whole Building	0.4	-	-	-	-	0.4
	Behavioral	0.0	-	-	-	-	0.0
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	0.1	-	-	-	-	0.1
	Program Total	**2.9**	**-**	**-**	**-**	**-**	**2.9**
Verified Gross Demand Savings (MW)	Equipment and Systems	1.9	-	-	-	-	1.9
	New Construction	0.4	-	-	-	-	0.4
	Whole Building	0.4	-	-	-	-	0.4
	Behavioral	0.0	-	-	-	-	0.0
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	0.1	-	-	-	-	0.1
	Program Total	**2.8**	**-**	**-**	**-**	**-**	**2.8**
Demand Savings RR	Equipment and Systems	0.92	-	-	-	-	0.92
	New Construction	1.01	-	-	-	-	1.01
	Whole Building	0.97	-	-	-	-	0.97
	Behavioral	0.00	-	-	-	-	0.00
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.91	-	-	-	-	0.91
	Program Total	**0.94**	**-**	**-**	**-**	**-**	**0.94**
Relative Precision of Verified Gross Demand Savings at 90% Confidence Interval	Equipment and Systems	0.08	-	-	-	-	0.08
	New Construction	0.09	-	-	-	-	0.09
	Whole Building	0.08	-	-	-	-	0.08
	Behavioral	0.00	-	-	-	-	0.00
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.38	-	-	-	-	0.38
	Program Total	**0.06**	**-**	**-**	**-**	**-**	**0.06**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-59 provides a summary of the verified lifetime energy (MWh) savings results by solution.

Table 3-59. Summary of Small C&I EE Program Lifetime Energy Savings by Solution

Parameter	Solution/ Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Lifetime Gross Energy Savings (MWh)	Equipment and Systems	137,164.4	-	-	-	-	137,164.4
	New Construction	28,030.3	-	-	-	-	28,030.3
	Whole Building	32,382.2	-	-	-	-	32,382.2
	Behavioral	0.0	-	-	-	-	0.0
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	3,700.3	-	-	-	-	3,700.3
	Program Total	**201,277.1**	**-**	**-**	**-**	**-**	**201,277.1**
Verified Lifetime Net Energy Savings (MWh)	Equipment and Systems	108,314.1	-	-	-	-	108,314.1
	New Construction	8,689.4	-	-	-	-	8,689.4
	Whole Building	29,143.9	-	-	-	-	29,143.9
	Behavioral	0.0	-	-	-	-	0.0
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	2,391.3	-	-	-	-	2,391.3
	Program Total	**148,538.7**	**-**	**-**	**-**	**-**	**148,538.7**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.3.5 Process Evaluation

Due to significant change in the PECO portfolio design for Phase III, Navigant performed early feedback process evaluation tasks for the Small C&I EE Program and its solutions duringPY8 to capture a clear assessment of how the program started the phase and to provide PECO with rapid and specific feedback about the program design. This included in-depth interviews with key PECO and CSP staff and a detailed review of program materials including program databases, tracking systems, and other documents across all solutions. The PY8 evaluation also included in-person and phone surveys with customers who participated in the Equipment and Systems and New Construction Solution offerings. This section summarizes the evaluation methods, data collection techniques, sample design, and key results related to these PY8 activities.

PECO and CSP staff provided essential information about the program design and how the program experience on the ground compares with the EE&C Plan. The Navigant team conducted in-depth interviews at the beginning of the PY8 evaluation and communicated with staff on an ongoing basis as needed. The team developed interview instruments to include questions of interest for the evaluation and to allow for free-flowing conversations to obtain candid feedback from the interviewees.

In addition to interviews with staff and CSPs, the evaluation team leveraged the C&I phone and in-person verification surveys to explore customer satisfaction and experience with customers who participated in the Equipment and Systems and New Construction Solutions.

The following provides a summary of the process evaluation activities conducted for each C&I EE solution.

- Equipment and Systems Solution
  - PECO and CSP staff interviews
  - Solution materials review
  - Phone or onsite survey: Navigant used phone surveys to assess customer awareness of the incentive offerings, their satisfaction with the application, the level of effort required to receive their incentive, communication with PECO staff, and the program overall.
- New Construction Solution
  - PECO and CSP staff interviews
  - Solution materials review
  - Phone or onsite survey: Navigant used phone surveys to assess customer awareness of the incentive offerings, their satisfaction with the application, the level of effort required to receive their incentive, communication with PECO staff, and the program overall.
- Data Centers Targeted Market Segment
  - PECO and CSP staff interviews
  - Solution materials review
- Whole Building Solution
  - PECO and CSP staff interviews
  - Solution materials review
- Multifamily Targeted Market Segment (Landlord Focus)
  - PECO and CSP staff interviews
  - Program materials review
  - Phone survey: Navigant used phone surveys to assess how landlords heard about the Multifamily Targeted Market Segment; their satisfaction with the program, solution, and PECO overall; and awareness of other PECO solutions. The survey sample was stratified by project size (large and small).

Table 3-60. Multifamily Targeted Market Segment Participant Landlord Phone Survey Sample Design for PY8

Stratum	Population Size	Target Sample Size	Achieved Sample Size
Property Owners, Managers, and Landlords	40*	Census (40)	17
Total	**40**	**40**	**17**

*Population size was dynamic throughout the study. The original dataset started with 52 sites but due to contact turnover and overlap between sites, the evaluation team ended with about 40 contacts.

Source: Navigant analysis

3.3.5.1 Key Findings from Process Evaluation

This is the first year that PECO developed targets specific to the small C&I sector, and program staff and CSPs are learning how to market the program to this audience. While gaining small C&I customer

participation was a challenge in PY8, CSPs and the EEMF are identifying potential small C&I projects and using the trade ally network to increase participation.

As of the writing of this report and based on the PY8 impact evaluation results, it is clear that PECO and its CSPs needed time in PY8 to adjust to new requirements and implementation changes associated with the new phase and that some of the elements needed for success, such as supporting data and infrastructure are still in progress. In short, the Small C&I EE Program did not meet its PY8 savings goals. Navigant's early feedback process evaluation research indicates that the savings shortfall is likely a result of several complex factors that are sometimes, but not always, solution specific. For example, the length of the program application and time involved in applying for incentives coupled with customer perception that incentives have decreased caused Small C&I customers to forgo applying for incentives; these customers believe the incentive is not worth the effort. As a PY9 activity, Navigant will conduct a targeted process review of PECO's procedures and the documentation (i.e., lighting worksheet) required of customers to apply for incentives. In addition, per the PY9 Evaluation Plan, Navigant will survey Small C&I New Construction, Equipment and Systems, Data Centers, and Whole Building participants to measure program successes, identify improvements to design, and understand customer decision-making related to free ridership and spillover.

3.3.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-61. TRC benefits were calculated using gross verified impacts. NNPV PYTD costs and benefits are expressed in 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 3-61. Summary of Small C&I Finances – Gross Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	1,081	-	-	-	-	1,081
	EDC Incentives to Trade Allies	0	-	-	-	-	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	3,646	-	-	-	-	3,646
	Cost Subtotal	**4,728**	**-**	**-**	**-**	**-**	**4,728**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	-	-	-	-	0
	Design and Development (CSP Costs) [2]	0	-	-	-	-	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	194	-	-	-	-	194
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	-	-	-	-	0

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Marketing (EDC Costs) [4]	797	-	-	-	-	797
	Marketing (CSP Costs) [4]	0	-	-	-	-	0
	Program Delivery (EDC Costs) [5]	0	-	-	-	-	0
	Program Delivery (CSP Costs) [5]	2,087	-	-	-	-	2,087
	EDC Evaluation Costs	0	-	-	-	-	0
	SWE Audit Costs	0	-	-	-	-	0
	Cost Subtotal	**3,077**	**-**	**-**	**-**	**-**	**3,077**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	-	-	-	-	0
	Cost Subtotal	**0**	-	-	-	-	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**7,805**	**-**	**-**	**-**	**-**	**7,805**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	5,685	-	-	-	-	5,685
	Lifetime Electric Capacity Benefits	2,339	-	-	-	-	2,339
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	462	-	-	-	-	462
	Benefits Total	**8,485**	**-**	**-**	**-**	**-**	**8,485**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**1.09**	**-**	**-**	**-**	**-**	**1.09**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

*Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-62 presents program financials and cost-effectiveness on a net savings basis.

Table 3-62. Summary of Small C&I Finances – Net Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	1,081	-	-	-	-	1,081
	EDC Incentives to Trade Allies	0	-	-	-	-	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	2378	-	-	-	-	2378
	Cost Subtotal	**3,459**	**-**	**-**	**-**	**-**	**3,459**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	-	-	-	-	0
	Design and Development (CSP Costs) [2]	0	-	-	-	-	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	194	-	-	-	-	194
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	-	-	-	-	0
	Marketing (EDC Costs) [4]	797	-	-	-	-	797
	Marketing (CSP Costs) [4]	0	-	-	-	-	0
	Program Delivery (EDC Costs) [5]	0	-	-	-	-	0
	Program Delivery (CSP Costs) [5]	2,087	-	-	-	-	2,087
	EDC Evaluation Costs	0	-	-	-	-	0
	SWE Audit Costs	0	-	-	-	-	0
	Cost Subtotal	**3,077**	**-**	**-**	**-**	**-**	**3,077**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	-	-	-	-	0
	Cost Subtotal	**0**	-	-	-	-	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**6,536**	**-**	**-**	**-**	**-**	**6,536**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	4,201	-	-	-	-	4,201
	Lifetime Electric Capacity Benefits	1,702	-	-	-	-	1,702
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	370	-	-	-	-	370
	Benefits Total	**6,274**	**-**	**-**	**-**	**-**	**6,274**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.96**	**-**	**-**	**-**	**-**	**0.96**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

* Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.3.7 Status of Recommendations

The impact and process evaluation activities in PY8 led to the following findings and recommendations from Navigant to PECO, along with a summary of how PECO plans to address the recommendation in program delivery.

Table 3-63. Summary of Findings and Recommendations for Small C&I EE Program

Solution	Finding	Recommendation	EDC Status
Equipment and Systems **New Construction**	Customers and incentive administrators have indicated that the TRM Appendix C calculator is difficult to customize and has limited the number of space types. This may lead to customer frustration with PECO and/or lower program participation.	PECO and Navigant should explore and suggest improvements to the TRM Appendix C calculator to allow for easier savings calculations and a better customer experience.	PECO agrees improvements to the calculator should be exported and will work with Navigant to find potential opportunities.
Equipment and Systems	The CSP sometimes reported hours of use using deemed hours even though the CSP had more accurate hours of use from logger data or via customer feedback available. This may lead to inaccurate ex ante calculations and a risk of low realization rates upon verification.	PECO should require the CSP to use customer-reported hours or logger data when available.	Implemented. PECO now requires the CSP to use customer-reported hours or logger data when available.

Solution	Finding	Recommendation	EDC Status
Equipment and Systems	Some ex ante projects did not have transparent savings calculations in their project files. This was especially common among variable speed drive projects, and often led to low realization rates, presenting a risk of missing targets upon verification.	PECO should require the CSP to include transparent savings calculation files for all sampled projects.	Per PECO's request, the CSP is developing a calculations template that will enable more transparent savings calculations for sampled projects.
Equipment and Systems New Construction Multifamily Targeted Market Segment	Evaluating sites via phone verification may not be providing significant value to the evaluation of the program. Typical phone verification results do not differ greatly from the reported values and do not provide significant insight into individual projects or the program as a whole.	Navigant recommends shifting resources away from verifying projects via a phone conversation with the customer to doing more on-site and file review work. Specifically, Navigant sees value in shifting resources to doing on-site work for small stratum customers.	PECO agrees that resources should be shifted to verification via on-site and file review and works with customers to improve responsiveness and better facilitate this shift.
New Construction	Five of the 17 new construction projects sampled for the gross impact evaluation used lighting variables from the 2015 TRM rather than the 2016 TRM. Three of these projects are in the Large C&I EE Program and two are in the Small C&I EE Program. Specifically, the ex-ante calculations for these projects applied interaction factors from the 2015 TRM. For three of the five projects, the building permit date in the tracking system confirmed the correct use of the 2015 TRM. For the remaining two projects, the building permit date was not populated in the tracking system. For all five projects, the provided project documentation did not include files clearly indicating or labeling the building permit date.	PECO should ensure that the tracking system includes building permit dates for all new construction projects and provide documentation that clearly indicates the building permit date. This will allow confirmation of the correct version of the TRM and all associated variables.	Under consideration. PECO will ensure that all project related documentation such as the building permit dates for all new construction projects is clearly indicated and included in the tracking system. This will allow confirmation of the correct version of the TRM and all associated variables that are used to calculate measure savings.

Solution	Finding	Recommendation	EDC Status
New Construction	In PY7, the energy and demand savings from several new construction projects were excluded from official program totals due to less than 100% building occupancy at the close of the PY. Although Navigant did not find any incomplete projects during the site inspection process in PY8, building occupancy remains an important issue in Phase III.	PECO should continue to review this issue and consider future revisions to the TRM.	Under consideration. Permit dates for all 5 projects indicate that TRM 2015 is appropriate and therefore this recommendation should be satisfied and the realization rate updated to 100%
Data Centers Targeted Market Segment	Most data center energy savings are derived from the load on the equipment—i.e., the greater the load, the larger the savings. This is potentially causing customers to delay program engagement until load is realized.	PECO should explore decision-making related to data center projects during future process evaluations through interviews with current and potential participants and reviews of other data center program evaluations. A focus of this review should be to understand whether a PECO should consider multi-stage incentive plans for data centers to track with the load increases on servers over time would be in the best interest of all parties.	PECO is looking to address decision making related to data center projects. A review and updated incentive plan is in discussion with the CSP.
Multifamily Targeted (Property Owner-Focused)	Property managers are not aware of other PECO program and solution offerings. In addition, the measure mix in PY8 only included direct install lighting and water conservation measures.	PECO should explore strategies to more effectively channel participants to appropriate programs based on their need. For example, the energy advisors could provide printed material about the other solutions, leave behind appropriate contact information for the PECO call center and relevant CSP(s), and share customer contact information with relevant CSPs for follow up. Channeling efforts should explain the benefits of prescriptive measures like high efficiency HVAC and shell improvements to property owners. The CSP should also focus on signing service agreements for prescriptive measures that are deemed beneficial to the property by the energy advisor, and include a breakdown of available incentives, the cost to the customer, and the payback period in the energy assessment to make the decision-making process easier for the customer.	PECO will consider additional marketing strategies to generate more awareness among the multifamily customer universe. We already have leave behinds and surveys for every customer. There is complementary marketing for other In-unit direct installs as well as prescriptive recommendations and the associated benefits and costs. Decision makers are not always involved.

Source: Navigant analysis

3.4 Large C&I EE Program

The Large C&I EE Program offers a comprehensive and cross-cutting array of opportunities to assist large C&I customers in reducing their energy consumption and costs. The program encompasses a variety of energy solutions and measures to achieve this goal. The Large C&I EE Program is made up of two solutions and two targeted market segments, shown with the solution and segment implementers below:

- Equipment and Systems Solution – ICF
- New Construction Solution – ICF
- Data Centers Targeted Market Segment – ICF
- Multifamily Targeted Market Segment – Franklin

The Data Centers Targeted Market Segment had no participation in PY8.

Common measures within the Large C&I EE Program include efficient lighting equipment, lighting controls, HVAC equipment, VFDs, refrigeration, and building automation systems, among others. Several solutions cut across multiple programs, and participation rules vary according to program rules. 4.Appendix G contains additional detail on the individual solutions including descriptions of major measures, CSPs, and how participants are counted.

3.4.1 Participation and Reported Savings by Customer Segment

This section provides the Large C&I EE Program results for PY8, including participation, energy and demand savings, and incentive costs. Table 3-64 presents the participation counts and incentive payments for the Large C&I EE Program in PY8 by customer segment.

Table 3-64. Summary Statistics for Large C&I EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Residential	0	-	-	-	-	0
	Small C&I	0	-	-	-	-	0
	Large C&I	159	-	-	-	-	159
	Total	**159**	**-**	**-**	**-**	**-**	**159**
Incentive Spending ($1,000)	Residential	0	-	-	-	-	0
	Small C&I	0	-	-	-	-	0
	Large C&I	1,014	-	-	-	-	1,014
	Total	**1,014**	**-**	**-**	**-**	**-**	**1,014**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-65 provides a summary of reported, verified, and net energy (MWh) savings results by customer sector for the Large C&I EE Program for PY8.

Table 3-65. Summary of Energy Savings for Large C&I EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Residential	0.0	-	-	-	-	0.0
	Small C&I	0.0	-	-	-	-	0.0
	Large C&I	25,965.5	-	-	-	-	25,965.5
	Total	**25,965.5**	**-**	**-**	**-**	**-**	**25,965.5**
Verified Gross Energy Savings (MWh)	Residential	0.0	-	-	-	-	0
	Small C&I	0.0	-	-	-	-	0
	Large C&I	25,965.5	-	-	-	-	25,965.5
	Total	**25,965.5**	**-**	**-**	**-**	**-**	**25,965.5**
Energy Savings RR	Residential	0.00	-	-	-	-	0.00
	Small C&I	0.00	-	-	-	-	0.00
	Large C&I	1.00	-	-	-	-	1.00
	Total	**1.00**	**-**	**-**	**-**	**-**	**1.00**
Verified Net Energy Savings (MWh)	Residential	0.0	-	-	-	-	0
	Small C&I	0.0	-	-	-	-	0
	Large C&I	16,625.3	-	-	-	-	16,625.3
	Total	**16,625.3**	**-**	**-**	**-**	**-**	**16,625.3**
NTG Ratio	Residential	0.00	-	-	-	-	0.00
	Small C&I	0.00	-	-	-	-	0.00
	Large C&I	0.64	-	-	-	-	0.64
	Total	**0.64**	**-**	**-**	**-**	**-**	**0.64**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-66 provides the reported and verified demand (MW) savings results for the Large C&I EE Program for PY8.

Table 3-66. Summary of Demand Savings for Large C&I EE Program by Customer Segment

Parameter	Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Residential	0.0	-	-	-	-	0.0
	Small C&I	0.0	-	-	-	-	0.0
	Large C&I	3.9	-	-	-	-	3.9
	Total	**3.9**	**-**	**-**	**-**	**-**	**3.9**
Verified Gross Demand Savings (MW)	Residential	0.0	-	-	-	-	0.0
	Small C&I	0.0	-	-	-	-	0.0
	Large C&I	3.9	-	-	-	-	3.9
	Total	**3.9**	**-**	**-**	**-**	**-**	**3.9**
Demand Savings RR	Residential	0.00	-	-	-	-	0.00
	Small C&I	0.00	-	-	-	-	0.00
	Large C&I	1.01	-	-	-	-	1.01
	Total	**1.01**	**-**	**-**	**-**	**-**	**1.01**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-67 shows the participation and incentive spending for the low-income and government/education/non-profit (G/E/NP) sector carve-outs.

Table 3-67. Summary Statistics for Large C&I EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Low-Income	0	-	-	-	-	0
	G/E/NP	42	-	-	-	-	42
Incentive Spending ($1,000)	Low-Income	0	-	-	-	-	0
	G/E/NP	471	-	-	-	-	471

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-68 shows the reported, verified, and net energy (MWh) savings results for the sector carve-outs.

Table 3-68. Summary of Energy Savings for Large C&I EE Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	10,190.8	-	-	-	-	10,190.8
Verified Gross Energy Savings (MWh)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	10,274.7	-	-	-	-	10,274.7
Energy Savings RR	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	1.01	-	-	-	-	1.01
Verified Net Energy Savings (MWh)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	7,224.0	-	-	-	-	7,224.0
NTG Ratio	Low-Income	0.00	-	-	-	-	0.00
	G/E/NP	0.70	-	-	-	-	0.70

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-69 shows the reported and verified demand (MW) savings results for the sector carve-outs.

Table 3-69. Summary of Demand Savings for Large C&I Program by Carve-Out

Parameter	Carve-Out	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	1.6	-	-	-	-	1.6
Verified Gross Demand Savings (MW)	Low-Income	0.0	-	-	-	-	0.0
	G/E/NP	1.6	-	-	-	-	1.6
Demand Savings RR	Low-Income	0.00	-	-	-	-	0.00
	G/E/NP	1.01	-	-	-	-	1.01

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.4.2 Gross Impact Evaluation

In PY8, the Large C&I gross impact evaluation consisted of a combination of desk reviews, phone verifications, onsite verifications, and onsite metering for a sample of projects. Summaries of verification activities for each solution and targeted market segment follow:

Equipment and Systems. The evaluation team conducted ex post verification for 29 projects in the Large C&I Equipment and Systems PY8 evaluation sample. The verification of these 29 projects aligns with the Large C&I Evaluation Plan for Phase III, which called for a total Small C&I Equipment and Systems sample of 29 projects.

New Construction. The evaluation team conducted ex post verification for 17 projects in the New Construction Solution. The New Construction sample includes a combination of both Small C&I and Large C&I projects, and a combined sample will be conducted across PY8 and PY9. The PY8 sample includes seven Small C&I projects and 10 Large C&I projects. The verification of these 17 projects aligns with the Small and Large C&I Evaluation Plans for Phase III, which calls for a total New Construction sample of 36 projects across the 2-year period.

Multifamily Targeted Market Segment. The evaluation team conducted ex post verification for 70 projects in the Multifamily Targeted Market Segment PY8 evaluation sample. The Evaluation Plan for Phase III called for a total Multifamily targeted sample of 89 projects. Due to limited access at certain sites,19 projects were not verified.

Data Centers. There were no impact verification activities for the Data Centers Targeted Market Segment in PY8 because there was no participation in the Data Centers Targeted Market Segment in PY8.

Appendix G contains additional detail on the gross impact evaluation process and methodology for individual solutions.

Table 3-70. Large C&I EE Program Gross Impact Sample Design for PY8

Stratum Solution	Stratum Name	Percentage of Program Reported Savings	Population Size	Achieved Sample Size	Verification Method
Equipment and Systems	Large Projects	24%	5	5	Onsite Verification and/or Onsite Metering
	Medium Projects	28%	15	8	Onsite Verification or Phone Verification
	Small Projects	25%	66	16	Phone Verification
	Very Small Projects	2%	36	0	None
	Solution Total	**79%**	**122**	**29**	
New Construction	Large Projects	6%	3	3	Onsite Verification and/or Onsite Metering
	Medium Projects	8%	9	5	Onsite Verification or Phone Verification
	Small Projects	2%	5	2	Phone Verification
	Very Small Projects	0%	4	0	None
	Solution Total	**16%**	**21**	**10**	
Multifamily Targeted	Large – Small and Large C&I Projects	4%	4	2	Onsite Verification

Stratum Solution	Stratum Name	Percentage of Program Reported Savings	Population Size	Achieved Sample Size	Verification Method
	Small – Small and Large C&I Projects	1%	8	2	Onsite Verification
	Solution Total	**5%**	**12**	**4**	
Total Program	**All**	**100%**	**155**	**43**	

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-71 provides a summary of reported and verified energy (MWh) savings results, along with the C_v and relative precision for each stratum sampled for the Large C&I Program in PY8.

Overall, the Large C&I Program achieved PY8 gross RRs of 1.00 for energy and 1.01 for demand. The program-level relative precision was at 85% confidence for energy and demand. The goal of 15% precision at 85% confidence was met for both energy and demand. The program achieved 7.9% precision for energy and 9.0% precision for demand at 85% confidence.

Table 3-71. Large C&I EE Program Gross Energy Savings Impact Evaluation Results for PY8

Stratum Solution	Stratum Name	Reported Gross Energy Savings (MWh)	Verified Gross Energy Savings (MWh)	Energy RR	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Equipment and Systems	Large Projects	6,271.5	6,020.2	0.96	0.12	0.00	0.00
	Medium Projects	7,224.9	8,727.1	1.21	0.52	0.20	0.24
	Small and Very Small Projects	6,970.1	5,854.2	0.84	0.64	0.22	0.26
	Solution Total	**20,466.6**	**20,601.5**	**1.01**	**NA**	**0.10**	**0.12**
New Construction	Large Projects	1,433.2	1,503.9	1.05	0.10	0.00	0.00
	Medium Projects	2,164.9	2,142.5	0.99	0.03	0.01	0.02
	Small and Very Small Projects	517.5	354.8	0.69	0.44	1.13	1.72
	Solution Total	**4,115.6**	**4,001.2**	**0.97**	**NA**	**0.04**	**0.04**
Multifamily Targeted	Large – Small and Large C&I Projects	1,013.6	1,018.2	1.00	0.05	0.10	0.14
	Small – Small and Large C&I Projects	369.7	344.5	0.93	0.14	0.37	0.56
	Solution Total	**1,383.3**	**1,362.7**	**0.99**	**NA**	**0.05**	**0.07**
Total Program	**All**	**25,965.5**	**25,965.5**	**1.00**	**NA**	**0.08**	**0.09**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-72 provides a summary of reported and verified demand (MW) savings results, along with the C_v and relative precision for each stratum sampled for the Large C&I Program in PY8.

Table 3-72. Large C&I EE Program Gross Demand Savings Impact Evaluation Results for PY8

Stratum Solution	Stratum Name	Reported Gross Demand Savings (MW)	Verified Gross Demand Savings (MW)	Demand RR	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Equipment and Systems	Large Projects	0.9	0.9	0.95	0.22	0.00	0.00
	Medium Projects	1.3	1.4	1.11	0.26	0.10	0.12
	Small and Very Small Projects	1.1	1.0	0.93	0.98	0.34	0.39
	Solution Total	**3.3**	**3.3**	**1.01**	**NA**	**0.11**	**0.12**
New Construction	Large Projects	0.2	0.2	1.00	0.00	0.00	0.00
	Medium Projects	0.2	0.2	0.98	0.08	0.04	0.05
	Small and Very Small Projects	0.1	0.1	0.89	0.19	0.49	0.74
	Solution Total	**0.5**	**0.5**	**0.98**	**NA**	**0.03**	**0.03**
Multifamily Targeted	Large – Small and Large C&I Projects	0.1	0.1	1.11	0.16	0.33	0.50
	Small – Small and Large C&I Projects	0.0	0.0	0.94	0.14	0.36	0.54
	Solution Total	**0.2**	**0.2**	**1.06**	**NA**	**0.12**	**0.15**
Total Program	**All**	**3.9**	**3.9**	**1.01**		**0.09**	**0.10**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The majority of the 29 Large C&I Equipment and Systems projects and 10 New Construction projects achieved RRs for both demand and energy within 20% of the expected values. Fourteen projects had verified savings values fall above 120% or below 80% the reported values, either for energy or demand savings. Navigant analyzed these projects to capture any trends in the verified data. The following factors led to variation between the reported and verified savings and led to the observed RRs.

- The most significant change between ex ante and ex post calculations was in annual hours of use. Eight of the 14 flagged projects reported annual runtime that was significantly different from the reported values. In many cases, ex ante calculations reported a deemed savings value based on building type, but ex post verification revealed runtime that was more than 10% different. Navigant uncovered discrepancies both higher and lower than reported.
- Other minor discrepancies were found but were either limited to one or two projects or their impacts were too minor to reflect upon the overall population.
- The most common discrepancy for Multifamily targeted projects was a mismatch in the quantities of expected and verified lighting measures. Navigant found anecdotal and visual evidence that the efficient bulbs were out of operation in a matter of days or a few months and were not found in the sockets during onsite evaluation.

3.4.3 Net Impact Evaluation

The Large C&I EE Program net impact evaluation activities used several methods to estimate free ridership, spillover, market effects, and NTG ratios for each solution. Navigant relied on consistent, crosscutting approaches as well as ones tailored to certain solutions' unique characteristics. The primary objective of the net savings analysis was to determine the program's net effect on customer electricity usage. Navigant derived net program impacts by estimating a NTG ratio that quantifies the percentage of the gross program impacts that can reliably be attributed to the program.

Free ridership is defined as those participants who would have implemented a measure or purchased equipment anyway, without program support or a rebate. The key questions determining free ridership focus on the influence of key program interventions. These interventions vary by solution but can include discounted prices and program information regarding efficient products, as well as the customer's perception of what they would most likely have done in the absence of the program.

Spillover is defined as those participants who were influenced by the program to purchase and install additional energy efficient equipment that saves electricity without a rebate or other program support. The evaluation team analyzed participant responses to a battery of spillover questions. The intent of these questions was to identify what types and amounts of equipment customers purchased and installed on their own to inform a quantitative estimate of program spillover within the overall NTG calculation.

Market effects represent a change in the structure of a market or the behavior of participants in a market that is reflective of an increase in the adoption of EE products, services, or practices and is casually related to market intervention(s).

PECO program and solution participants were surveyed in-person or via phone to gather information about free ridership and spillover. Navigant developed survey instruments consistent with the Phase III

Evaluation Framework's guidance on net impact evaluation techniques[37] and guidance from the Uniform Methods Project on estimating net savings.[38] The team carefully reviewed and managed samples across solutions to reduce the likelihood that a respondent participating in multiple solutions during PY8 would be called multiple times to respond to the survey. Survey instruments also captured feedback about customer experiences from participants to inform the process evaluation. Many solutions or strata within solutions also added question batteries to the phone surveys or site visits to inform the gross impact verification.

The only Large C&I component to conduct a NTG evaluation in PY8 was the Multifamily Targeted Market Segment, whose NTG process is detailed in Section 3.1.3 in Table 3-13. In the case of the Equipment and Systems Solution, C&I New Construction Solution, and Whole Building Solution, NTG ratio values from PY7 were applied to PY8 gross impact evaluation results to calculate net savings. These solutions will conduct full NTG ratio calculations in PY9.

Details of the PY7 NTG methodology and calculations can be found in Sections 11.3 and 12.3 for the Equipment and Systems Solution, and Section 13.2 for the New Construction Solution of the PY7 annual report.

Table 3-73 provides the sampling frame for the net impact evaluation of the Large C&I Program in PY8.

Table 3-73. Large C&I EE Program Net Impact Sample Design for PY8

Stratum Solution	Stratum Name	Percentage of Program Reported Savings	Population Size	Achieved Sample Size	Response Rate	Verification Method
Equipment and Systems	Large C&I	41%	N/A	N/A	N/A	PY7 Smart Equipment Incentives NTGR
	Large G/E/NP	38%				
	Solution Total	**79%**				
New Construction	**Solution Total**	**15%**	N/A	N/A	N/A	PY7 Smart Construction Incentives NTGR
Multifamily Targeted Market Segment	Landlord/ Owners	5%	12	4	33%	Phone Survey
	Solution Total	**5%**	**12**	**4**	**33%**	
Total Program	**All**	**100%**	**12**	**4**	**33%**	**-**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

[37] Phase III Evaluation Framework. Section 3.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

[38] The Uniform Methods Project. *Estimating Net Savings: Common Practices.* NREL. https://www.nrel.gov/docs/fy14osti/62678.pdf

Table 3-74 provides a summary of reported and verified energy (MWh) savings results, the calculated NTG results, and the C_v and relative precision for each stratum sampled for the Large C&I Program in PY8.

Table 3-74. Large C&I EE Program Net Energy Savings Impact Evaluation Results for PY8

Solution Name	Stratum Name	Verified Gross Energy Savings (MWh)	Verified Net Energy Savings (MWh)	Free Ridership Rate	Spillover Rate	NTG Ratio	Achieved Sample C_v or Error Ratio	Relative Precision at 85% Confidence Interval	Relative Precision at 90% Confidence Interval
Equipment and Systems	Large C&I	10,700.8	6,634.5	0.39	0.01	0.62	0.48	0.20	N/A
	Large G/E/NP	9,900.7	7,029.5	0.29	0.00	0.71	0.32	0.09	N/A
	Solution Total	**20,601.5**	**13,658.2**	**0.34**	**0.01**	**0.66**	**0.44**	**0.11**	**NA**
New Construction	**Solution Total**	**4,001.2**	**2,080.6**	**0.48**	**0.00**	**0.52**	**0.50**	**0.10**	**N/A**
Multifamily Targeted Market Segment	Landlord/Owners	1,362.7	880.7	0.35	0.00	0.65	0.02	0.01	0.01
	Solution Total	**1,362.7**	**880.7**	**0.35**	**0.00**	**0.65**	**0.02**	**0.01**	**0.01**
Total Program	**All**	**25,965.5**	**16,616.9**	**0.36**	**0.00**	**0.64**	**0.54**	**0.09**	**0.09**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.4.3.1 High Impact Measure Research

HIMs represent measure categories or technologies of high importance. In Phase III, the SWE suggested EDCs oversample HIMs to help program planners make decisions concerning those measures for downstream programs only.[39] EDCs were to identify three to five measures for study within each program year based on energy impact, level of uncertainty, prospective value, funding, or other parameters. The SWE stated that HIMs should be sampled at 85% confidence and 15% absolute precision to ensure an adequate sample size for statistically valid, measure-level NTG estimates. Below is a description of the methodology used to determine the HIMs in PY8.

Navigant identified HIMs through several steps that involved careful review of program- and solution-level savings, energy impact, and value to PECO. In PY8, NTG research focused on the Multifamily Targeted Market Segment. Navigant reviewed savings across this segment and focused on measures based on both the measure category[40] and end-use subcategory to identify the types of measures falling under a category. The lighting measure category was flagged as a HIM, including the end-use subcategory of LEDs, as shown in Table 3-75.

Table 3-75. Large C&I EE Program Savings by Measure Category and HIM End-Use Subcategory

Measure Names and End-Use Subcategories	Sum of kWh Savings	Percentage of Savings
Lighting	**15,674,982**	**72.2%**
LED	12,078,754	55.6%

Source: Navigant analysis

Table 3-76 presents NTG findings for HIMs for the Large C&I EE Program.

Table 3-76. Large C&I EE Program HIM NTG Summary

Large C&I HIM	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Multifamily: LEDs [1]	Free Ridership	0.35	-	-	-	-	0.35
	Spillover	0.00	-	-	-	-	0.00
	NTG Ratio	0.65	-	-	-	-	0.65

[1] The NTG estimates provided for LEDs are based on findings from surveys conducted with tenants participating in the Multifamily Targeted Market Segment aligning with guidance provided in Section 3.4.1.4 of the Phase III Evaluation Framework indicating that HIM research should focus on measures in downstream programs only.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

[39] Phase III Evaluation Framework. Section 3.4.1.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

[40] PECO Phase III data refers to measure categories as the "Measure Name."

3.4.4 Verified Savings Summary by Solution

Table 3-77 shows the participation and incentive spending results for the Large C&I EE Program at the solution level.

Table 3-77. Summary Statistics for Large C&I EE Program by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Participation	Equipment and Systems	122	-	-	-	-	122
	New Construction	21	-	-	-	-	21
	Data Centers Targeted	0	-	-	-	-	0
	Multifamily Targeted	16	-	-	-	-	16
	Program Total	**159**	**-**	**-**	**-**	**-**	**159**
Incentive Spending ($1,000)	Equipment and Systems	832	-	-	-	-	832
	New Construction	182	-	-	-	-	182
	Data Centers Targeted	0	-	-	-	-	0
	Multifamily Targeted	0	-	-	-	-	0
	Program Total	**1,014**	**-**	**-**	**-**	**-**	**1,014**

Note: Costs associated with direct install measures are categorized as costs and not incentives for reporting purposes.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-78 shows the summary of reported and verified energy (MWh) savings results by solution.

Table 3-78. Summary of Large C&I EE Program Incremental Annual Gross Energy Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Energy Savings (MWh)	Equipment and Systems	20,466.6	-	-	-	-	20,466.6
	New Construction	4,115.6	-	-	-	-	4,115.6
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	1,383.3	-	-	-	-	1,383.3
	Program Total	**25,965.5**	**-**	**-**	**-**	**-**	**25,965.5**
Verified Gross Energy Savings (MWh)	Equipment and Systems	20,601.5	-	-	-	-	20,601.5
	New Construction	4,001.2	-	-	-	-	4.001.2
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	1,362.7	-	-	-	-	1,362.7
	Program Total	**25,965.5**	**-**	**-**	**-**	**-**	**25,965.5**

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Energy RR	Equipment and Systems	1.01	-	-	-	-	1.01
	New Construction	0.97	-	-	-	-	0.97
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.99	-	-	-	-	0.99
	Program Total	**1.00**	**-**	**-**	**-**	**-**	**1.00**
Relative Precision of Verified Gross Energy Savings at 90% Confidence Interval	Equipment and Systems	0.11	-	-	-	-	0.11
	New Construction	0.04	-	-	-	-	0.04
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.07	-	-	-	-	0.07
	Program Total	**0.09**	**-**	**-**	**-**	**-**	**0.09**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-79 shows the verified net energy (MWh) savings results by solution along with the calculated NTG results for PY8.

Table 3-79. Summary of Large C&I EE Program Incremental Annual Net Energy Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Net Energy Savings (MWh)	Equipment and Systems	13,664.0	-	-	-	-	13,664.0
	New Construction	2,080.6	-	-	-	-	2,080.6
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	880.7	-	-	-	-	880.7
	Program Total	**16,625.3**	**-**	**-**	**-**	**-**	**16,625.3**
Free Ridership	Equipment and Systems	0.34	-	-	-	-	0.34
	New Construction	0.48	-	-	-	-	0.48
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.35	-	-	-	-	0.35
	Program Total	**0.36**	**-**	**-**	**-**	**-**	**0.36**
Spillover	Equipment and Systems	0.01	-	-	-	-	0.01
	New Construction	0.00	-	-	-	-	0.00
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.00	-	-	-	-	0.00
	Program Total	**0.00**	**-**	**-**	**-**	**-**	**0.00**

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NTG Ratio	Equipment and Systems	0.66	-	-	-	-	0.66
	New Construction	0.52	-	-	-	-	0.52
	Data Centers Targeted	1.00	-	-	-	-	1.00
	Multifamily Targeted	0.65	-	-	-	-	0.65
	Program Total	**0.64**	**-**	**-**	**-**	**-**	**0.64**
Relative Precision of Verified Net Energy Savings at 90% Confidence Interval	Equipment and Systems	0.10	-	-	-	-	0.10
	New Construction	0.00	-	-	-	-	0.00
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.01	-	-	-	-	0.01
	Program Total	**0.09**	**-**	**-**	**-**	**-**	**0.09**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-80 shows the summary of reported and verified demand (MW) savings results by solution.

Table 3-80. Summary of Large C&I EE Program Demand Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Reported Gross Demand Savings (MW)	Equipment and Systems	3.3	-	-	-	-	3.3
	New Construction	0.5	-	-	-	-	0.5
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	0.2	-	-	-	-	0.2
	Program Total	**3.9**	**-**	**-**	**-**	**-**	**3.9**
Verified Gross Demand Savings (MW)	Equipment and Systems	3.3	-	-	-	-	3.3
	New Construction	0.5	-	-	-	-	0.5
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	0.2	-	-	-	-	0.2
	Program Total	**3.9**	**-**	**-**	**-**	**-**	**3.9**
Demand Savings RR	Equipment and Systems	1.01	-	-	-	-	1.01
	New Construction	0.98	-	-	-	-	0.98
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	1.06	-	-	-	-	1.06
	Program Total	**1.01**	**-**	**-**	**-**	**-**	**1.01**
Relative Precision of	Equipment and Systems	0.12	-	-	-	-	0.10

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Gross Demand Savings at 90% Confidence Interval	New Construction	0.03	-	-	-	-	0.03
	Data Centers Targeted	0.00	-	-	-	-	0.00
	Multifamily Targeted	0.15	-	-	-	-	0.15
	Program Total	**0.10**	**-**	**-**	**-**	**-**	**0.10**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-81 provides a summary of the verified lifetime energy (MWh) savings results by solution.

Table 3-81. Summary of Large C&I EE Program Lifetime Energy Savings by Solution

Parameter	Solution/Targeted Customer Segment	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
Verified Lifetime Gross Energy Savings (MWh)	Equipment and Systems	242,469.4	-	-	-	-	242,469.4
	New Construction	57,636.9	-	-	-	-	57,636.9
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	9,474.2	-	-	-	-	9,474.2
	Program Total	**309,580.6**	**-**	**-**	**-**	**-**	**309,580.6**
Verified Lifetime Net Energy Savings (MWh)	Equipment and Systems	160,749.5	-	-	-	-	160,749.5
	New Construction	29,971.2	-	-	-	-	29,971.2
	Data Centers Targeted	0.0	-	-	-	-	0.0
	Multifamily Targeted	6,122.8	-	-	-	-	6,122.8
	Program Total	**196,843.5**	**-**	**-**	**-**	**-**	**196,843.5**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.4.5 Process Evaluation

Due to significant change in the PECO portfolio design for Phase III, Navigant performed early feedback process evaluation tasks for the Large C&I EE Program and its solutions duringPY8 to capture a clear assessment of how the program started the phase and to provide PECO with rapid and specific feedback about the program design. This included in-depth interviews with key PECO and CSP staff and a detailed review of program materials including program databases, tracking systems, and other documents across all solutions.

PECO and CSP staff provided essential information about the program design and how the program experience on the ground compares with the EE&C Plan. The Navigant team conducted in-depth interviews at the beginning of the PY8 evaluation and communicated with staff on an ongoing basis as

needed. The evaluation team developed interview instruments to include questions of interest for the evaluation and to allow for free-flowing conversations to obtain candid feedback from the interviewees.

The following provides a summary of the process evaluation activities conducted for each C&I EE solution.

- Equipment and Systems Solution
    - PECO and CSP staff interviews
    - Solution materials review
    - Phone or onsite survey: Navigant used phone surveys to assess customer awareness of the incentive offerings, their satisfaction with the application, the level of effort required to receive their incentive, communication with PECO staff, and the program overall.
- New Construction Solution
    - PECO and CSP staff interviews
    - Solution materials review
    - Phone or onsite survey: Navigant used phone surveys to assess customer awareness of the incentive offerings, their satisfaction with the application, the level of effort required to receive their incentive, communication with PECO staff, and the program overall.
- Data Centers Targeted Market Segment
    - PECO and CSP staff interviews
    - Targeted market materials review
- Multifamily Targeted Market Segment (Landlord Focus)
    - PECO and CSP staff interviews
    - Targeted market materials review
    - Phone survey: Navigant used phone surveys to assess how landlords heard about the Multifamily Target Market Segment; their satisfaction with the program, solution, and PECO overall; and awareness of other PECO solutions. The survey sample was stratified by project size (large and small). See Appendix H for sample details.

3.4.5.1 Key Findings from Process Evaluation

PECO made significant changes to the Large C&I EE Program in PY8, including changing incentive structures and shifting from program-/solution-specific marketing to a centralized marketing entity, the EEMF. These changes caused delays in program participation as the EEMF ramped up their marketing efforts and PECO, as well as customers, became familiar with the new incentive structures.

Similar to the Small C&I Program, not one Large Commercial EE Program solution met its PY8 savings goals. As discussed earlier, the Navigant early feedback process evaluation research indicates that the shortfall is likely a result of several complex factors that are sometimes, but not always, solution specific. For example, the length of the program application and the corresponding time involved in applying for incentives, coupled with customer perception the incentives have decreased, may be the reason Large C&I customers are not applying for incentives; these customers believe the incentive is not worth the

effort. As a PY9 activity, Navigant will review PECO's new online application, as well as the processes, procedures, and documentation (i.e., lighting worksheet) required of customers to apply for incentives. In addition, per the PY9 Evaluation Plan, Navigant will survey Large C&I New Construction, Equipment and Systems, and Data Center customers to measure program successes, identify improvements to design, and understand customer decision-making related to free ridership and spillover.

3.4.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-82. TRC benefits were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 3-82. Summary of Large C&I Program Finances – Gross Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	1,188	-	-	-	-	1,188
	EDC Incentives to Trade Allies	0	-	-	-	-	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	6,328	-	-	-	-	6,328
	Cost Subtotal	**7,516**	**-**	**-**	**-**	**-**	**7,516**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	-	-	-	-	0
	Design and Development (CSP Costs) [2]	0	-	-	-	-	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	131	-	-	-	-	131
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	-	-	-	-	0
	Marketing (EDC Costs) [4]	1,226	-	-	-	-	1,226
	Marketing (CSP Costs) [4]	0	-	-	-	-	0
	Program Delivery (EDC Costs) [5]	0	-	-	-	-	0
	Program Delivery (CSP Costs) [5]	3,739	-	-	-	-	3,739
	EDC Evaluation Costs	0	-	-	-	-	0
	SWE Audit Costs	0	-	-	-	-	0
	Cost Subtotal	**5,095**	**-**	**-**	**-**	**-**	**5,095**
NPV of Fossil Fuel Impacts	Increased Fossil Fuel Consumption	0	-	-	-	-	0

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
from Fuel Switching ($1,000)	**Cost Subtotal**	**0**	**-**	**-**	**-**	**-**	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**12,611**	**-**	**-**	**-**	**-**	**12,611**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	8,826	-	-	-	-	8,826
	Lifetime Electric Capacity Benefits	3,225	-	-	-	-	3,225
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	399	-	-	-	-	399
	Benefits Total	**12,450**	**-**	**-**	**-**	**-**	**12,450**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.99**	**-**	**-**	**-**	**-**	**0.99**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

*Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 3-83 presents program financials and cost-effectiveness on a net savings basis.

Table 3-83. Summary of Large C&I Program Finances – Net Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	1,188	-	-	-	-	1,188
	EDC Incentives to Trade Allies	0	-	-	-	-	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	3,716	-	-	-	-	3,716
	Cost Subtotal	**4,904**	**-**	**-**	**-**	**-**	**4,904**

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	-	-	-	-	0
	Design and Development (CSP Costs) [2]	0	-	-	-	-	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	131	-	-	-	-	131
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	-	-	-	-	0
	Marketing (EDC Costs) [4]	1,226	-	-	-	-	1,226
	Marketing (CSP Costs) [4]	0	-	-	-	-	0
	Program Delivery (EDC Costs) [5]	0	-	-	-	-	0
	Program Delivery (CSP Costs) [5]	3,739	-	-	-	-	3,739
	EDC Evaluation Costs	0	-	-	-	-	0
	SWE Audit Costs	0	-	-	-	-	0
	Cost Subtotal	**5,095**	**-**	**-**	**-**	**-**	**5,095**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	-	-	-	-	0
	Cost Subtotal	**0**	-	-	-	-	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**9,999**	**-**	**-**	**-**	**-**	**9,999**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	5,618	-	-	-	-	5,618
	Lifetime Electric Capacity Benefits	2,075	-	-	-	-	2,075
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	262	-	-	-	-	262
	Benefits Total	**7,956**	**-**	**-**	**-**	**-**	**7,956**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.80**	**-**	**-**	**-**	**-**	**0.80**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

*Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.4.7 Status of Recommendations

The impact and process evaluation activities in PY8 led to the following findings and recommendations from Navigant to PECO, along with a summary of how PECO plans to address the recommendation in program delivery.

Table 3-84. Summary of Findings and Recommendations for Large C&I EE Program

Solution	Finding	Recommendation	EDC Status
Equipment and Systems **New Construction**	Customers and incentive administrators have indicated that the TRM Appendix C calculator is difficult to customize and has limited the number of space types. This may lead to customer frustration with PECO and/or lower program participation.	PECO and Navigant should explore and suggest improvements to the TRM Appendix C calculator to allow for easier savings calculations and a better customer experience PECO and Navigant should explore and suggest improvements to Appendix C to allow for easier savings calculations and a better customer experience.	PECO agrees improvements to the calculator should be exported and will work with Navigant to find potential opportunities.
Equipment and Systems	The CSP sometimes reported hours of use using deemed hours even though the CSP had more accurate hours of use from logger data or via customer feedback available. This may lead to inaccurate ex ante calculations and a risk of low realization rates upon verification.	PECO should require the CSP to use customer-reported hours or logger data when available. PECO should require the CSP to use logger data or customer-reported hours when available.	PECO now requires the CSP to use customer-reported hours or logger data when available.
Equipment and Systems	Some ex ante projects did not have transparent savings calculations in their project files. This was especially common among variable speed drive projects, and often led to low realization rates, presenting a risk of missing targets upon verification...	PECO should require the CSP to include transparent savings calculation files for all sampled projects.	Per PECO's request, the CSP is developing a calculations template that will enable more transparent savings calculations for sampled projects.

Solution	Finding	Recommendation	EDC Status
Equipment and Systems **New Construction** **Multifamily Targeted Market Segment**	Evaluating sites via phone verification may not be providing significant value to the evaluation of the program. Typical phone verification results do not differ greatly from the reported values and do not provide significant insight into individual projects or the program as a whole.	Navigant recommends shifting resources away from verifying projects via a phone conversation with the customer to doing more on-site and file review work. Specifically, Navigant sees value in shifting resources to doing on-site work for small strata customers.	PECO agrees that resources should be shifted to verification via on-site and file review and works with customers to improve responsiveness and better facilitate this shift.
New Construction	Five of the 17 new construction projects sampled for the gross impact evaluation used lighting variables from the 2015 TRM rather than the 2016 TRM. Three of these projects are in the Large C&I EE Program and two are in the Small C&I EE Program. Specifically, the ex-ante calculations for these projects applied interaction factors from the 2015 TRM. For three of the five projects, the building permit date in the tracking system confirmed the correct use of the 2015 TRM. For the remaining two projects, the building permit date was not populated in the tracking system. For all five projects, the provided project documentation did not include files clearly indicating or labeling the building permit date.	PECO should ensure that the tracking system includes building permit dates for all new construction projects and provide documentation that clearly indicates the building permit date. This will allow confirmation of the correct version of the TRM and all associated variables.	Under consideration. PECO will ensure that all project related documentation such as the building permit dates for all new construction projects is clearly indicated and included in the tracking system. This will allow confirmation of the correct version of the TRM and all associated variables that are used to calculate measure savings.
New Construction	In PY7, the energy and demand savings from several new construction projects were excluded from official program totals due to less than 100% building occupancy at the close of the PY. Although Navigant did not find any incomplete projects during the site inspection process in PY8, building occupancy remains an important issue in Phase III.	PECO should continue to review this issue and consider future revisions to the TRM.	Under consideration. Permit dates for all 5 projects indicate that TRM 2015 is appropriate and therefore this recommendation should be satisfied and the realization rate updated to 100%

Solution	Finding	Recommendation	EDC Status
Data Centers Targeted Market Segment	Most data center energy savings are derived from the load on the equipment, i.e. the greater the load the larger the savings. This is potentially causing customers to delay program engagement until load is realized.	PECO should explore decision-making related to data center projects during future process evaluations through interviews with current and potential participants and reviews of other data center program evaluations. A focus of this review should be to understand whether a multi-stage incentive plan would be in the best interest of all parties. PECO should consider multi-stage incentive plans for data centers to track with the load increases on servers over time.	PECO is looking to address decision making related to data center projects. A review and updated incentive plan is in discussion with the CSP.
Multifamily Targeted (Property Owner-Focused)	Property managers are not aware of other PECO program and solution offerings. In addition, the measure mix in PY8 only included direct install lighting and water conservation measures.	PECO should explore strategies to more effectively channel participants to appropriate programs based on their need. For example, the energy advisors could provide printed material about the other solutions, leave behind appropriate contact information for the PECO call center and relevant CSP(s), and share customer contact information with relevant CSPs for follow up. Channeling efforts should explain the benefits of prescriptive measures like high efficiency HVAC and shell improvements to property owners. The CSP should also focus on signing service agreements for prescriptive measures that are deemed beneficial to the property by the energy advisor, and include a breakdown of available incentives, the cost to the customer, and the payback period in the energy assessment to make the decision-making process easier for the customer.	PECO will consider additional marketing strategies to generate more awareness among the multifamily customer universe. We already have leave behinds and surveys for every customer. There is complementary marketing for other In-unit direct installs as well as prescriptive recommendations and the associated benefits and costs. Decision makers are not always involved.

Source: Navigant analysis

3.5 Combined Heat and Power Program

The PECO Combined Heat and Power (CHP) Program is designed to influence customer behavior and purchasing decisions. CHP technologies generate electric and thermal energy from a single fuel source. Customers with steady baseload electricity usage coupled with steady thermal demand can realize significant efficiencies and savings by incorporating CHP (sometimes referred to as cogeneration) in their facilities. The best economics are realized for CHP systems sized to match the minimum electric and

thermal loads. PECO designed the CHP Program to ensure participating customers install CHP projects that maximize operational savings and minimize operational and maintenance costs.

The CHP Program has three types of incentives that are distributed at key milestones in the design, construction, and operation phases:

- **Design:** Incentives based on proposed system capacity.
- **Capacity:** Incentives are based on a declining tiered incentive rate by installed capacity. Each tier has a fixed incentive per kW paid toward the incremental capacity within each tier.
- **Performance:** Incentives are based on a fixed per kWh basis based on actual energy production. The kWh production is determined during a monitoring period that begins after the commercial date of operation (CDO) and is designed to capture the typical system operational performance. Savings for all projects are claimed upon implementation and can be adjusted based on the performance monitoring results.

PECO delivers the program directly through a mechanism known as the Call for Projects (CfP), which is loosely structured around a typical request for proposals (RFP) process. Potential participates are invited to apply during several application windows known as “calls.” The frequency of calls depends on program participation. Once a call period has closed, PECO evaluates each project based on a scoring criteria involving strength of schedule, likelihood of completion, and cost-effectiveness during a given program year. Projects with the highest scores are given priority to enroll in the program.

Participation is counted on a project basis. Projects that consist of multiple prime movers at a single facility are classified as a single project.

3.5.1 Participation and Reported Savings by Customer Segment

The PECO CHP Program did not have any participants in PY8.

3.5.2 Gross Impact Evaluation

The PECO CHP Program did not have any PY8 participants, so no gross impact evaluation was conducted.

3.5.3 Net Impact Evaluation

The PECO CHP program did not have any PY8 participants so no net impact evaluation was conducted.

3.5.4 Verified Savings Summary by Solution

The PECO CHP program did not have any participants in PY8.

3.5.5 Process Evaluation

No process evaluation was conducted in PY8. A process evaluation is scheduled for PY9.

3.5.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-85. TRC benefits were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 3-85. Summary of CHP Program Finances – Gross Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	0	0	0	0	0	0
	EDC Incentives to Trade Allies	0	0	0	0	0	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	0	0	0	0	0	0
	Cost Subtotal	**0**	**0**	**0**	**0**	**0**	**0**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	0	0	0	0	0
	Design and Development (CSP Costs) [2]	0	0	0	0	0	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	0	0	0	0	0	0
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	0	0	0	0	0
	Marketing (EDC Costs) [4]	0	0	0	0	0	0
	Marketing (CSP Costs) [4]	0	0	0	0	0	0
	Program Delivery (EDC Costs) [5]	0	0	0	0	0	0
	Program Delivery (CSP Costs) [5]	15	0	0	0	0	15
	EDC Evaluation Costs	0	0	0	0	0	0
	SWE Audit Costs	0	0	0	0	0	0
	Cost Subtotal	**15**	**0**	**0**	**0**	**0**	**15**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	0	0	0	0	0
	Cost Subtotal	**0**	**0**	**0**	**0**	**0**	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**15**	**0**	**0**	**0**	**0**	**15**
Total NPV of Benefits [7]	Lifetime Electric Energy Benefits	0	0	0	0	0	0

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
($1,000)	Lifetime Electric Capacity Benefits	0	0	0	0	0	0
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	0	0	0	0	0	0
	Benefits Total	**0**	**0**	**0**	**0**	**0**	**0**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.00**	**0**	**0**	**0**	**0**	**0.00**

[1] Includes direct install equipment costs.
[2] Includes direct costs attributable to plan and advance the programs.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.
[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for direct install programs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
*Rows 1-11 are presented in nominal dollars
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.
Source: Navigant analysis

Table 3-86 presents program financials and cost-effectiveness on a net savings basis.

Table 3-86. Summary of CHP Program Finances – Net Verified

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	0	0	0	0	0	0
	EDC Incentives to Trade Allies	0	0	0	0	0	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	0	0	0	0	0	0
	Cost Subtotal	**0**	**0**	**0**	**0**	**0**	**0**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	0	0	0	0	0
	Design and Development (CSP Costs) [2]	0	0	0	0	0	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	0	0	0	0	0	0

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	0	0	0	0	0
	Marketing (EDC Costs) [4]	0	0	0	0	0	0
	Marketing (CSP Costs) [4]	0	0	0	0	0	0
	Program Delivery (EDC Costs) [5]	0	0	0	0	0	0
	Program Delivery (CSP Costs) [5]	15	0	0	0	0	15
	EDC Evaluation Costs	0	0	0	0	0	0
	SWE Audit Costs	0	0	0	0	0	0
	Cost Subtotal	**15**	**0**	**0**	**0**	**0**	**15**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	0	0	0	0	0
	Cost Subtotal	**0**	**0**	**0**	**0**	**0**	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**15**	**0**	**0**	**0**	**0**	**15**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	0	0	0	0	0	0
	Lifetime Electric Capacity Benefits	0	0	0	0	0	0
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	0	0	0	0	0	0
	Benefits Total	**0**	**0**	**0**	**0**	**0**	**0**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.00**	**0**	**0**	**0**	**0**	**0.00**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

* Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Because no evaluation was conducted for PY8, Navigant does not have any findings or recommendations to report at this time.

3.6 Residential DR Program

The PECO Residential DR Program encompasses opportunities designed to engage customers in demand reduction. The eligible population and target markets for the PECO Residential DR Program are all PECO residential electric customers. The program encompasses three solutions: the Residential DLC Solution, the Smart Thermostat for DR Savings Solution, and the Behavioral DR Savings Solution. Only the Residential DLC Solution is currently active.

The Residential DLC Solution is implemented by Itron (previously Comverge). The program shifts participant load off of peak hours by cycling their air conditioner during DR event days. For Phase III, these event days are called when the PJM day-ahead peak load forecast reaches 96%. While no official compliance events were called in PY8, the program did run two DLC test events during the summer of 2016 on June 23 and July 7. The summer DR events had nearly 63,000 residential participants. This year and for the remainder of Phase III, the incentive is $40 per DLC unit per year. Because these events were considered test events and PECO did not have savings targets for PY8, PECO will not be claiming any savings from this program for PY8.

Compliance targets for DR programs were established at the system level, which means the load reductions measured at the customer meter must be escalated to reflect transmission and distribution losses. However, because no savings were claimed in PY8, there are no savings to apply these correction factors for transmission and distribution losses.

3.6.1 Participation and Reported Savings by Customer Segment

PECO held two test events in the summer of PY8. Because these events were considered test events and PECO did not have savings targets for PY8, PECO will not be claiming any savings from this program for PY8.

Table 3-87 presents the participation counts, reported peak demand savings, and EDC expenditures for the Residential DR Program in PY8 by customer segment.

Table 3-87. PY8 Residential DR Program by Customer Segment

Customer Segment	Parameter				
	No. of Participants	PYRTD MWh	PYRTD MW (EE)	PYVTD MW (DR)	Incentives ($1,000)
Residential	61,440	0.0	0.0	0.0	3,005
Small C&I	0	0.0	0.0	0.0	0
Large C&I	0	0.0	0.0	0.0	0
Total	**61,440**	**0.0**	**0.0**	**0.0**	**3,005**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.6.2 Gross Impact Evaluation

There were no claimed savings to evaluate for PY8 for the Residential DR Program.

3.6.3 Process Evaluation

No process evaluation was conducted in PY8. Navigant will conduct a process evaluation in PY9, including CSP interviews and customer surveys.

3.6.4 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-88. TRC benefits were calculated using gross verified impacts. PYTD financials are expressed in 2016 dollars, and P3TD financials are expressed in 2016 dollars.

Table 3-88. Summary of Residential DR Program Finances

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	3,005	0	0	0	0	3,005
	EDC Incentives to Trade Allies	0	0	0	0	0	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities) [9]	2,254	0	0	0	0	2,254
	Cost Subtotal [9]	**2,254**	**0**	**0**	**0**	**0**	**2,254**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	0	0	0	0	0
	Design and Development (CSP Costs) [2]	0	0	0	0	0	0

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Administration, Management, and Technical Assistance (EDC Costs) [3]	31	0	0	0	0	31
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	0	0	0	0	0
	Marketing (EDC Costs) [4]	0	0	0	0	0	0
	Marketing (CSP Costs) [4]	0	0	0	0	0	0
	Program Delivery (EDC Costs) [5]	0	0	0	0	0	0
	Program Delivery (CSP Costs) [5]	917	0	0	0	0	917
	EDC Evaluation Costs	0	0	0	0	0	0
	SWE Audit Costs	0	0	0	0	0	0
	Cost Subtotal	**948**	**0**	**0**	**0**	**0**	**948**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	0	0	0	0	0
	Cost Subtotal	**0**	**0**	**0**	**0**	**0**	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**3,201**	**0**	**0**	**0**	**0**	**3,201**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	0	0	0	0	0	0
	Lifetime Electric Capacity Benefits	0	0	0	0	0	0
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	0	0	0	0	0	0
	Benefits Total	**0**	**0**	**0**	**0**	**0**	**0**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.00**	**0**	**0**	**0**	**0**	**0.00**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for direct install programs

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

[9] For demand response programs, the participant incremental cost is equal to 75% of incentives to participants per the PA 2016 TRC Order. Therefore, the cost subtotal is equal to the participant cost only.

* Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.6.5 Status of Recommendations

An evaluation was not conducted for PY8 and will be conducted in PY9, the first year of claimed savings.

3.7 Small C&I DR Program

PECO designed the PECO Small C&I DR Program to engage customers in demand reduction through DLC of major electrical end-use equipment during designated peak load hours. The eligible population and target markets for the Small C&I DR Program are all PECO small C&I customers, which includes customers in the G/E/NP sector. The program encompasses a single solution: the DLC Solution.

The program shifts participant load off of peak hours by cycling their air conditioner during DR event days. For Phase III, these event days are called when the PJM day-ahead peak load forecast reaches 96%. The program, as in years past, is implemented by Itron (previously Comverge). The program ran two DLC test events during the summer of 2016 (June 23 and July 7). The summer DR events had nearly 1,700 commercial participants. This year, and for the remainder of Phase III, the incentive is $40 per thermostat per year. Because these events were considered test events and PECO did not have savings targets for PY8, PECO will not be claiming any savings from this program for PY8.

Compliance targets for DR programs were established at the system level, which means the load reductions measured at the customer meter must be escalated to reflect transmission and distribution losses. However, because no savings were claimed in PY8, there are no savings to apply these correction factors for transmission and distribution losses.

3.7.1 Participation and Reported Savings by Customer Segment

PECO held two test events in the summer of PY8. Because these events were considered test events and PECO did not have savings targets for PY8, PECO will not be claiming any savings from this program for PY8.

Table 3-89 presents the participation counts, reported peak demand savings, and EDC expenditures for the Small C&I DR Program in PY8 by customer segment.

Table 3-89. PY8 Small C&I DR Program by Customer Segment

Customer Segment	Parameter				
	No. of Participants	PYRTD MWh	PYRTD MW (EE)	PYVTD MW (DR)	Incentives ($1,000)
Residential	0	0	0	0	0
Small C&I	1,586	0	0	0	122
Large C&I	0	0	0	0	0
Total	**1,586**	**0**	**0**	**0**	**122**

Source: Navigant analysis

3.7.2 Gross Impact Evaluation

There were no claimed savings to evaluate for the PY8 Small C&I DR Program.

3.7.3 Process Evaluation

No process evaluation was conducted for PY8. Navigant will conduct a process evaluation in PY9, including CSP interviews and customer surveys.

3.7.4 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-90. TRC benefits were calculated using gross verified impacts. PYTD financials are expressed in 2016 dollars and P3TD financials are expressed in 2016 dollars.

Table 3-90. Summary of Small C&I DR Program Finances

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	122	0	0	0	0	122
	EDC Incentives to Trade Allies	0	0	0	0	0	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities) [9]	91	0	0	0	0	91
	Cost Subtotal [9]	**91**	**0**	**0**	**0**	**0**	**91**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	0	0	0	0	0
	Design and Development (CSP Costs) [2]	0	0	0	0	0	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	2	0	0	0	0	2
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	0	0	0	0	0
	Marketing (EDC Costs) [4]	0	0	0	0	0	0
	Marketing (CSP Costs) [4]	0	0	0	0	0	0
	Program Delivery (EDC Costs) [5]	0	0	0	0	0	0
	Program Delivery (CSP Costs) [5]	-18 [10]	0	0	0	0	-18
	EDC Evaluation Costs	0	0	0	0	0	0
	SWE Audit Costs	0	0	0	0	0	0
	Cost Subtotal	**-16**	**0**	**0**	**0**	**0**	**-16**

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	0	0	0	0	0
	Cost Subtotal	**0**	**0**	**0**	**0**	**0**	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**75**	**0**	**0**	**0**	**0**	**75**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	0	0	0	0	0	0
	Lifetime Electric Capacity Benefits	0	0	0	0	0	0
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	0	0	0	0	0	0
	Benefits Total	**0**	**0**	**0**	**0**	**0**	**0**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.00**	**0**	**0**	**0**	**0**	**0.00**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] These costs represent an accrual for PECO's contracted liability with the Commission approved Curtailment Service Provider contract to deliver the required MW resources, beginning in PY9 peak load reduction performance period.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

[9] For demand response programs, the participant incremental cost is equal to 75% of incentives to participants per the PA 2016 TRC Order. Therefore, the cost subtotal is equal to the participant cost only.

[10] PJM credits offset by the ongoing administrative costs incurred by the AC Saver program in PY8.

* Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.7.5 Status of Recommendations

An evaluation was not conducted for PY8 and will be conducted in PY9, the first year of claimed savings.

3.8 Large C&I DR Program

PECO designed the Large C&I DR Program to engage customers in demand reduction through DR aggregation across multiple customers. The eligible population and target markets for the PECO Large

C&I DR Program are all PECO large C&I electric customers, including those in the G/E/NP sector. The program encompasses a single solution: the Demand Response Aggregator (DRA) Solution. This program was not operational in PY8. It will begin in PY9 and will report findings in PY9.

3.8.1 Participation and Reported Savings by Customer Segment

This program was not operational in PY8. It will begin in PY9 and will report findings in PY9.

3.8.2 Gross Impact Evaluation

No impact evaluation was conducted, as this program did not operate in PY8. It will begin in PY9 and will report findings in PY9.

3.8.3 Process Evaluation

A process evaluation will be conducted in PY9, which is the first year of program implementation. The evaluation will include CSP interviews and customer surveys.

3.8.4 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-91. TRC benefits were calculated using gross verified impacts. PYTD financials are expressed in 2016 dollars, and P3TD financials are expressed in 2016 dollars.

Table 3-91. Summary of Large C&I DR Program Finances

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
NPV of Incremental Measure Costs ($1,000)	EDC Incentives to Participants [1]	0	0	0	0	0	0
	EDC Incentives to Trade Allies	0	0	0	0	0	0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities) [9]	0	0	0	0	0	0
	Cost Subtotal [9]	**0**	**0**	**0**	**0**	**0**	**0**
NPV of Program Overhead Costs ($1,000)	Design and Development (EDC Costs) [2]	0	0	0	0	0	0
	Design and Development (CSP Costs) [2]	0	0	0	0	0	0
	Administration, Management, and Technical Assistance (EDC Costs) [3]	61	0	0	0	0	61
	Administration, Management, and Technical Assistance (CSP Costs) [3]	0	0	0	0	0	0

Category	Parameter	Program Year					
		PY8	PY9	PY10	PY11	PY12	Phase III to Date
	Marketing (EDC Costs) [4]	0	0	0	0	0	0
	Marketing (CSP Costs) [4]	0	0	0	0	0	0
	Program Delivery (EDC Costs) [5]	0	0	0	0	0	0
	Program Delivery (CSP Costs) [5]	1,680	0	0	0	0	1,680
	EDC Evaluation Costs	0	0	0	0	0	0
	SWE Audit Costs	0	0	0	0	0	0
	Cost Subtotal	**1,742**	**0**	**0**	**0**	**0**	**1,742**
NPV of Fossil Fuel Impacts from Fuel Switching ($1,000)	Increased Fossil Fuel Consumption	0	0	0	0	0	0
	Cost Subtotal	**0**	**0**	**0**	**0**	**0**	**0**
Total NPV of Costs [6] ($1,000)	**Cost Total**	**1,742**	**0**	**0**	**0**	**0**	**1,742**
Total NPV of Benefits [7] ($1,000)	Lifetime Electric Energy Benefits	0	0	0	0	0	0
	Lifetime Electric Capacity Benefits	0	0	0	0	0	0
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	0	0	0	0	0	0
	Benefits Total	**0**	**0**	**0**	**0**	**0**	**0**
TRC Benefit-Cost Ratio [8]	**Benefits Total/Costs Total**	**0.00**	**0**	**0**	**0**	**0**	**0.00**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance.

[4] Includes the marketing CSP and marketing costs by program CSPs. EDC marketing costs broken out as a percentage of sector lifetime savings. This is an adjustment from the Preliminary Annual Report.

[5] These costs represent an accrual for PECO's contracted liability with the Commission approved Curtailment Service Provider contract to deliver the required MW resources, beginning in PY9 peak load reduction performance period.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

[9] For demand response programs, the participant incremental cost is equal to 75% of incentives to participants per the PA 2016 TRC Order. Therefore, the cost subtotal is equal to the participant cost only.

* Rows 1-11 are presented in nominal dollars

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

3.8.5 Status of Recommendations

No evaluation was conducted in PY8, as the Large C&I DR Program was not operational. A full evaluation will be completed in PY9.

4. COST RECOVERY

Act 129 allows Pennsylvania EDCs to recover EE&C Plan costs through a cost recovery mechanism. PECO's cost recovery charges are organized separately by four customer sectors to ensure that the electric rate classes that finance the programs are the rate classes that receive the direct energy and conservation benefits. Cost recovery is governed by tariffed rate class, so it is necessarily tied to the way customers are metered and charged for electric service. Readers should be mindful of the differences between Table 4-1 and Section 2.4. For example, the low-income customer segment is a subset of PECO's residential tariff(s) and, therefore, is not listed in Table 4-1.

Table 4-1. EE&C Plan Expenditures by Cost Recovery Category[41]

Parameter	Cost Recovery Sector	Rate Classes Included	Program Year					
			PY8	PY9	PY10	PY11	PY12	Phase III to Date
EE&C Plan Expenditures ($1,000)	Residential	R, RH, and CAP	$35,450	-	-	-	-	$35,450
	Small C&I	GS	$7,036	-	-	-	-	$7,036
	Large C&I	PD, HT, and EP	$9,713	-	-	-	-	$9,713
	Municipal	SLE, AL, and TLCL	$28	-	-	-	-	$28
	Portfolio Total	**All**	**$52,226**	-	**-**	**-**	**-**	**$52,226**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: PECO

[41] SWE costs not included.

APPENDIX A. UPSTREAM LIGHTING CROSS-SECTOR SALES

Navigant completed its analysis of the upstream lighting cross-sector sales estimation as part of the PY8 evaluation for the Lighting, Appliances & HVAC Solution. Details about the evaluation including the cross-sector sales findings for the solution can be found in Appendix D.1 of this report.

APPENDIX B. SITE INSPECTION SUMMARY

Table B-1. PY8 Site Visit Summary

Program	Inspection Firm	Number of Inspections Conducted	Number of Sites with Discrepancies from Reported Values	Summary of Common Discrepancies
Small C&I	Navigant/ INCA	13	10 [1]	Hours of use, pre/post fixture quantities, pre/post fixture specifications
Large C&I	Navigant/ INCA	24	9 [1]	Hours of use, pre/post fixture quantities, pre/post fixture specifications
Multifamily Targeted	Navigant	11	11 [2]	Pre/post fixture quantities, pre/post fixture specifications, not all projects visited
Total				

[1] For C&I projects, the vast majority of projects had small discrepancies from the reported values, with few projects showing 100% realization rates for both energy and demand savings. The numbers listed here include projects whose energy or demand savings were more than 20% different from the ex ante results.

[2] For Multifamily projects, the buildings were sub-sampled at a project level. If the field technicians observed discrepancy at a project, we reported the building as having a discrepancy from reported values.

APPENDIX C. HER IMPACT EVALUATION DETAIL

Navigant completed its analysis of the Behavioral Solution (i.e., the HER impact evaluation) as part of its overall solution-level evaluation. Details about the evaluation including the regression analysis results can be found in Appendix D.5 of this report.

APPENDIX D. RESIDENTIAL EE PROGRAM DETAIL

The following appendix subsections detail the evaluation activities and findings for the Residential Energy Efficiency (EE) Program solutions for PY8. Summary discussions and program-level, overarching findings can be found in Section 3.1. This section includes detailed findings for the following solutions. For each solution, details relate to gross impacts, net impacts, process evaluations, and findings and recommendations.

- Lighting, Appliances & HVAC Solution
- Appliance Recycling Solution
- Whole Home Solution
- New Construction Solution
- Multifamily Targeted Market Segment
- Behavioral Solution

The Multifamily Targeted Market Segment also contributes to the Residential EE Program; however, evaluation details for that solution are included in a separate section—Appendix H—given its cross-program nature.

D.1 Lighting, Appliances & HVAC Solution

The Lighting, Appliances & HVAC Solution offers customers energy savings opportunities through a retail pathway that assists customers in purchasing the most efficient technology when they are shopping for new products. The solution provides upstream incentives in the form of point-of-purchase discounts to increase the market share of ENERGY STAR-qualified lighting (CFLs and LEDs) and downstream incentives in the form of rebates for appliances sold through retail and HVAC installer sales channels. Appliances and HVAC equipment rebated by the program include central air conditioners (A/Cs), central heat pumps, and high efficiency furnace fans, for example. The solution also distributes educational materials that increase customer awareness and acceptance.

Ecova is the conservation service provider (CSP) for this solution. The upstream lighting component's participation is defined as the sum of stock keeping unit (SKU) sales. A SKU describes a sold lighting product that can be a single bulb or a multi-pack of bulbs. For the Appliances and HVAC participants, participation is defined as the total number of non-adjusted records in PECO's tracking data. A record may represent one or more rebated items (e.g., a single participant purchasing multiple thermostats during the same purchase event).

Participation and Reported Savings

Table I-2 in Appendix I provides the total Lighting, Appliances & HVAC Solution results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

The following subsections present the evaluation details separately for the lighting and non-lighting components of the Lighting, Appliances & HVAC Solution.

Lighting Component

The following subsections present the evaluation details and findings for the lighting component of the Lighting, Appliances & HVAC Solution.

Gross Impacts

Navigant conducted the following activities to verify the gross impacts and to review the CSP database for reporting accuracy:

- Desk reviews
    - Record-level Technical Reference Manual (TRM) review
    - Invoice review
    - Incentive analysis
- In-store intercept surveys (also inform the net impact evaluation and process evaluation)
    - Cross-sector sales estimation
    - In-service rate (ISR) estimation

Desk Reviews
Reviews include quarterly verification of program-reported savings based on comparing manufacturer invoices against the program tracking data and Navigant's research of bulb model number specifications. Navigant also applied energy and demand savings algorithms to verified input parameters as laid out in the Pennsylvania TRM (PA TRM) to calculate impacts. The team used commercial and industrial (C&I) facility lighting usage assumptions as described in the PA TRM to calculate savings for the portion of bulbs purchased by non-residential customers as estimated by the in-store intercept efforts. Otherwise, the team characterized residential lighting use. Overall, these analysis activities verified the solution's reported savings through a bulb-level, bottoms-up recalculation of energy and demand impacts for all program bulbs incented during PY8 by PECO.

The following summarizes the results of these desk review activities.

Table D-1. Residential Lighting Summary of Desk Review Activities

Impact Activity	Finding	Description
Record-level savings review	Some bulb types do not map to TRM Section 2.1.1; therefore, assigning savings is not straightforward	The following bulb types do not align with categories in the TRM and, therefore, are difficult to match to baseline wattages: • All fixtures • Reflector-exempt PAR38, lumen range 1,100-1,599 • Reflector-exempt PAR38, lumen range 2,000-2,600 • Reflector MR16, lumen range 450-799 • All other bulb types align well with TRM categories found in Section 2.1.1 of the 2016 PA TRM
Invoice review	No issues	Navigant reviewed the incentives to confirm that the invoiced amount from manufacturers equals the invoiced amount in the CSP data. The team found no discrepancies.
Incentive analysis	No issues	Navigant compiled the minimum, maximum, and average incentive for each retailer/bulb category/bulb type combination to ensure that incentives align with PECO's Phase III Energy Efficiency and Conservation (EE&C) Plan. Navigant found no cases where the incentives fell outside of plan guidelines.

Source: Navigant analysis

In addition, Navigant conducted a pricing review to compare the per-bulb incentives with the manufacturer suggested retail price (MSRP) and the expected retail price.[42] The team expected that the MSRP less the per-package incentive equals the expected retail price. However, this equation does not compute for 883 out of 118,649 records (0.7% of records). Furthermore, there were 15,226 cases where the expected retail price is higher than the MSRP (12.8% of 118,649 records). Navigant shared these issues with PECO and the CSP and discussed opportunities for improvement. The PECO representative explained that there could be a manufacturer's rebate that could bring down the expected retail price even more than the PECO incentive. Navigant recommends that PECO continue to work with the CSP and manufacturers to encourage maintenance of accurate inputs, communication of other manufacturer rebates, and updates to prices as often as possible. The team also recommends that PECO work with the CSP to institute a quality control (QC) check as part of data processing that would indicate an error when the MSRP is lower than the expected retail price, which should never be the case.

In-Store Customer Intercept Surveys

The key evaluation activity for the lighting measures of the Lighting, Appliances & HVAC Solution in PY8 was the in-store surveys of program bulb purchasers. The primary objective of the surveys was to collect information from retail light bulb purchasers to inform:

- **Cross-sector sales:** The rate of cross-sector installation of residential program bulbs in non-residential sockets.
- **Low-income purchase activities:** Through a self-reported estimate of the percentage of purchasers who are low-income customers.

[42] The expected retail price is the actual price that the customer pays after the PECO incentive and any other incentive, such as a manufacturer rebate.

  - Navigant prepared this estimate for informational and planning purposes only. This low-income percentage does not contribute to PECO's low-income savings goals.

- **ISR:** An informational, self-reported estimate of the ISR for purchased program bulbs.
- The surveys also informed net impact and process evaluation activities, as described in the Net Impact and Process Evaluation subsections found within this solution's section.
  - Net Impact: A self-reported net-to-gross (NTG) ratio.
  - Process Evaluation: Understanding of customer awareness and intentions.

Navigant conducted 864 in-store intercept surveys. Of shoppers, 93% agreed to take the survey when asked. Shoppers were offered a $10 retailer gift card as an incentive for completing the survey. Table D-2 summarizes the initial sampling plan strata and actual sample resulting from the effort.

Table D-2. Residential Lighting In-Store Intercept Planned and Achieved Surveys

Survey	Planned	Actual
Individual Retailer Locations Surveyed	38	28
Retailer Store Visits	83	83
Total Surveys	800	864
Program Bulb Surveys	300	487

Source: Navigant analysis

The breakdown of reported gross savings and retailer store locations by sampling plan strata is shown in Table D-3. This table shows that Navigant completed surveys in stores representing 45% of the Residential Lighting Program savings.

Table D-3. Residential Lighting In-Store Intercept Savings and Store Locations by Sampling Strata

Stratum	Reported Gross Savings (kWh)	Reported Gross Savings (%)	Store Locations
A	30,227,358	45%	27
B.a	30,964,264	47%	86
B.b	3,230,153	5%	84
B.c	2,091,530	3%	87
Total	**66,513,305**	**100%**	**284**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Navigant assigned a research-based, cross-sector installation rate to each stratum according to its Phase III Evaluation Sample Plan. The team stratified the cross-sector sales results by retailer because the locations visited for the intercept surveys (Stratum A) were primarily home improvement, warehouse-style retail locations like Home Depot. The clientele at these stores may differ systematically from the remainder of stores that were not visited as part of the survey effort. These stores include other big box retailers, grocery stores, or thrift store locations, as found in Stratum B. Therefore, before extrapolating

findings from the Stratum A surveys, Navigant further stratified Stratum B into three sub-strata based on the retailer type and then applied different cross-sector sales estimates to each sub-stratum.

- Stratum B.a includes stores that are similar to Stratum A, such as DIY, hardware, and warehouse club stores. For stores in this stratum, Navigant applied the point estimate from Stratum A.
- Stratum B.b consists of dollar stores and large retailers such as Target that are likely to have some cross-sector sales but are unlikely to have as high a portion of cross-sector sales as Stratum A. Navigant applied the lower bound estimate from Stratum A to Stratum B.b.
- Finally, Stratum B.c consists of grocery stores and secondhand retailers. Navigant applied zero cross-sector sales to Stratum B.c because it is unlikely that a significant amount of non-residential purchases are made at these retailers.

For other research besides cross-sector sales, Navigant stratified the sample by bulb type: standard LED, specialty LED, and standard CFL.

Table D-4. Residential Lighting In-Store Intercept Achieved Surveys by Retailer

Retailer	Savings (kWh)	Savings (%)	Store Locations	Stores Locations Visited	In-Store Intercept Shifts	In-Store Intercept Surveys	Percentage of Surveys	Stratum (Stores Not Visited)
The Home Depot	38,656,583	58%	24	17	55	604	70%	B.a
Costco	13,626,163	20%	5	0	0	0	0%	B.a
Walmart	2,371,361	4%	25	2	4	46	5%	B.b
Lowes	2,092,166	3%	16	0	0	0	0%	B.a
Ace Hardware	1,743,445	3%	15	4	11	100	12%	B.a
Habitat ReStore	1,305,665	2%	5	2	7	62	7%	B.c
Denney Electric	1,028,811	2%	4	0	0	0	0%	B.a
Billows Electric Supply	975,866	1%	7	0	0	0	0%	B.a
Goodwill	706,911	1%	9	0	0	0	0%	B.c
Hard-to-Reach (HTR)	580,805	1%	17	0	0	0	0%	B.c
Giant Food Stores	572,620	1%	61	0	0	0	0%	B.c
Dollar Tree	532,559	1%	34	0	0	0	0%	B.b
Sams Club	517,128	1%	4	1	2	18	2%	B.a
City Electric Supply	455,643	1%	4	0	0	0	0%	B.a
Batteries Plus	362,181	1%	5	0	0	0	0%	B.b
True Value	359,154	1%	12	1	4	34	4%	B.a

Retailer	Savings (kWh)	Savings (%)	Store Locations	Stores Locations Visited	In-Store Intercept Shifts	In-Store Intercept Surveys	Percentage of Surveys	Stratum (Stores Not Visited)
Rittenhouse Lighting Supply	222,827	0%	1	0	0	0	0%	B.a
Target	220,341	0%	22	0	0	0	0%	B.b
Colonial Electric	93,523	0%	8	0	0	0	0%	B.a
Lighting by Design	61,358	0%	1	0	0	0	0%	B.a
BJs Wholesale Club	18,429	0%	9	0	0	0	0%	B.a
Kody Lighting	9,766	0%	1	0	0	0	0%	B.a
Total	**66,513,305**	**100%**	**289**	**27**	**83**	**864**	**100%**	**Varies**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The following sections describe the detailed results for each of the in-store intercept survey objectives.

Cross-Sector Sales Results

In-store intercept surveys measure the characteristics of individual bulb purchasers with the primary purpose of verifying the percentage of program bulbs being installed in non-residential sockets that have higher hours of use than residential sockets per the TRM. All bulbs were first assumed to be residential in the reported savings. The verified savings and realization rate (RR) reflect a portion of bulbs identified via the intercept surveys as being installed in non-residential sockets where lighting usage is greater per year than residential usage. For both residential and non-residential lighting savings estimates, the evaluation team relied on the PA TRM's savings algorithms and calculation input assumptions. The variation in reported and verified savings mostly reflects the incremental savings that non-residential lighting achieves over residential lighting.

Navigant's evaluation also estimates that those non-residential lighting sockets receiving program bulbs are found specifically in Small C&I sector buildings and that no bulbs are going to the Large C&I sector. Navigant concluded this via a check of addresses for the non-residential survey respondents who provided addresses. In response to these findings, PECO updated its financial accounting information to reflect a portion of incentives funding coming from the appropriate sector via the sector-specific rates.

In the PY8 analysis, 218 program bulb purchasers answered questions pertaining to cross-sector installation of standard LED bulbs and 274 program bulb purchasers answered questions pertaining to cross-sector installation of specialty LED bulbs. Of the 958 bulbs in the baskets of the 218 standard LED respondents, seven bulbs were slated for non-residential sockets, which yielded a cross-sector sales rate of 0.73%.[43] Of the 1,320 bulbs in the baskets of the 274 specialty LED respondents, 26 bulbs were slated

[43] The range for cross-sector sales of standard LED bulbs at the 85% confidence level is 0.2%-1.1%.

for non-residential sockets, which yielded a cross-sector sales rate of 2.0%.[44] Table D-5 shows cross-sector installations by bulb type and commercial building type from the PY8 intercept survey data.

Table D-5. Bulb Sales by Sector and Bulb Type

Bulb Type	Business Type	Standard Bulb	Specialty Bulb
Residential Bulbs	N/A	951	1,294
Non-Residential Bulbs	Exterior	0	2
	Health	1	0
	Electrical Contractor	0	4
	Office	0	2
	Restaurant	0	14
	Don't Know	0	4
	Retail	6	0
Total		**958**	**1,320**

Source: Navigant analysis

Navigant assigned a cross-sector installation rate to each stratum, according to the previously described assignment strategy. For CFL bulbs, the evaluation team applied the bulb-specific rate of 11% for standard CFLs based on the PY7 research value. The team used this value because CFLs were no longer a part of PECO's program as of January 2017, and team members were not able to interview any customers who purchased program CFLs. Table D-6 shows cross-sector installations by bulb type and commercial building type from the PY8 intercept survey data.

Table D-6. Cross-Sector Sales Rate by Stratum and Bulb Type

Bulb Type	Stratum	Standard Bulb	Specialty Bulb
LED	A	0.7%	2.0%
	B.a	0.7%	2.0%
	B.b	0.2%	1.1%
	B.c	0.0%	0.0%
CFL	N/A	11.0%	N/A

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

For bulbs attributed to the non-residential sector, Navigant applied average hours of use and peak coincidence factors of 2,711 hours and 0.47, respectively. These values were based on the bulb-weighted average hours of use and coincident factors for non-residential bulb purchases observed in the in-store intercept survey and informed by building type-specific estimates in the TRM. For interactive effects, the team used the values for the Unknown for Comfort Cooled Spaces for All Building Types heating type.

[44] The range for cross-sector sales of specialty LED bulbs at the 85% confidence level is 1.1%-2.8%.

Taking the above into consideration, Navigant determined verified gross impacts for the Residential Lighting Program, as shown in Table D-7.

Table D-7. Verified Gross Impacts for Residential Lighting

Bulb Type	Tracking System Savings (kWh)	Tracking System Demand Savings (kW)	Gross Verified Savings (kWh)	Gross Verified Demand Savings (kW)	Energy (kWh) RR	Demand (kW) RR
Standard LED	25,172,914	2,966	25,437,743	3,035	1.01	1.02
Specialty LED	36,718,635	4,326	38,076,949	4,658	1.04	1.08
Standard CFL	4,621,756	545	5,467,236	767	1.18	1.41
Total	**66,513,305**	**7,836**	**68,981,927**	**8,460**	**1.04**	**1.08**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

ISR

Navigant asked in-store customer intercept survey respondents to estimate the number of program-discounted LEDs they expect to install in the next 6 months. Customers estimated that 72% of standard LED bulbs would be installed within 6 months and 74% of specialty bulbs would be installed within 6 months. The ISR is informational; it was not used to compute verified savings, though it may inform future TRM updates.

Net Impact Evaluation

Free ridership is defined as the portion of participants who would have purchased the program measures anyway, without the program rebate, to arrive at the discounted, expected retail price. The key questions determining free ridership focus on the influence of key program interventions such as discounted prices, program information regarding efficient products, and placement of program-discounted products in the store, as well as the customer's perception of what they would most likely have done in the absence of the program. The free ridership section of the in-store customer intercept survey was structured based on guidance from the Uniform Methods Project,[45] as detailed in the Phase III Evaluation Framework.[46] Using this methodology, customers were asked if they would have purchased all, some, or none of the same program bulbs in the absence of the program discount. They were also asked to rate the influence of several key program elements in their decision to purchase program bulbs.

The program elements that customers were asked to rate on a 0 to 10 scale, where 0 meant "not at all influential" and 10 meant "extremely influential" included the discount offered by the program, the placement of program bulbs in the store, and the program information provided in the store. Using customer responses to the free ridership questions, the evaluation team calculated a non-program score and a program influence score, which could each have a value between 0 and 0.5 and when added

[45] The Uniform Methods Project. *Estimating Net Savings: Common Practices.* NREL. https://www.nrel.gov/docs/fy14osti/62678.pdf

[46] Phase III Evaluation Framework. Section 3.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

together made up the overall free ridership score. Using this approach, free ridership can take on values ranging from 0.0 to 1.0 for each respondent and for the program overall. High free rider scores are associated with survey respondents who reported they would have purchased all of the same program bulbs in the absence of the program and who rated the influence of the program on their decision-making as very low or zero.

The net impact evaluation also estimates spillover. Spillover is defined as activity among participants who were influenced by the program to purchase and install additional energy efficient equipment that saves electricity without a rebate or incentive (i.e., discount on a program bulb). In-store intercepts typically assess spillover by asking customers purchasing non-discounted LEDs the extent to which their purchases were influenced by in-store information and marketing; both customers who only purchased non-discounted bulbs and customers who purchased both discounted and non-discounted bulbs may have spillover, but most customers purchase only one type of bulb in a given purchase. Due to an issue in the data collection for the PY8 battery of spillover questions—only purchasers of discounted bulbs were asked about the influence of information, resulting in an incomplete set of spillover data—the evaluation team applied the PY7 spillover results to the PY8 NTG calculations. For spillover, CFLs yielded a spillover rate of 0.01 and LEDs yielded a spillover rate of 0.04.

The intent of the spillover questions is to identify what types and amounts of equipment customers purchased and installed on their own to inform a quantitative estimate of program spillover within the overall NTG calculation. Spillover was estimated from the PY7 intercepts based on the quantity and type of efficient lighting equipment purchased without a rebate, the degree of self-reported influence of the program on the decision to purchase the efficient lighting equipment, and confirmation via intercept data, shelf survey data, program tracking data, and online lookups that the lighting product in question was not rebated. The participant spillover rate was calculated by summing the spillover adoptions over all intercept respondents and then dividing it by the total number of program bulbs in the baskets of intercept respondents.

The evaluation team used Equation D-1 to calculate the NTG ratio:

Equation D-1. Total NTG Ratio

$$NTG\ Ratio = 1 - Free\ Ridership\ Rate + Spillover\ Rate$$

Free ridership, spillover, and NTG values for lighting measures are shown by program bulb type in Table D-8. Free ridership was lowest for standard LEDs at 0.53 and slightly higher for specialty LEDs at 0.58. This is higher than the free ridership observed for LEDs in PY7, which was 0.38 for standard LEDs and 0.42 for specialty LEDs. Because CFLs were no longer offered as part of PECO's program at the time of data collection, Navigant applied the PY7 in-store intercept free ridership value for CFLs at 0.61. In general and consistent with last year's research, residential lighting has inherently high free ridership, as many bulb purchasers are familiar with the benefits of energy efficient models and The Energy Independence and Security Act **(**EISA) of 2007 has phased out many inefficient bulb options over the past few years. These results also could suggest that the residential lighting market is transforming toward LEDs.

Table D-8. Free Ridership, Spillover, and NTG Values by Bulb Type

Bulb Type	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio
Standard LED	0.53	0.04	0.51
Specialty LED	0.58	0.04	0.46
Standard CFL	0.61	0.01	0.40

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Process Evaluation

Navigant also relied on the in-store customer intercept surveys to understand customers within the Lighting Solution. The survey included questions to estimate home ownership status, the percentage of shoppers who are low-income (i.e., household income less than 150% of the FPL), and other demographics. The survey responses revealed that low-income customers are more likely to buy standard efficiency bulbs[47] than program-discounted LEDs. Specifically, 6% of discounted LED purchasers were low-income customers (25 out of 418 respondents), compared to 14% of standard efficiency purchasers that were low-income customers (22 out of 153 respondents). Similarly, Table D-9 shows that, overall, approximately 7% of program-discounted standard LEDs and 4% of program-discounted specialty LEDs were purchased by low-income customers.

Table D-9. Percentage of Program Bulbs Purchased by Low-Income Customers

Bulb Type	Percentage of Bulbs
Standard LED	7%
Specialty LED	4%

Approach: The survey included a battery of demographic questions that included several questions related to income.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

[47] Because CFLs were no longer part of the program at the time of the survey, standard efficiency bulbs include all bulb types except LEDs.

Source: Navigant analysis

While no energy savings from these participants are being claimed for the low-income carve-out, this is an important finding for PECO to consider for future program implementation. This finding shows that the Residential Lighting Program is generally not reaching low-income customers with incentives for program-discounted LEDs and provides support for continued incentives through the Low-Income Lighting Solution.

The survey also indicated that homeowners buy LEDs more frequently than renters, and that single-family residents are more likely to buy LEDs than multifamily residents. Specifically, 83% of discounted bulb purchasers and 88% of non-discounted LED purchasers are homeowners compared to 64% of standard efficiency purchasers. Additionally, 72% of LED purchasers have single-family homes, compared to 46% of standard efficiency purchasers. PECO could consider additional marketing and education for multifamily residents if they would like to increase participation for this segment.

The lighting in-store intercept survey also collected information on customer awareness, satisfaction, purchase intentions, and factors influencing purchasing decisions. The mix of products in intercepted customer carts revealed that customers are purchasing a higher majority of LEDs (both discounted and non-discounted) and a much lower portion of non-efficient (non-LED/non-CFL) bulbs in PY8 compared to PY7. The percentage of customers purchasing CFLs remained roughly the same from last year to this year. The share of bulb purchases by bulb type is shown in Table D-10. This suggests that the lighting market is transforming rapidly from non-efficient bulbs toward LEDs, perhaps in part due to program incentives and marketing.

Table D-10. Distribution of Bulb Purchases by Bulb Type

Bulb Type	PY8 Number of Bulbs	PY8 Percentage of Bulbs	PY7 Number of Bulbs	PY7 Percentage of Bulbs
Program-Discounted LEDs	2,278	54%	663	28%
Non-Discounted LEDs	956	23%	455	19%
CFLs	495	12%	336	14%
Non-LED/non-CFL Bulbs	487	12%	918	39%
Total	**4,216**	**100%**	**2,372**	**100%**

Source: Navigant analysis

In terms of customer intentions, 76% of all bulb purchasers were planning to buy light bulbs before they came into the store on the day of the intercept survey. Of those planning to buy bulbs, 67% planned to buy LEDs. This is a significant finding suggesting that many shoppers are coming to stores with the intention of buying LEDs and is an increase from 47% of shoppers who planned to buy LEDs in PY7. The factors that influenced people who originally were not planning to buy bulbs upon entering a store but ended up buying them are shown in Table D-11. These results suggest that LED bulb placement and PECO signage outside of the lighting aisle could be an important factor driving customers to purchase light bulbs even when they did not intend to buy them when they walked into a store.

Table D-11. Factors Influencing Unplanned Bulb Purchases, n=204

Response	Percentage of Respondents
Customer saw them and was reminded that they needed them	72%
Low price	48%
Information in the store	7%
PECO advertisement outside of retailer	0.5%

Question (for those not planning to buy bulbs today): What factors influenced you to buy them today?

Sample included all bulb purchasers.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

In terms of the discounted bulb purchasers' rebate and information awareness, less than half of discounted bulb purchasers were aware that they received a discount (42%). This is down from last year's survey, which revealed that 61% were aware of the discount in PY7. The research team found that the discount awareness is significantly higher on event days than on non-event days,[48] at 70% awareness on event days versus 33% awareness on non-event days. This finding suggests that the lighting events are having a significant impact on awareness of PECO's program.

Of those who were aware that they received a discount, 51% indicated that they saw information or displays about LED bulbs in the store (including stickers and marketing material in the store) and 24% received information from a retail staffer. Additionally, 10% of those who were aware that they received a discount were motivated by their knowledge of the discount to come to the store that day.

Among purchasers of non-discounted bulbs, 20% of respondents knew that the store sold bulbs that were discounted by PECO but did not purchase them. Of those, 50% knew because of the PECO sticker on the shelf, 15% knew because of a bill insert, 12% knew because of marketing materials in the store, and 8% knew because of a store employee. Similar to program bulb purchasers, awareness of PECO discounts among non-discounted bulb purchasers was significantly higher on event days than non-event days (53% on event days versus 15% on non-event days).

Customer preferences and experience with non-discounted models were the main reasons that customers purchased non-discounted LEDs over PECO-discounted bulbs, as shown in Table D-12. These results could suggest that PECO might encourage more efficient lighting purchases by increasing the number of brands/manufacturers they carry in participating stores or by talking to customers on event days about the concerns customers have with switching to new products/brands.

[48] Retail events are opportunities to educate utility customers and retail staff about program qualified-ENERGY STAR lighting, appliances, and HVAC equipment. Program staff coordinate with participating retailers to schedule these events and trainings, which include table-top displays, educational literature, and giveaways to promote program opportunities.

Table D-12. Customer Reasons for Purchasing Non-Program LEDs, n=188

Reason	Percentage of Respondents
Prefer this brand/manufacturer	30%
Prior experience with this model	30%
Didn't know about the discount	25%
Didn't want to buy a multi-pack	7%
Thought these bulbs were discounted	5%
No discounted LEDs in this bulb category	4%
Don't know	2%

Question: The LED bulbs you are buying are NOT discounted by PECO. Why did you choose these LEDs instead of the discounted ones?

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

For customers who opted not to purchase LEDs at all, the price of LEDs was the most commonly cited deterrent, followed by lack of understanding about LEDs and a familiarity with incandescent bulbs. The results are shown in Table D-13. Of non-LED purchasers, 34% say they would be very likely (8 through 10 on a 10-point scale, where 10 means very likely) to purchase LEDs today if they were the same price as incandescent bulbs. These results suggest that education and perhaps additional incentives for LEDs, would increase program participation.

Table D-13. Customer Reasons for Purchasing Non-LEDs, n=189

Reason	Percentage of Respondents
LEDs are too expensive	36%
Don't know enough about LEDs	23%
Accustomed to incandescent bulbs	13%
Dislike the light quality/color of LEDs	12%
Need other specialty bulb	11%
Don't like the way LEDs fit or look in fixtures	8%
Need dimmable bulbs	3%
Need 3-way bulbs	3%
Not aware of LEDs before today	1%
LEDs are/seem too complicated	1%
Don't know	2%

Question: Why aren't you purchasing LEDs?

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Status of Recommendations

For the Lighting, Appliances & HVAC Solution, the following provides a summary of Navigant's findings, recommendations, and PECO's response to recommendations resulting from the PY8 evaluation for the upstream lighting component of the solution.

- **Finding:** Some bulb types found in Ecova's tracking data do not map well to TRM assumption tables in Section 2.1.1 for the purposes of assigning baseline wattages. For example, the TRM's section on lighting (Section 2.1.1) has limited information on fixtures. Therefore, assigning savings is not straightforward and relies on analyses that can result in different baseline wattage assumptions between the evaluator and the CSP.
    - **Recommendation:** PECO should request an accompanying file from the CSP that provides bulb-specific information for each program bulb's model number. The file would include information on model number, bulb type, and baseline/efficient wattage, with sources listed for baseline wattages to enable verification.
- **Finding:** Navigant conducted a pricing review to compare the per-bulb incentives with the MSRP and the expected retail price. The team expected that the MSRP less the per-package incentive equals the expected retail price. However, this equation does not compute for 883 out of 118,649 records (0.7% of records). Furthermore, there were 15,226 cases where the expected retail price was higher than the MSRP (12.8% of 118,649 records).
    - **Recommendation:** Navigant recommends that PECO continue to work with the CSP and manufacturers to encourage maintenance of accurate inputs, communication of other manufacturer rebates, and updates to prices as often as possible. The team also recommends that PECO institute a QC check as part of data processing that would indicate an error when the MSRP is lower than the expected retail price, which should never be the case.
- **Finding:** Customer preferences and experience with non-discounted models were the main reasons that customers purchased non-discounted LEDs over PECO-discounted bulbs.
    - **Recommendation:** PECO might encourage more efficient lighting purchases by increasing the number of brands/manufacturers they carry in participating stores or by talking to customers on event days about the concerns customers have with switching to new products/brands.
- **Finding:** The survey indicated that homeowners buy LEDs more frequently than renters, and that single family residents buy LEDs more frequently than multifamily residents. Specifically, 83% of discounted bulb purchasers and 88% of non-discounted LED purchasers are homeowners compared to 64% of standard efficiency purchasers. Additionally, 72% of LED purchasers have single-family homes, compared to 46% of standard efficiency purchasers.
    - **Recommendation:** PECO could consider additional marketing and education for multifamily residents if they would like to increase participation for this segment.
- **Finding:** The survey responses revealed that low-income customers are more likely to buy standard efficiency bulbs than program-discounted LEDs. Specifically, 5% of discounted LED purchasers were low-income customers compared to 14% of standard efficiency purchasers that were low-income customers. This finding shows that the Residential Lighting Program is generally not reaching low-income customers with incentives for program-discounted LEDs.

- **Recommendation:** PECO should continue to provide enhanced incentives through the Low-Income Lighting Solution to reach a greater penetration of low-income customers.

Appliances and HVAC Component

The following subsections present the evaluation details and findings for the non-lighting components of the Lighting, Appliances & HVAC Solution (i.e., Appliances and HVAC component).

Gross Impacts

Navigant conducted the following activities to verify the gross impacts and to review the CSP database for reporting accuracy:

- Desk reviews for all strata
  - Record-level TRM review
  - Invoice review
  - Incentive analysis
- Engineering file reviews and phone verification for the HVAC component
  - HVAC participant project file review
  - HVAC participant phone verification
- Phone survey verification for the Appliances component
  - Using questions within the Customer Experience Survey to inform installation verification for Appliance participants

Desk Reviews
Navigant's reviews included quarterly verification of program-reported savings in the program tracking database. The team applied energy and demand savings algorithms to verify that the input parameters, as laid out in the PA TRM, used to calculate impacts were accurately reported within the program tracking data. Navigant completed these desk reviews for a census of non-lighting measures for the Appliances and HVAC component.

Table D-14 summarizes the results of these desk review activities.

Table D-14. Residential Non-Lighting Summary of Desk Review Activities

Impact Activity	Finding	Description
Record-level savings review	Ductless mini-split heat pumps were not being entered into the tracking database in a consistent manner	Navigant reviewed the energy (kWh) and demand (kW) savings at the customer record level and compared the results to those calculated by the current PA TRM. Navigant found that the tracking database contained inconsistencies around ductless mini-split heat pump technologies. This technology consists of an outdoor air handling heat pump and several room units, but savings were sometimes attributed to the heat pump and other times to the room units. PECO has since fixed this inconsistency and now attributes savings to each of the individual room units and not to the outdoor air handling unit.
Invoice review	No issues	Navigant reviewed the incentives to confirm that the invoice amounts in the PECO tracking database match those from the CSP data. Navigant found no discrepancies.

Source: Navigant analysis

Engineering File Reviews and Phone Verification

This activity included a detailed engineering review of project files for HVAC participants in the Appliances and HVAC component, as well as phone calls to participants to verify equipment installation. The team requested a sample of 80 project files from the CSP to complete the necessary 40 reviews to achieve 15% relative precision at the 85% confidence level for the non-lighting HVAC measures. Using the current PA TRM, the team calculated energy and demand savings from the details within each project file and compared it to the tracking database. The project files contained details beyond the program tracking database such as the participant application and contractor invoicing and specification details. From these details, Navigant confirmed, for example, equipment input capacities (e.g., tons or kBtu/hour) and efficiencies (e.g., seasonal energy efficiency ratio [SEER] or energy factor [EF]). This activity yielded a RR of 1.04 for energy (kWh) savings and 1.36 for demand (kW) savings for HVAC measures as shown in Table D-15.

Phone Survey Verification

Navigant conducted 75 customer surveys with Appliance participants in the Appliances and HVAC component and asked them to verify the installation of their rebated energy efficient equipment. The team found no issues with the verification of any equipment, yielding a RR of 1.00 for energy (kWh) savings and 1.00 for demand (kW) savings for Appliance measures, as shown in Table D-15.

Table D-15 provides the RR results of the gross impact evaluation activities for the Appliances and HVAC component for PY8. The total solution RRs are weighted by the energy and demand savings for each strata.

Table D-15. Appliances and HVAC Gross Impact Verification RRs

Strata	Energy (kWh)	Demand (kW)
Appliance Participants	1.00	1.00
HVAC Participants	1.04	1.36
Overall Component	**1.03**	**1.33**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Net Impact Evaluation

Free ridership is defined as the portion of participants who would have purchased the program measures anyway, without the program incentive. The key questions determining free ridership focus on the influence of key program elements such as PECO's rebate, program information regarding efficient products, assistance from contractors installing measures homes, and customer intentions around what they would most likely have done in the absence of the program. The free ridership section of the Appliances and HVAC customer survey was structured based on guidance from the Uniform Methods Project,[49] as detailed in the Phase III Evaluation Framework.[50] Using this methodology, the team asked customers if they would have purchased all, some, or none of the same program equipment in the absence of the program rebate. The team also asked customers to rate the influence of several key program elements in their decision to purchase program measures on a 1-5 scale, where 1 meant "not at all influential" and 5 meant "extremely influential." Using the customer responses to the free ridership questions, the evaluation team calculated an intention score and an influence score that when summed made up the overall free ridership score. Using this approach, free ridership can take on values ranging from 0.0 to 1.0 for each respondent and for the program overall. High free rider scores are associated with survey respondents who reported they would have purchased all of the same program equipment in the absence of the program and who rated the influence of the program on their decision-making as very low or zero.

Navigant weighted the free ridership results by each participant's energy savings (kWh) and demand savings (kW) to provide further detail to the NTG results. The team calculated kWh and kW weighting factors for each participant in the customer survey sample and applied these factors to each customer's free ridership results to arrive at a weighted value. Table D-16 shows the weighted NTG results.

The net impact evaluation also estimated spillover. Spillover is defined as activity among participants who were influenced by the program to purchase and install additional energy efficient equipment that saves electricity without a rebate or incentive. The intent of the spillover questions is to identify what types and amounts of equipment customers purchased and installed on their own. This informs an estimate of quantitative program spillover within the overall NTG calculation. The team estimated spillover from the PY7 customer survey based on the quantity and type of efficient equipment purchased without a rebate and the degree of self-reported influence of the program on the decision to purchase the equipment. The

[49] The Uniform Methods Project. *Estimating Net Savings: Common Practices.* NREL. https://www.nrel.gov/docs/fy14osti/62678.pdf

[50] SWE Framework. Section 3.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

team used the current TRM to estimate energy savings for the non-rebated equipment and to calculate the spillover rate for the Appliances and HVAC component of this solution.

The evaluation team used Equation D-2 to calculate the NTG ratio:

Equation D-2. Total NTG Ratio

NTG Ratio = 1 – Free Ridership Rate + Spillover Rate

Free ridership, spillover, and NTG results for the Appliances and HVAC component of this solution are shown in Table D-16. The table shows the results at the component (i.e., Appliances and HVAC) level, the HVAC versus Appliances stratum level, and by the high impact measure (HIM) level. The NTG ratios are consistent across the various strata of the Appliances and HVAC component, with the exception of Appliances. Participants surveyed in this stratum reported installing other energy efficient measures without a rebate, which contributed to the higher spillover score. These customers participated in the program by visiting big box retail stores and, therefore, had other energy efficient technologies available at the time of purchase of their rebated measure. The survey data shows that approximately 75% of the spillover savings came from the purchase of programmable thermostats and increased insulation in the home.

Table D-16. Weighted Free Ridership, Spillover, and NTG Results for Appliances and HVAC

Segment	Energy (kWh) Weighted Results			Demand (kW) Weighted Results		
	Estimated Free Ridership	Estimated Spillover	NTG Ratio	Estimated Free Ridership	Estimated Spillover	NTG Ratio
Appliances Stratum	0.55	0.21	0.66	0.54	0.21	0.67
HVAC Stratum	0.46	0.03	0.56	0.47	0.03	0.56
Heat Pumps (HIM)	0.46	0.02	0.56	0.44	0.02	0.58
Central Air Conditioners (HIM)	0.58	0.04	0.45	0.58	0.04	0.46
High Efficiency Furnace Fans (HIM)	0.48	0.02	0.53	0.49	0.02	0.53
Appliances and HVAC Component Total	**0.49**	**0.07**	**0.57**	**0.49**	**0.07**	**0.57**

Source: Navigant analysis

Process Evaluation

As discussed in Section 3.1.5, Navigant performed an early feedback process evaluation for the Residential EE Program and its solutions during PY8. For the Appliances and HVAC component, this early feedback process evaluation work included the following:

- PECO and CSP staff interviews
- Phone surveys of participants to assess how customers heard about the solution; their satisfaction with the program, solution, and PECO overall; and awareness of other PECO solutions. Navigant segmented the survey sample according to participation type, as outlined in Section 3.1.5 and Table 3-21.

While PECO has successfully pioneered changes to the solution in PY8 along with its CSP partner Ecova, the solution did not achieve its savings targets due to low participation and a late start to the solution offering. As discussed in Section 3.1.5, the early process evaluation indicates that the Residential EE Program participation shortfalls are primarily due to PY8 being a ramp-up year for the phase and will be further explored via specific research during the PY9 evaluation. This applies to Lighting, Appliances & HVAC solution as a whole.

To better understand how PECO customers felt about the Appliances and HVAC component, Navigant conducted a customer experience survey of 150 participants. Table D-17 shows the breakdown of surveys by strata.

Table D-17. Appliances and HVAC Customer Experience Survey Sample

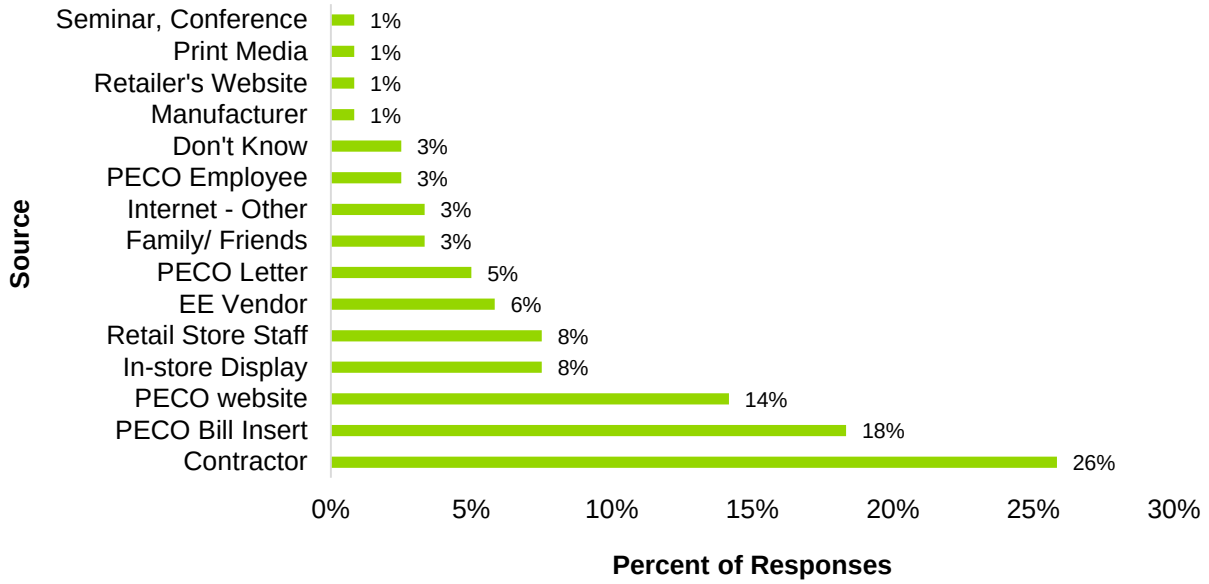
Solution	Stratum	Population Size	Target Sample Size	Achieved Sample Size
Appliances and HVAC Component	Appliance Measures	7,026	75	75
	HVAC Measures	9,187	75	75
	Solution Total	**16,213**	**150**	**150**

Source: Navigant analysis

As seen in Figure D-1, 26% of participants surveyed learned about the program from an installation contractor, 18% from a PECO bill insert, and another 14% from the PECO website. These results show that the interaction between contractors and customers is a key pathway for PECO to use when marketing their portfolio of EE programs. Providing this trade ally network with a consistent marketing message would allow contractors an easy method for promoting PECO's solutions to the EE needs of their customers.[51]

[51] The majority (98%) of the influence responses coded "contractor" came from participants in the HVAC strata. However, whenever a contractor visits a home to check on the HVAC equipment, they have the opportunity to promote the Appliances and HVAC component and are, therefore, still a valuable pathway for marketing PECO's programs in both strata.

Figure D-1. Sources of Appliances and HVAC Awareness, n=119

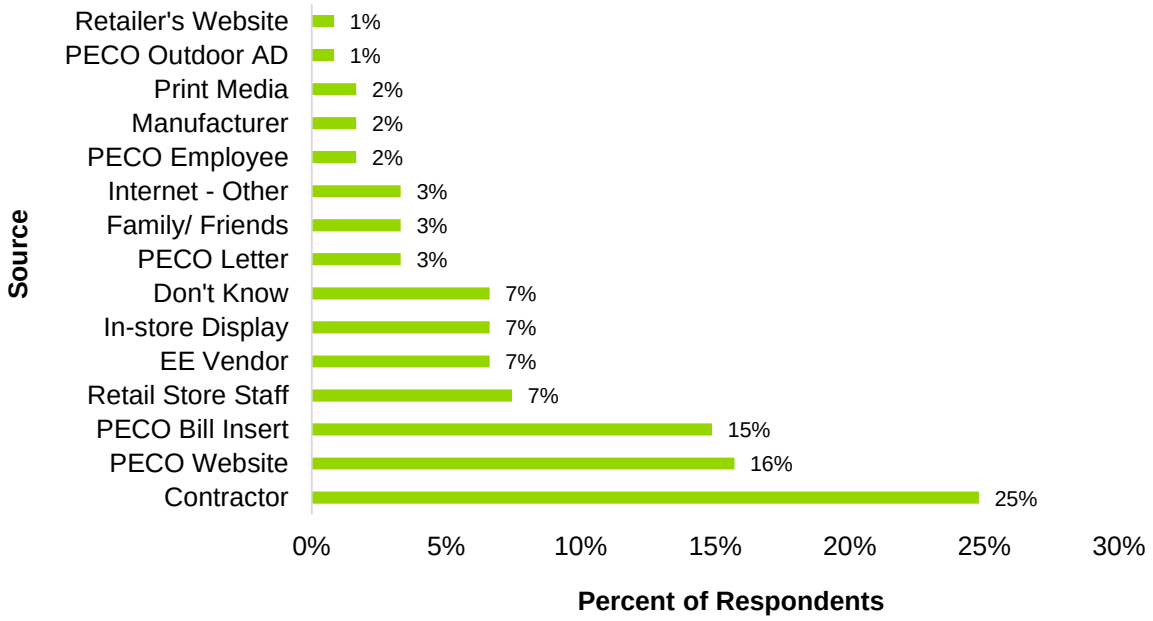


Question: "How did you learn about the Appliances and HVAC program?" Multiple responses allowed so percentages will not add up to 100%.

Source: Navigant analysis

Similarly, the installation contractor was also the most influential in a customer's decision to participate in the solution, as seen in Figure D-2. The PECO website and bill inserts were the second and third most influential responses, respectively. These results confirm that participant interactions with the trade ally network of installation contractors is an influential pathway for increasing program participation.

Figure D-2. Awareness Source Influence on Appliances and HVAC Participation, n=120

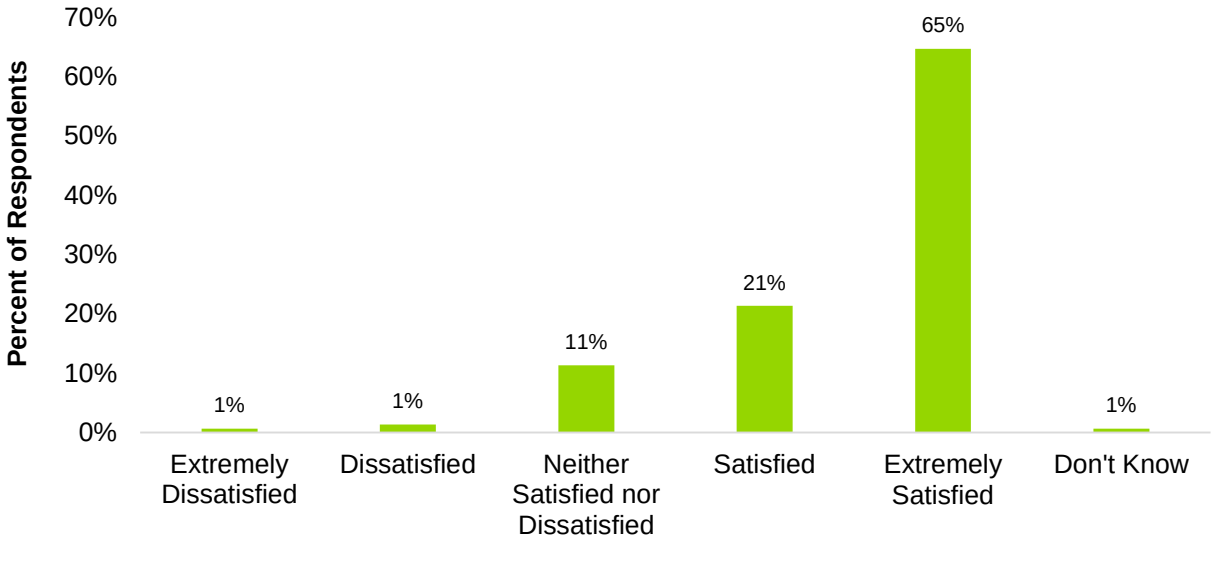


Question: "Thinking of the ways you heard about the Appliances and HVAC program, which one was most influential in your decision to participate in the program?" One response allowed.

Source: Navigant analysis

Based on a scale from 1 to 5, with 5 meaning "extremely satisfied" and 1 meaning "extremely dissatisfied," the Appliances and HVAC component received an average customer rating of 4.5, with 65% of respondents noting extreme satisfaction and 21% noting satisfaction. These responses are overwhelmingly positive; however, there is room for improvement, as there were 13% of respondents who reported a neutral or dissatisfying experience with the program. Reasons for a rating of 3 or below varied but generally included a desire for higher rebates, frustration with rebate delays, and difficulties with filling out the rebate application. Figure D-3 summarizes the satisfaction ratings provided by survey respondents when asked about the Appliances and HVAC component specifically.

Figure D-3. Overall Satisfaction with Appliances and HVAC, n=150

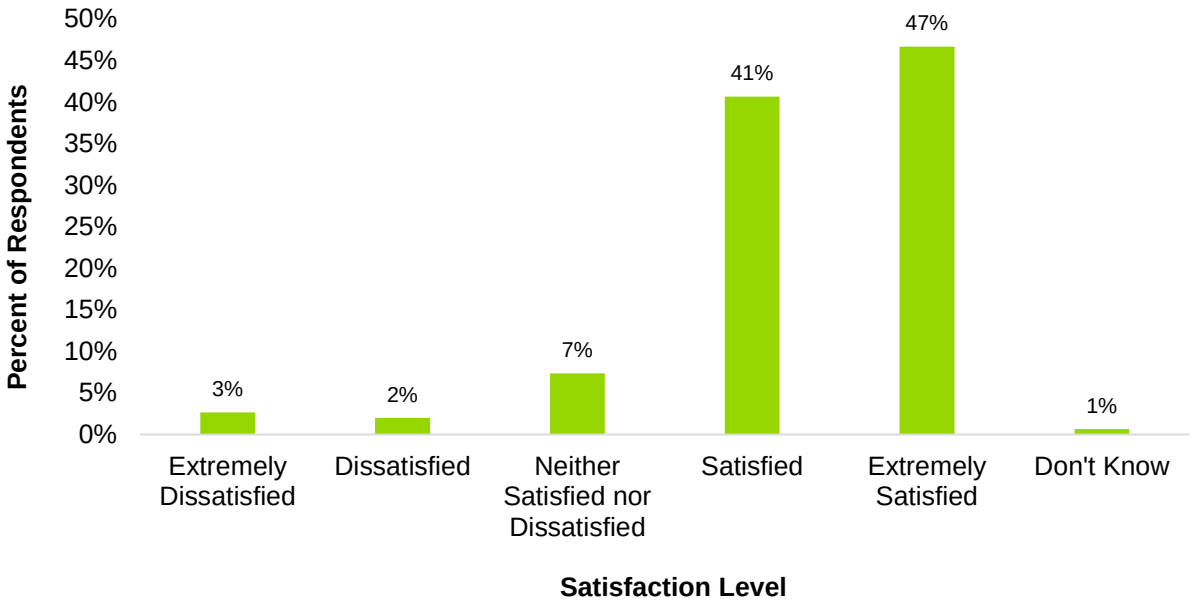


Question: "Using a scale of 1 to 5, with 5 meaning extremely satisfied and 1 meaning extremely dissatisfied, how would you rate your OVERALL satisfaction with the Appliances and HVAC program?"

Source: Navigant analysis

Based on the same scale from 1 to 5, PECO as a utility overall averaged a satisfaction rating of 4.3 among Appliances and HVAC participants, with 47% of respondents noting extreme satisfaction and 41% noting satisfaction. These responses were a bit lower than customer satisfaction with the Appliances and HVAC component itself, implying that satisfaction with PECO as a utility is not negatively impacted by the Appliances and HVAC component and that the component can likely play a role in increasing customer satisfaction with PECO overall. Figure D-4 summarizes the satisfaction ratings provided by survey respondents when asked about PECO as an overall utility.

Figure D-4. Appliances and HVAC Participant Satisfaction with PECO, n=150

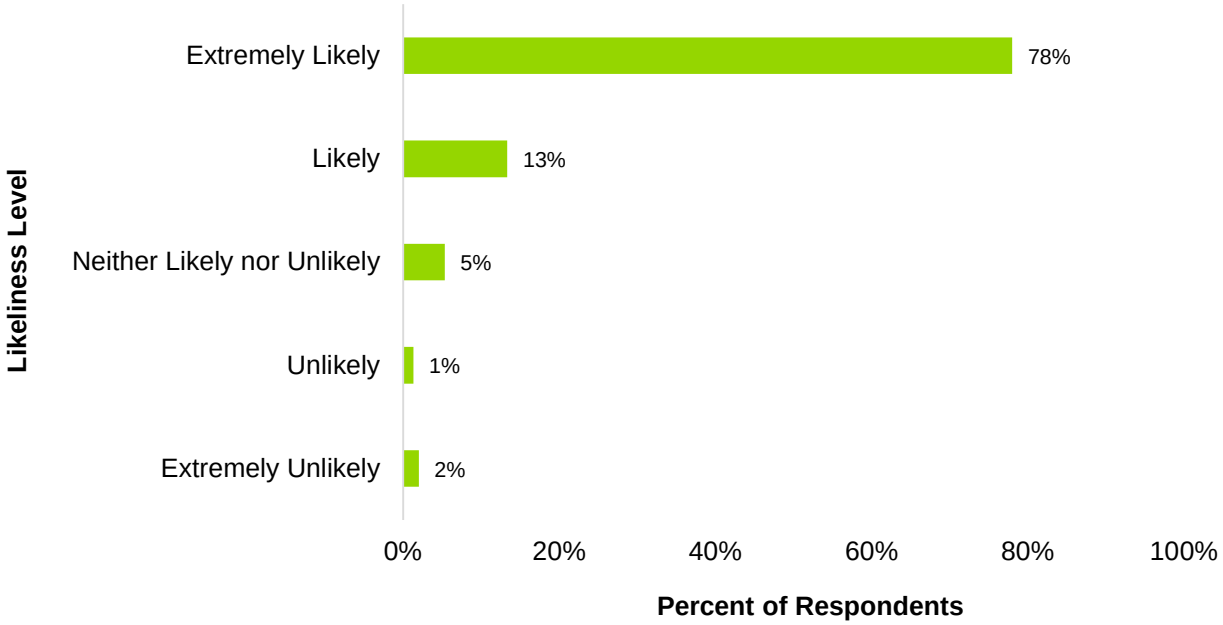


Question: "Thinking now about PECO the utility, and not just the Appliances and HVAC program, on a scale of 1 to 5, with 5 meaning extremely satisfied and 1 meaning extremely dissatisfied, how satisfied are you with PECO in general?"

Source: Navigant analysis

A majority (78%) of respondents said they were extremely likely to recommend the Appliances and HVAC component to another person, and only 3% said they were unlikely or extremely unlikely to recommend the component. As customer referrals and testimonials can be a powerful way to market programs and because the Appliances and HVAC component needs to increase participation moving forward, PECO should consider leveraging these customers by including quotes from them on marketing materials and by conducting a referral contest to encourage word of mouth marketing. Figure D-5 summarizes respondents' likelihood to recommend the program to others.

Figure D-5. Likelihood of Recommending the Appliances and HVAC to Others, n=150

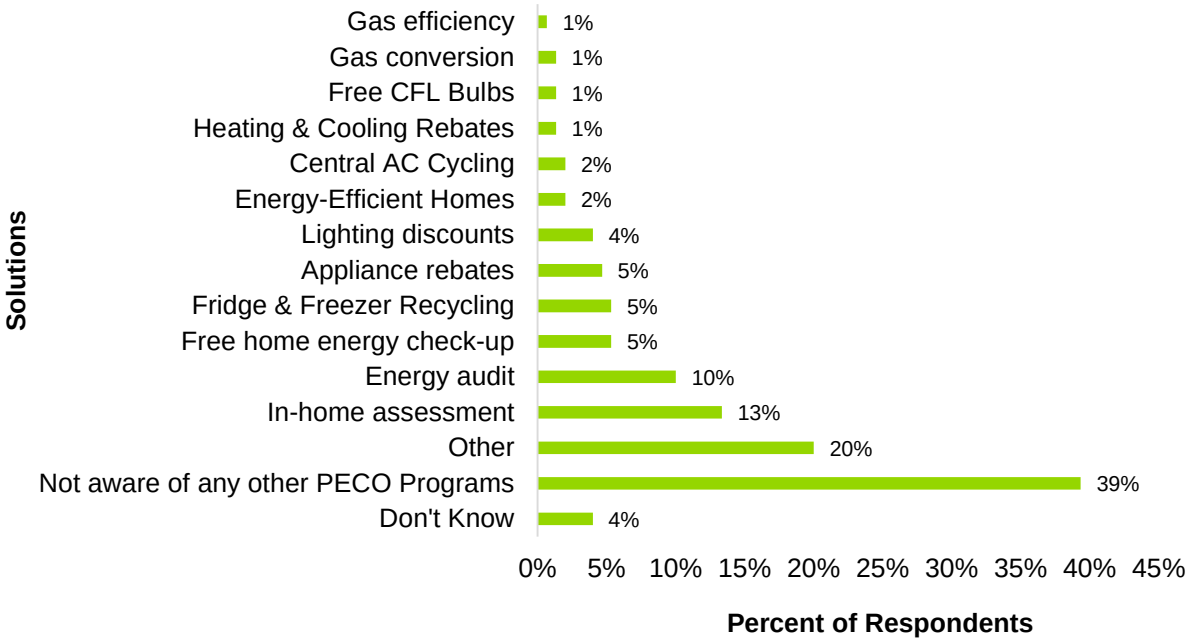


Question: "On a scale of 1-5, with 5 meaning extremely likely and 1 meaning extremely unlikely, overall, how likely are you to recommend PECOs Appliances and HVAC program to others?"

Source: Navigant analysis

The Appliances and HVAC component was only moderately effective at raising customer awareness of other PECO offerings. Most participants answered that they were not aware of any other PECO offerings (39%), which is lower than the cross-solution percentage of 47% seen in Figure 3-3. When they were aware of other offerings, Appliances and HVAC participants most often mentioned that they were aware of in-home assessments (13%) and energy audits (10%).

Figure D-6. Appliances and HVAC Participant Awareness of Other Solutions, n=150

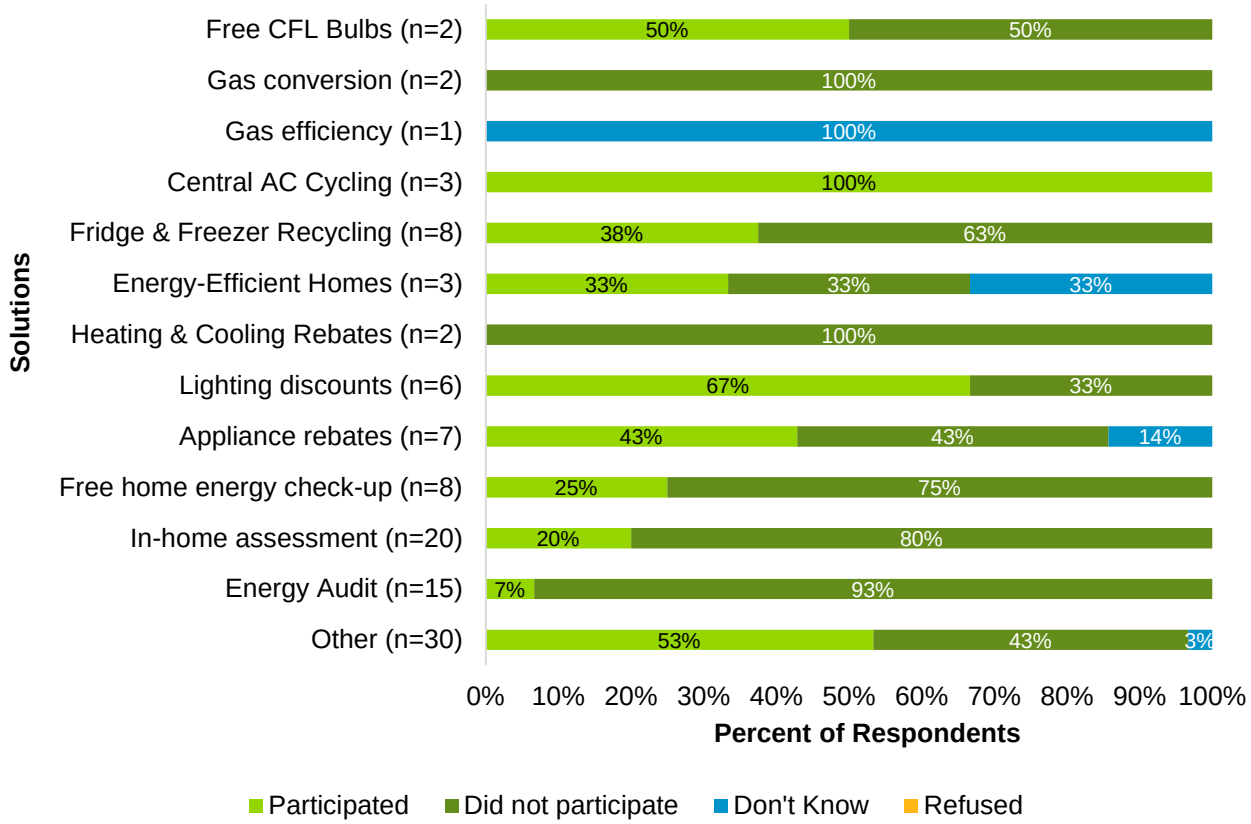


Question: ""Have you heard of any of PECOs other solutions to help you save energy and money in your home?"
Multiple responses allowed; sum of percentages will not add up to 100%.

Source: Navigant analysis

Furthermore, 20% of respondents who stated they were aware of the in-home assessment had participated in the in-home assessment, while only 7% of respondents who stated they were aware of the energy audit had participated in the energy audit. This indicates an opportunity to convert potentially eligible customers into new participants for the other solutions thus increasing participation across the Residential EE Program (Figure D-7).

Figure D-7. Residential EE Solution Participation Conditional on Awareness



Question: "Have you participated in PECO's [PREVIOUS RESPONSE] solution?"
Percentages may not add up to 100% due to rounding.
Source: Navigant analysis

Status of Recommendations

The following provides a summary of Navigant's findings and recommendations resulting from the PY8 evaluation of the Appliance and HVAC component of the Lighting, Appliances & HVAC Solution.

- **Finding:** Navigant found a small portion (13%) of respondents who reported a neutral or dissatisfying experience with the program. The majority of this group (11% of the 13%) said their satisfaction was neutral. However, the remainder of respondents voiced frustration with Appliance and HVAC rebate delays and difficulties with filling out the rebate application.
    - **Recommendation**: PECO and Navigant should research ways to improve the functionality of the online rebate application form to streamline the process for customers.
- **Finding:** The majority (78%) of respondents said they were extremely likely to recommend the Appliances and HVAC component to others.
    - **Recommendation:** PECO and Navigant should investigate ways to incentivize program participants to get friends and family to participate in the Appliances and HVAC component. For example, PECO should consider a referral reward system.

- **Finding:** The trade ally network of installation contractors is a key pathway for marketing PECO's portfolio of EE programs.
    - **Recommendation:** PECO should continue to provide the trade ally network with consistent marketing materials that send a unified message to customers and offer PECO as a one-stop-shop solution for a customer's EE needs.

D.2 Appliance Recycling Solution

The Appliance Recycling Solution helps customers recycle energy-wasting appliances by removing and recycling operating, inefficient refrigerators, freezers, and room air conditioners (AC) from residential customer sites at no cost to participants. As part of the changes to Phase III, PECO expanded the solution's offering to include room AC recycling for those participants recycling at least one refrigerator or freezer.

ARCA is the CSP for this solution. A participant is a customer who schedules a pickup for one or more units. If the same customer initiates multiple pickup orders during the year, each order is counted as an individual participant. However, if a customer initiates more than one order in the same day it counts as a single participant.

Additionally, customers may be referred to the Appliance Recycling Solution through other solution activities. For example, Low-Income Whole Home auditors may identify a qualifying appliance and recommend Appliance Recycling. A customer who implements Whole Home measures and recycles an appliance would be considered a participant in both solutions.

Participation and Reported Savings

Table I-3 in Appendix I provides the total Appliance Recycling solution results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

Gross Impact Evaluation

The Appliance Recycling Solution relied on two evaluation tasks to verify the gross impacts for the solution in PY8. Following an algorithm review of a census of recycled units in the program tracking data, the team first verified recycling through a survey of sampled customers to verify the accuracy of the tracking data. These verification surveys were conducted in concert with process and NTG research surveys. Information gathered by surveying such as the part-use factor (PUF) and other unit characteristics can also support updates to the PA TRM.

Secondly, the team refined the deemed gross verified savings through regression analysis to take into account the characteristics of the program's specific appliance stock—average age, number of cubic feet, and configuration, among others. The regression analysis specifics, including equation coefficients and independent variables, are detailed in the PA TRM. The evaluation team reviewed all units in the solution tracking data where these parameters are recorded so this regression analysis is comprehensive and does not require sampling. The results of the regression analysis produce the annual unit energy consumption (UEC) average for refrigerators and freezers in the EDC's territory. The regression analysis of the recycled stock calculated a higher UEC for refrigerators than the deemed value –1,093 kWh. It calculated a lower UEC for freezers—846 kWh.

This UEC is then multiplied by the PUF found through the participant survey. Survey respondents reported a lower PUF than the default value used in previous years: 84% for refrigerators, 81% for freezers. Though it has no impact on the verified savings estimate, survey respondents also reported a PUF of 23% for room ACs. The PUF for refrigerators and freezers is the primary driving factor for the Solution's verified savings.

Table D-18 provides details on the targeted and achieved sample for the PUF and NTGR calculation.

Table D-18. Appliance Recycling Solution PUF and NTG Sample

Stratum	Population Size*	Target Sample Size	Achieved Sample Size
Refrigerators	7,235	145	164
Freezers	1,569	35	47
Room Air Conditioners	769	10	10
Appliance Recycling Solution Total	**9,573**	**190**	**221**

Source: Navigant analysis

Based on the participant telephone survey, Navigant observed a 100% verification rate. That is, Navigant found no discrepancies between the tracked number of units picked up during each order.

The regression UEC, coupled with the survey verification and PUF, forms the basis for the gross verified savings related to compliance. This product yields a gross savings per unit that multiplied by the number of units recycled during the program year yields the solution verified savings. For refrigerators, Navigant verified gross energy and demand savings of 921 kWh and 0.1031 kWh. For freezers, Navigant verified gross energy and demand savings of 688 kWh and 0.0769 kWh. Finally, Navigant verified 100% of the room air conditioners, so their verified gross energy and demand savings match their deemed values, 159 kWh and 0.2603 kW. Overall, the energy and demand RRs for the Appliance Recycling Solution are of 0.93 and 0.92, respectively.

As shown by Table D-19, 82% of the solution's savings come from refrigerator recycling. Less than 2% of savings come from room ACs and the remainder from freezers. Navigant verified gross energy and demand savings of 7,968 MWh and 1.1 MW, respectively. Because some units are recycled as a referral from the Low Income Whole Home Solution, 7% of that savings is attributed to the Low Income Whole Home Solution, not Residential Appliance Recycling.

Table D-19. Appliance Recycling Gross Impacts Summary

Strata	Reported (kWh)	Reported (kW)	Verified (kWh)	Verified (kW)	Energy RR	Demand RR
Refrigerators	7,032,347	812	6,753,082	756	0.96	0.93
Freezers	1,373,476	156	1,090,510	122	0.79	0.78
Room Air Conditioners	124,338	204	124,338	204	1.00	1.00
Solution Total	**8,530,161**	**1,172**	**7,967,929**	**1,081**	**0.93**	**0.92**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Net Impact Evaluation

The Appliance Recycling Solution's net impact evaluation was informed by the previously described survey used to verify recycling events for the gross impact evaluation. That survey included specific question batteries so that net impacts could be calculated for each appliance type (refrigerators, freezers, and room ACs). Navigant also constructed questions so that net evaluation methods aligned with the Phase III Evaluation Framework's guidance.[52] Namely, the team gathered information to classify participants into one of four categories:

- Scenario A: Those who were induced to replace their appliance by the solution
- Scenario B: Those who would have kept their unit in lieu of the program
- Scenario C: Those who would have transferred the appliance to a second party
- Scenario D: Those who would have destroyed the appliance

Participants were separated into one of four categories: the small subset who was induced to replace their appliance by the solution, those who would have kept their unit in lieu of the program, those who would have transferred the appliance to a second party, and those who would have destroyed the appliance. In the Phase III Evaluation Framework terminology, these four categories correspond to Scenario A, Scenario B, Scenario C, and Scenario D.

Navigant estimated a NTG ratio of 0.35 for refrigerators, 0.50 for freezers, and 0.46 for room ACs. This is based on the overall proportion of participants who would keep their unit or discard it as described above. The net savings per refrigerator, freezer, and room AC were 319 kWh, 341 kWh, and 74 kWh per year, respectively.

The majority of respondents indicated that they would have transferred their appliance to a second party in the absence of the program, as indicated by Scenario C. Table D-20 shows the scenario assignments resulting from the survey. Navigant surveyed 198 participants who recycled 214 appliances.

[52] Phase III Evaluation Framework. Appendix B. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

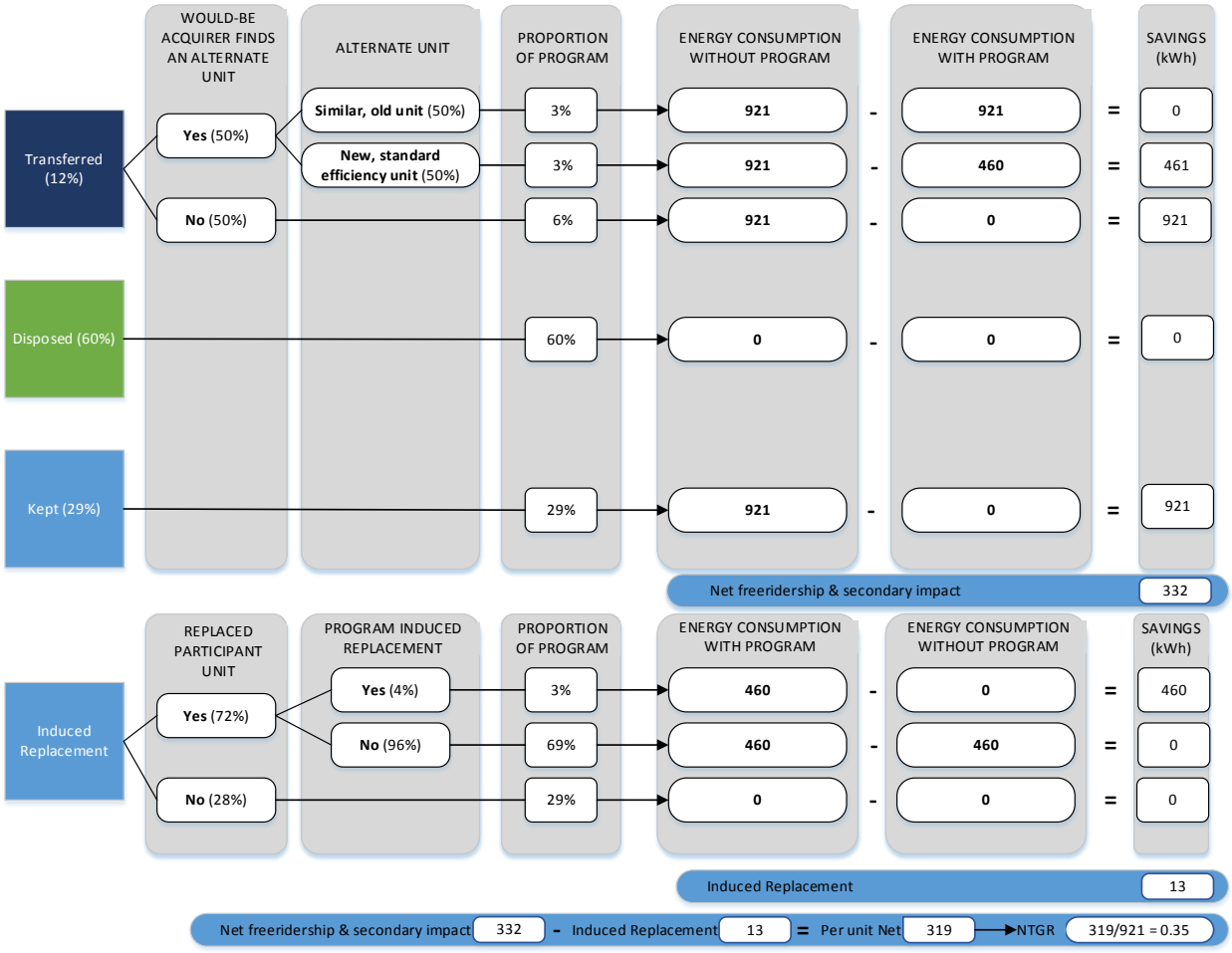
Table D-20. Appliance Recycling Net Scenario Assignment

Scenario	Total Units	Refrigerators	Freezers	Room AC Units
A	37	28	6	3
B	28	17	10	1
C	34	18	13	3
D	115	33	19	3
Total Classified in Strata (excluding don't knows)	**214**	**156**	**48**	**10**

Source: Navigant analysis

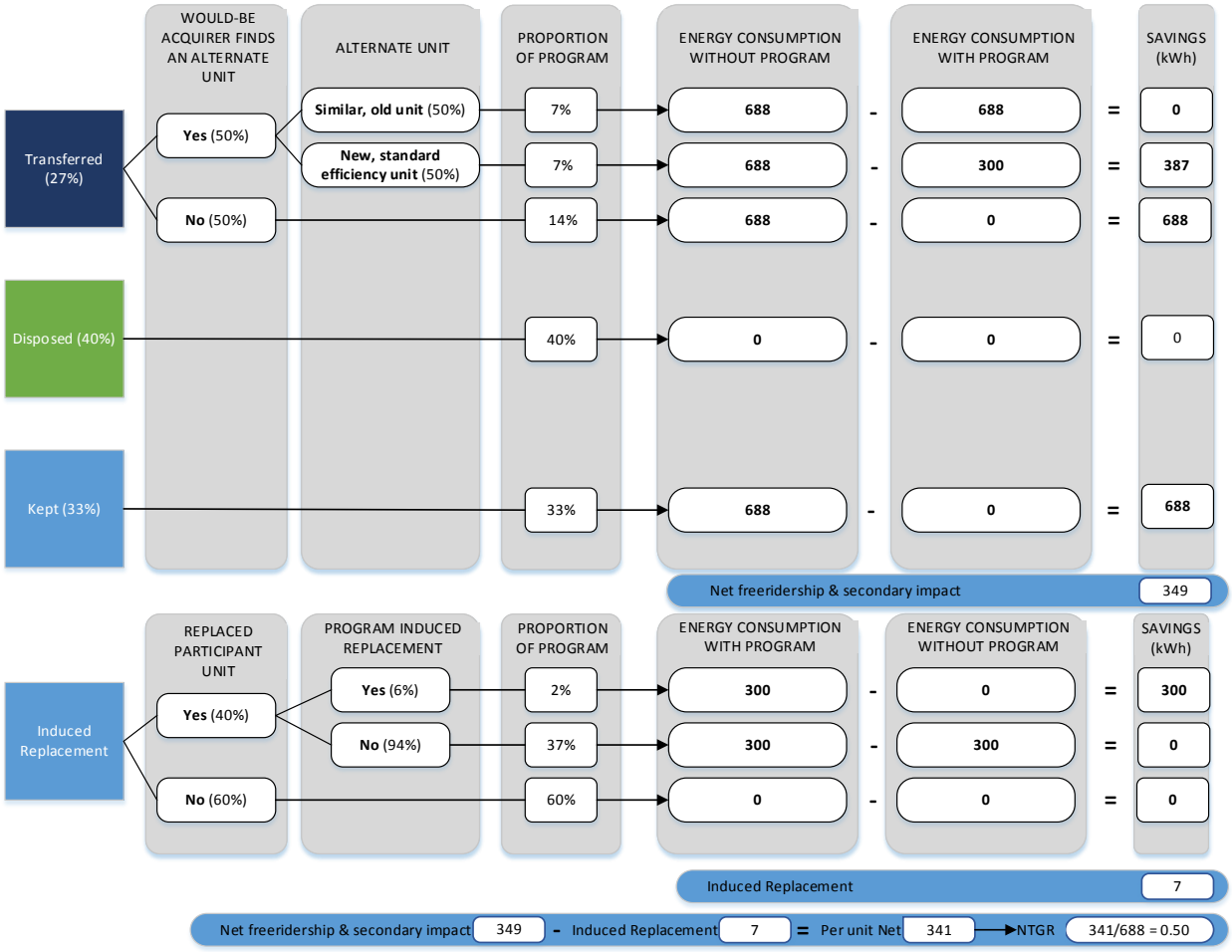
Figure D-8, Figure D-9, and Figure D-10 also show how the savings of each scenario, multiplied by the proportion of PY8 participants who would have followed that scenario if PECO did not recycle their appliance and less any induced replacement appliance purchases, determine the net savings per unit.

Figure D-8. Appliance Recycling Net Savings Calculation, Refrigerator



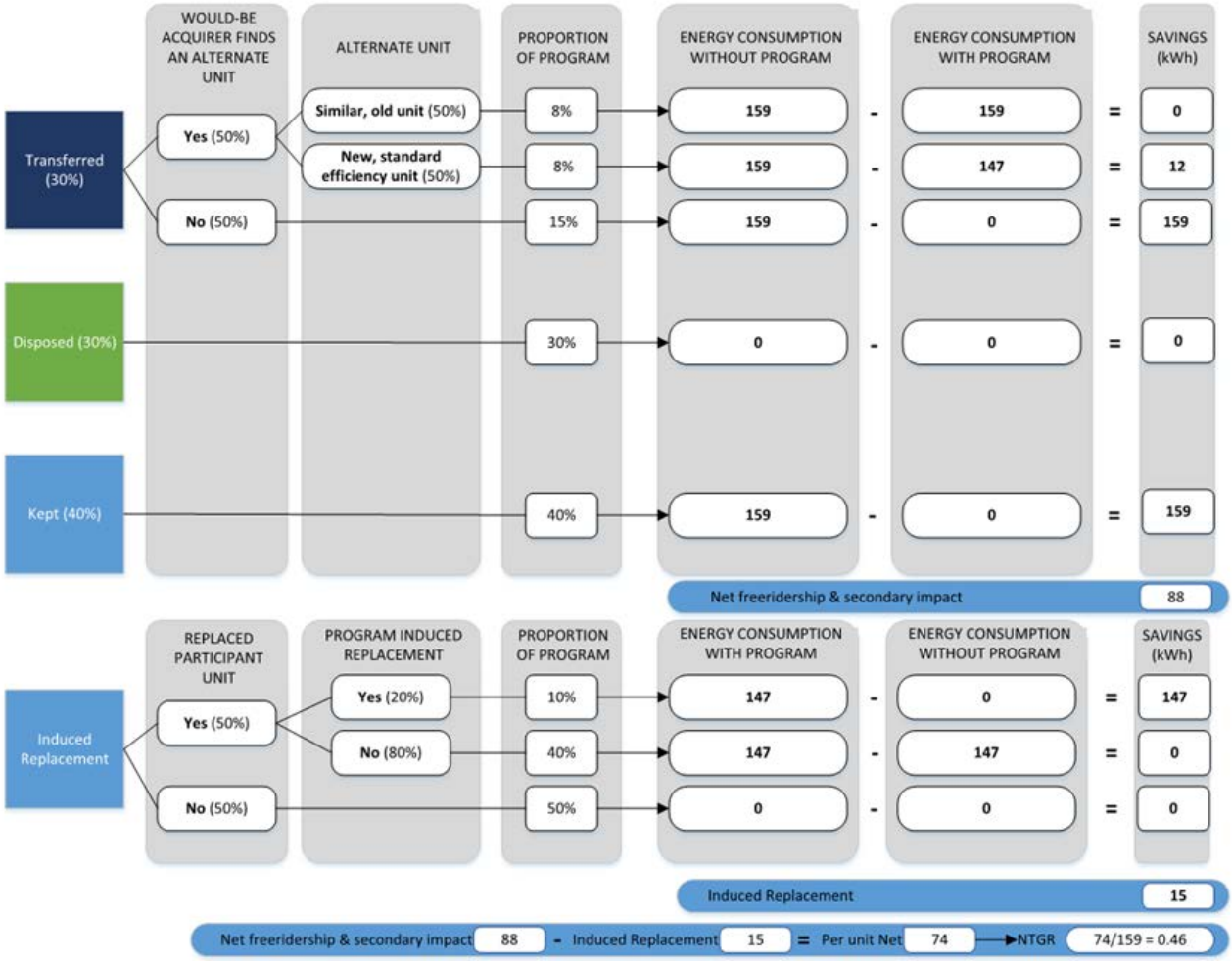
Source: Navigant analysis

Figure D-9. Appliance Recycling Net Savings Calculation, Freezer



Source: Navigant analysis

Figure D-10. Appliance Recycling Net Savings Calculation, Room AC



Source: Navigant analysis

The survey also found that 64% of respondents replaced their recycled units and that the program's offering induced 5% of respondents to seek out new replacement units. Table D-21 shows the replacement activities found from the PY8 survey.

Table D-21. Appliance Recycling Participant Replacement Activities

Scenario	Total Units	Refrigerators	Freezers	Room AC Units
Those who replaced participating unit (count)	136	112	19	5
Those who replaced participating unit (%)	64%	72%	48%	50%
Those with replacement induced (count)	11	6	3	2
Those with replacement induced (%)	5%	4%	8%	20%
Total Classified in Strata (excluding Don't Knows)	**214**	**156**	**40**	**10**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table D-22 shows the results of the gross and net impact evaluation. The program achieved an NTGR of 0.37 for PY8.

Table D-22. Appliance Recycling Net Impact Summary

Appliance	Reported Gross Savings (MWh)	Verified Gross Savings (MWh)	NTG Ratio	Verified Net Savings (MWh)
Refrigerator	7,032	6,753	0.35	2,342
Freezer	1,373	1,091	0.50	541
Room AC	124	124	0.46	58
Total	**8,530**	**7,968**	**0.37**	**2,940**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Process Evaluation

As discussed in Section 3.1.5, Navigant performed an early feedback process evaluation for the Residential EE Program and its solutions during PY8. For the Appliance Recycling Solution, this early feedback process evaluation work included the following:

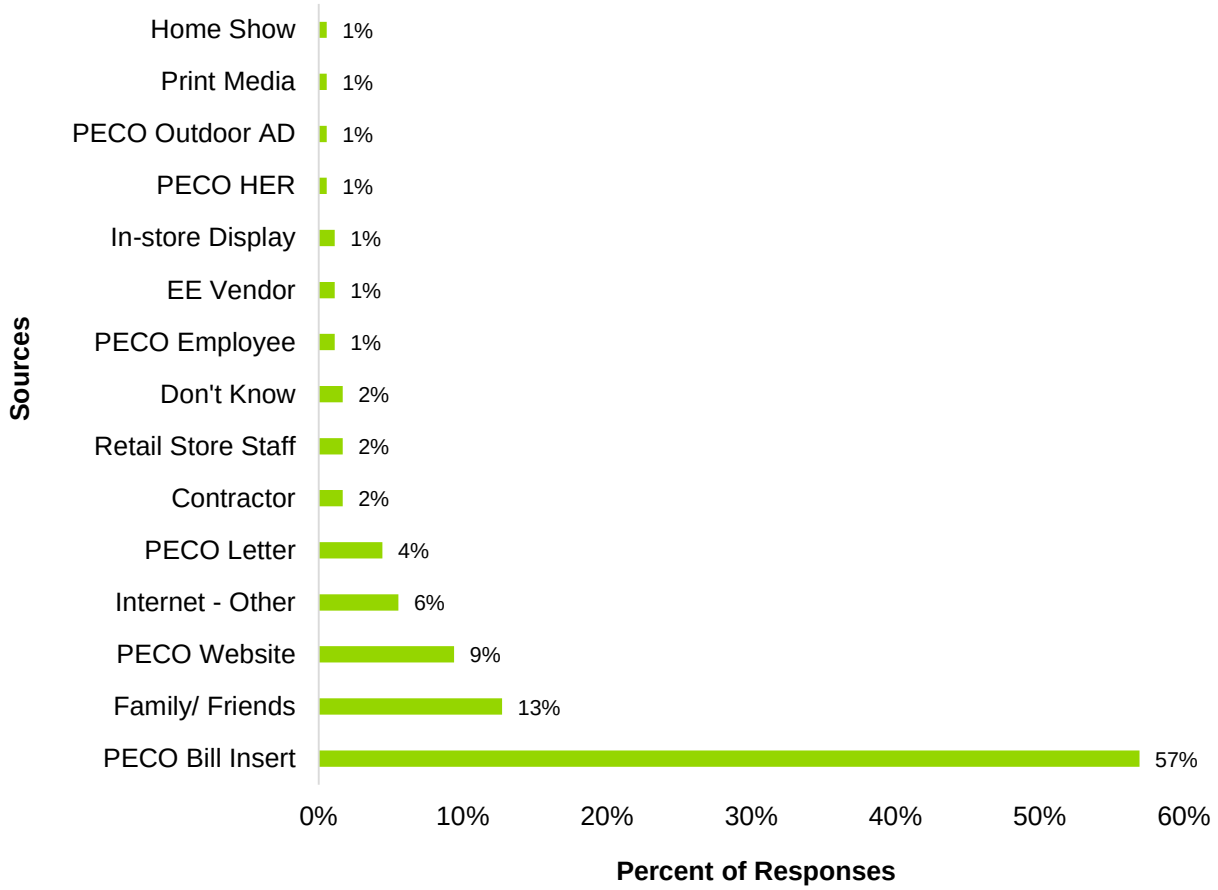
- PECO and CSP staff interviews
- Phone survey of participants to assess how customers heard about the solution; their satisfaction with the program, solution, and PECO overall; and awareness of other PECO solutions. Navigant segmented the survey sample according to participation type, as outlined in Section 3.1.5 and Table 3-21.

While PECO has successfully pioneered changes to the solution in PY8 along with its CSP partner ARCA, the solution did not achieve its savings targets due to low participation. As discussed in Section 3.1.5, the early process evaluation indicates that the Residential EE Program participation shortfalls are primarily due to PY8 being a ramp-up year for the phase and will be further explored via specific research during the PY9 evaluation. This applies to Appliance Recycling as well. For example, to ramp up for Phase III, PECO worked extensively with ARCA to co-brand crews and trucks and provide dedicated customer service agents. However, at the beginning of PY8 (June 2016), ARCA's call center was

inundated with calls and could not meet PECO's standard of answering calls within 30 seconds. This was addressed after PECO intervened, but the solution did not see a complete bounce back until later in the program year.

As seen in Figure D-11, the majority of participants surveyed (57%) learned about the program through a PECO bill insert, while the remaining 43% of participants learned about the program through family/friends, the PECO website, the general Internet, or through a PECO letter (in that order).

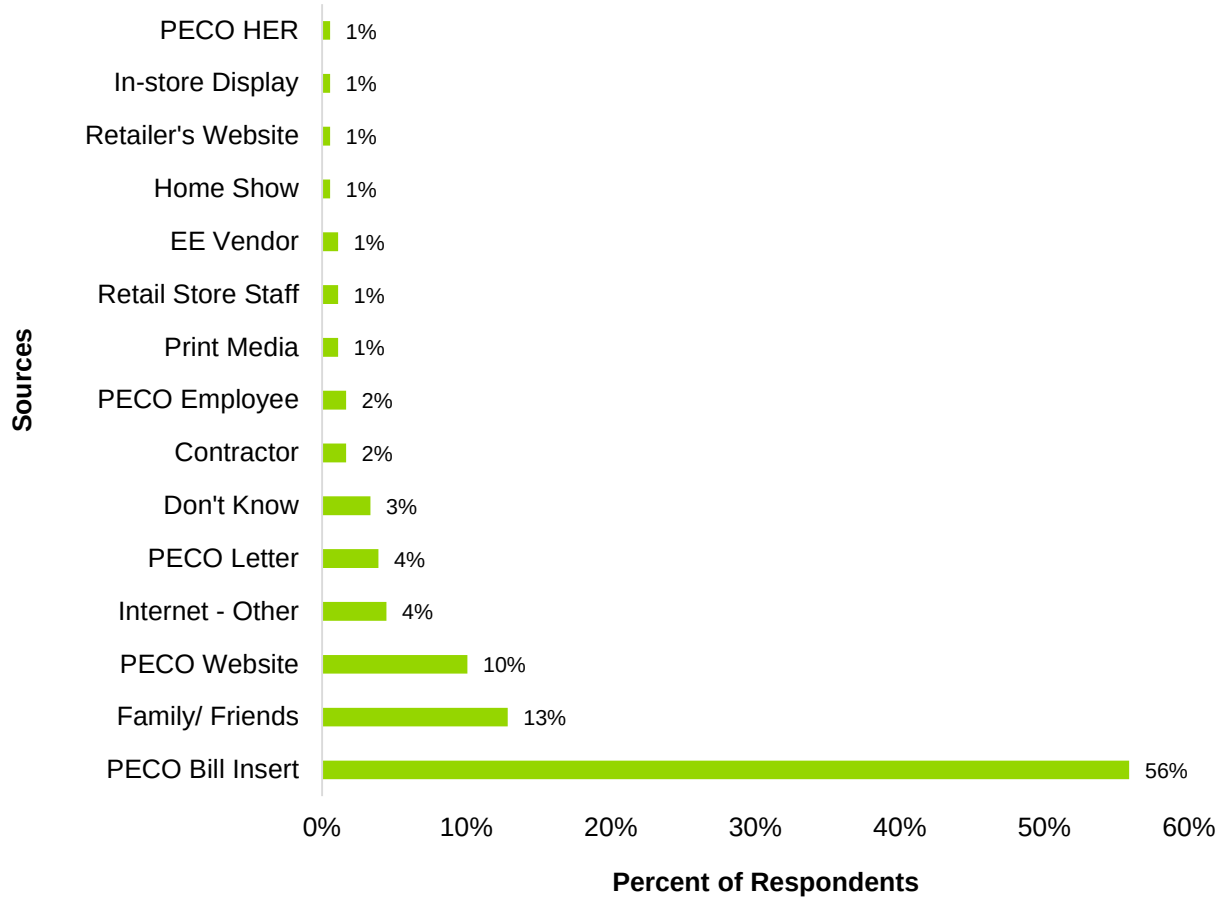
Figure D-11. Sources of Appliance Recycling Solution Awareness, n=180



Question: "How did you learn about the [SOLUTION] program?"
Multiple responses allowed so percentages will not add up to 100%.
Source: Navigant analysis

Similarly, bill inserts were also the most influential in a customer's decision to participate in the solution, as seen in Figure D-12. Family/friends, the PECO website, the general Internet, and PECO letters made up a majority of the rest of the responses regarding influence. These results confirm that participants felt that bill inserts were PECO's most memorable and influential marketing tool for this program. Continuing and possibly increasing the use of bill inserts to inform customers of PECO programs may serve to increase participation. Additionally, further optimization of other marketing channels such as vendors, home energy reports, and mass market advertising is needed.

Figure D-12. Awareness Source Influence on Appliance Recycling Participation, n=178

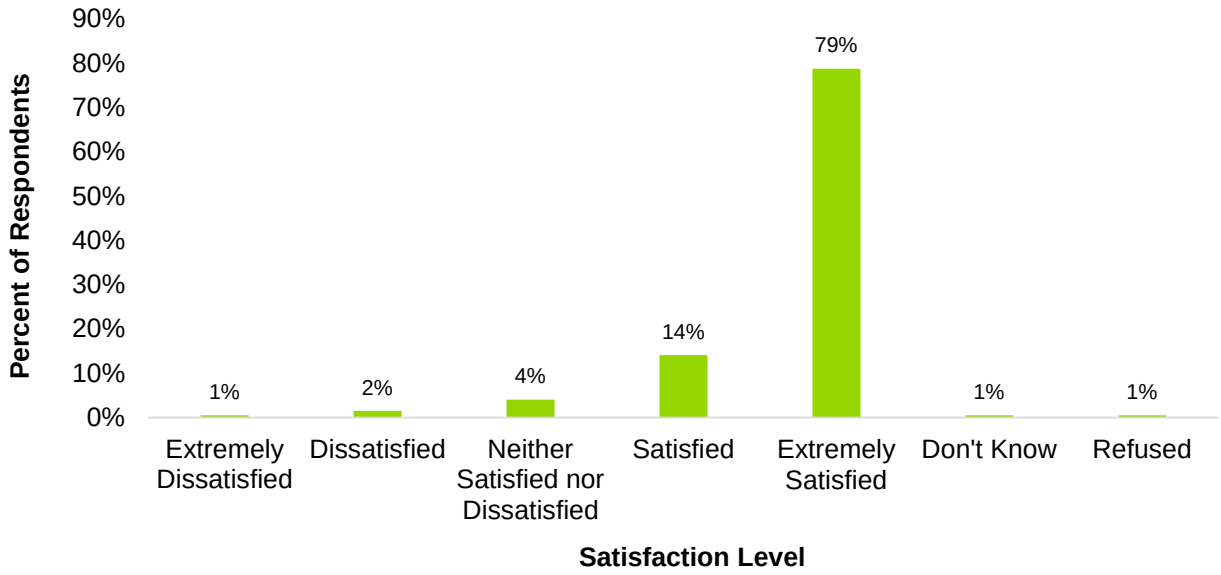


Question: "Thinking of the ways you heard about the [SOLUTION] program, which one was most influential in your decision to participate in the program?" One response allowed.

Source: Navigant analysis

Based on a scale from 1 to 5, with 5 meaning "extremely satisfied" and 1 meaning "extremely dissatisfied," the Appliance Recycling Solution received an average customer rating of 4.7, with 79% of respondents noting extreme satisfaction and 14% noting satisfaction. These responses are overwhelmingly positive; however, there is room for improvement, as there were 7% of respondents who reported a neutral or dissatisfying experience with the program. Reasons for a rating of 3 or below varied but generally included a desire for larger and faster rebates. While larger incentives are a typical response for a question of this nature, the point about providing rebates in a more timely manner indicates that PECO and the CSP should monitor and improve rebate processing times. Figure D-13 summarizes the satisfaction ratings provided by survey respondents when asked about the Appliance Recycling Solution specifically.

Figure D-13. Overall Satisfaction with Appliance Recycling Solution, n=198

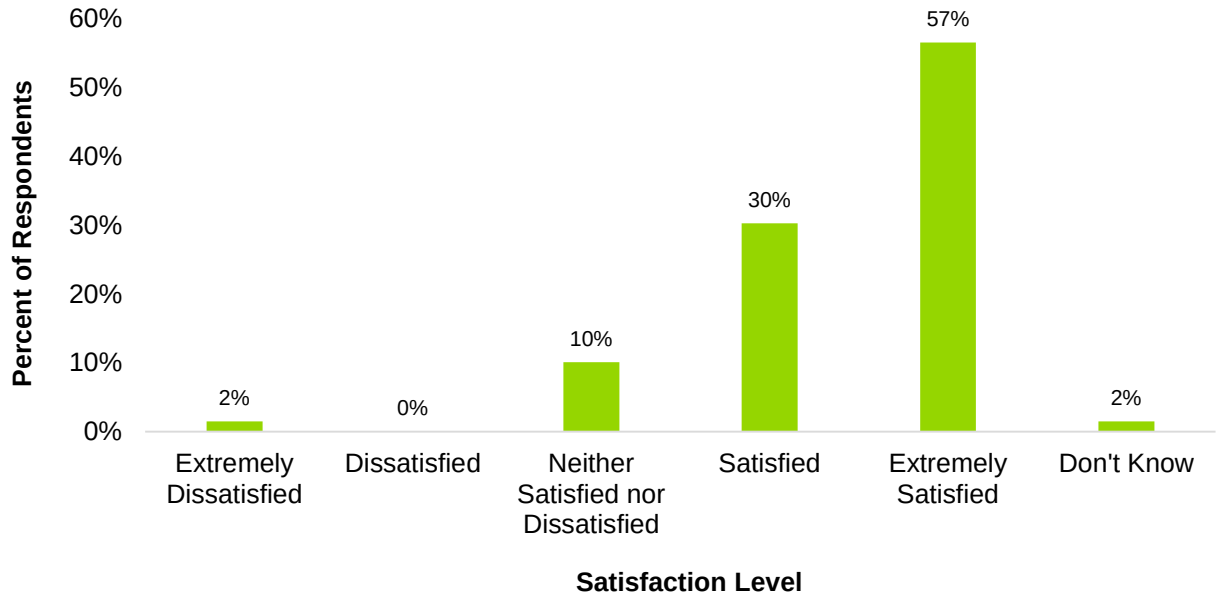


Question: "Using a scale of 1 to 5, with 5 meaning extremely satisfied and 1 meaning extremely dissatisfied, how would you rate your OVERALL satisfaction with the Recycling program?"

Source: Navigant analysis

Based on the same scale from 1 to 5, PECO as a utility overall averaged a satisfaction rating of 4.4 among Appliance Recycling participants, with 57% of respondents noting extreme satisfaction and 30% noting satisfaction. These responses were a bit lower than customer satisfaction with the Appliance Recycling Solution itself, implying that satisfaction with PECO as a utility is not negatively impacted by the Appliance Recycling Solution and that the solution can likely play a role in increasing customer satisfaction with PECO overall. Figure D-14 summarizes the satisfaction ratings provided by survey respondents when asked about PECO as an overall utility.

Figure D-14. Appliance Recycling Participant Satisfaction with PECO, n=198

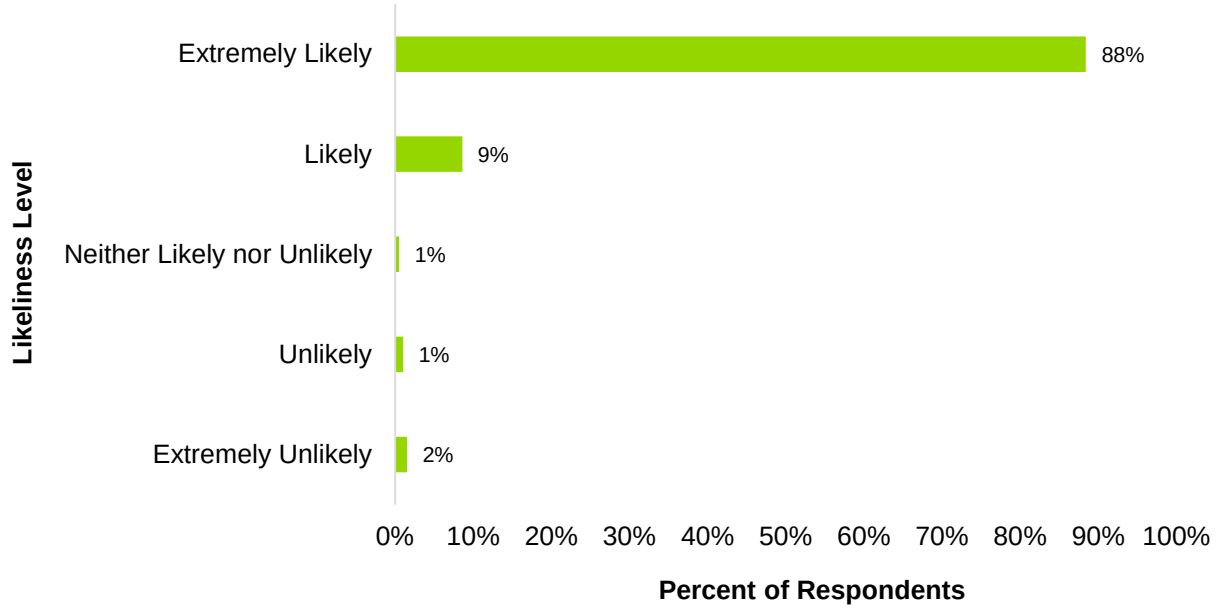


Question: "Thinking now about PECO the utility, and not just the [Solution] program, on a scale of 1 to 5, with 5 meaning extremely satisfied and 1 meaning extremely dissatisfied, how satisfied are you with PECO in general?"

Source: Navigant analysis

An overwhelming majority (88%) of respondents said they were extremely likely to recommend the Appliance Recycling Solution to another person, and only 3% said they were unlikely or extremely unlikely to recommend the solution. As customer referrals and testimonials can be a powerful way to market programs and because this solution needs to increase participation moving forward, PECO should consider leveraging these customers by including quotes from them on marketing materials and by conducting a referral contest to encourage word of mouth marketing. Figure D-15 summarizes respondents' likelihood to recommend the program to others.

Figure D-15. Likelihood of Recommending Appliance Recycling Solution to Others, n=198

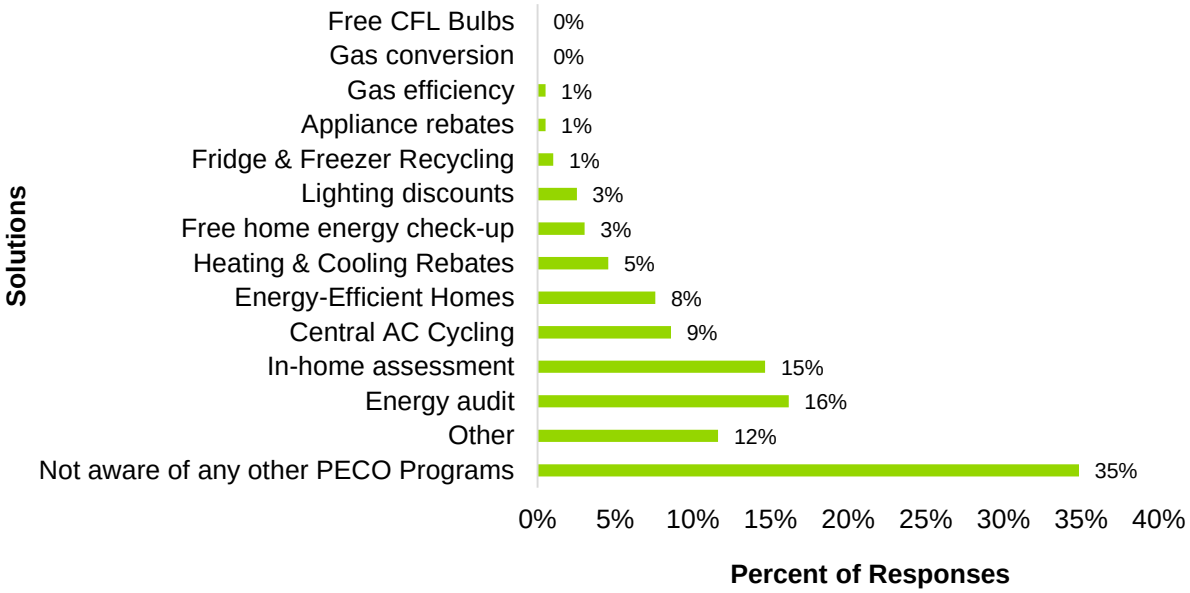


Question: "On a scale of 1-5, with 5 meaning extremely likely and 1 meaning extremely unlikely, overall, how likely are you to recommend PECOs Recycling program to others?"

Source: Navigant analysis

The Appliance Recycling Solution is moderately effective at raising customer awareness of other PECO offerings when compared to other PECO solutions. Participants were most likely to say they were not aware of any other PECO offerings (35%), which is lower than the cross-solution percentage of 47% seen in Figure 3-3. When they were aware of other offerings, Appliance Recycling participants were most likely to say they were aware of energy audits (16%) and in-home assessments (15%).

Figure D-16. Appliance Recycling Participant Awareness of Other Solutions, n=198

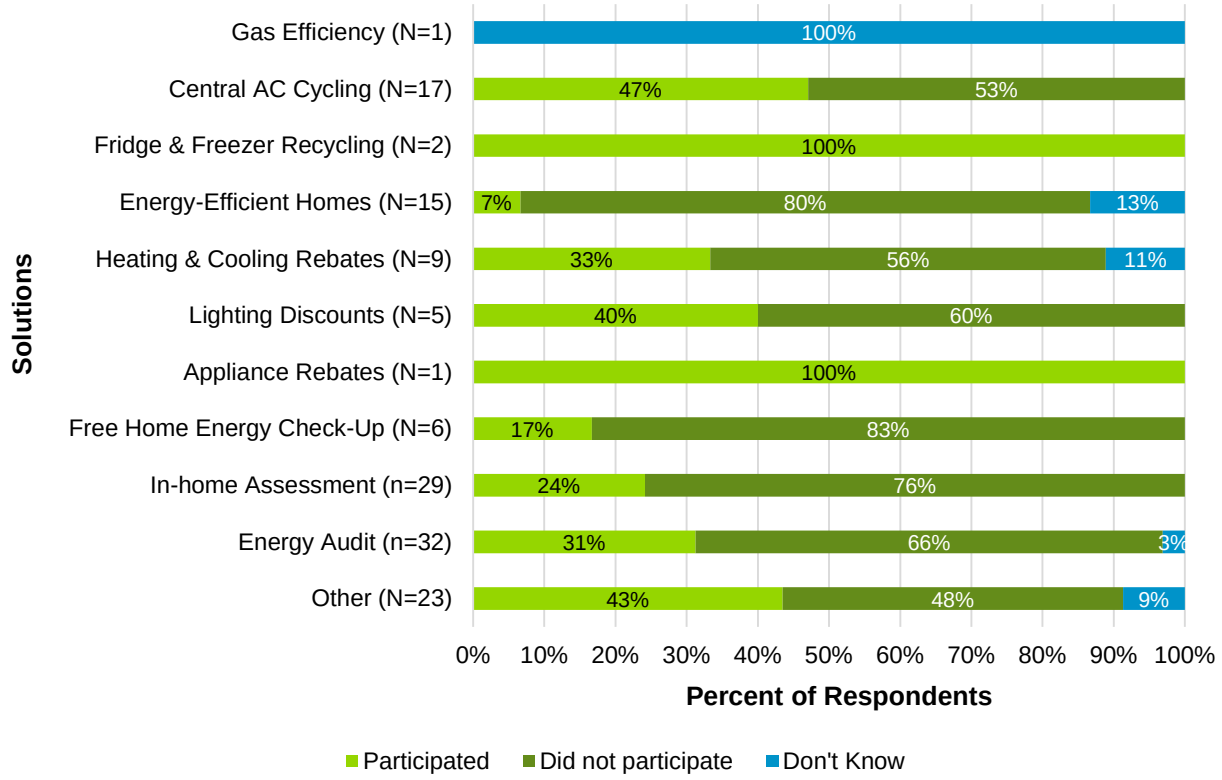


Question: ""Have you heard of any of PECOs other solutions to help you save energy and money in your home?"
Multiple responses allowed; sum of percentages will not add up to 100%.

Source: Navigant analysis

Of those Appliance Recycling Solution participants that stated they were aware of another PECO solution—31% of those aware of the energy audits and 24% of those aware of the in-home assessments—said they participated in the other solution. This indicates an opportunity to convert potentially eligible customers into new participants for the other solutions, thus increasing participation across the Residential EE Program.

Figure D-17. Residential EE Solution Participation Conditional on Awareness



Question: "Have you participated in PECO's [PREVIOUS RESPONSE] solution?"
Percentages may not add up to 100% due to rounding.
Source: Navigant analysis

Status of Recommendations

The following provides a summary of Navigant's findings and recommendations resulting from the PY8 evaluation of the Appliance Recycling Solution.

- **Finding:** Satisfaction ratings for the Appliance Recycling Solution were overwhelmingly positive; however, 7% of respondents reported a neutral or dissatisfying experience with the solution. Reasons for a rating of 3 or below varied but generally included a desire for faster rebates. The CSPs monthly reports to PECO include incentive check processing time as a key performance metric, but Navigant was unable to verify the claim that 100% of checks are processed within 15 business days.
    - **Recommendation**: PECO and Navigant should review the CSP's process for monitoring check issuance timing as part of the PY9 evaluation. PECO should continue to enforce acceptable rebate processing times as one of the CSP's key performance metrics.
- **Finding:** An overwhelming majority (88%) of respondents said they were extremely likely to recommend the Appliance Recycling Solution to another person.

  - **Recommendation:** As customer referrals and testimonials can be a powerful way to market programs and because this solution needs to increase participation moving forward, PECO should consider leveraging these customers by including quotes from them on marketing materials and by conducting a referral contest to encourage word of mouth marketing.

- **Finding:** Induced replacements are up from the previous year. In PY7, Navigant found that 2% of refrigerator and 3% of freezer replacements were driven by customer participation in the program. In PY8, those numbers increased to 4% and 8%, respectively.
  - **Recommendation:** PECO and Navigant should monitor this inducement rate throughout the phase. Specific marketing that highlights the benefits of recycling without replacement may positively impact this rate.

D.3 Whole Home Solution

The Whole Home Solution helps customers that want to understand how to improve the energy performance of their entire home. This solution offers a general walkthrough assessment to all PECO residential customers and a more comprehensive audit—including blower door test and combustion safety test—to PECO customers with residential electric heat or central air conditioning. Participating customers are sorted into one of these two categories based on the outcome of an initial screening call with CSP staff.

Direct install measures accompany the audits and can include measures for lighting (e.g., LEDs), water conservation (e.g., faucet aerators), and other end uses. Auditors may recommend air sealing or insulation, available through a follow-up visit with a participating contractor. Rebates are also available to these participants for HVAC system components (e.g., heat pumps, water heaters, etc.). Onsite auditors may identify and refer these measures as part of the home audit visit to meet specific customer situations. Participants then obtain the rebates separately.

The solution is implemented by two CSPs for PECO. CLEAResult implements the audits and direct installation of lighting, water conservation, and shell measures. Ecova implements rebates for major HVAC measures.

A participant is considered a unique project number from non-adjusted PECO records with a project type that does not include “Other Installations” or “CAC Other Installations.”

Participation and Reported Savings

Table I-4 in Appendix I provides the total Whole Home Solution results for PY8 that contribute to the Residential EE Program accomplishments. The solution results include participation, energy and demand savings, and incentive costs. The Whole Home Solution is undergoing a 2-year evaluation, combining PY8 and PY9. Reported savings for PY8 are unverified. The combined PY8 and PY9 evaluation will result in total verified savings for the 2-year period ending in and reported during PY9. PY9 verified savings will be adjusted to incorporate the impact evaluation and NTG results for the combined period.

Table D-23. PY8 Whole Home Unverified Savings

Solution	Unverified PYRTD MWh/year	Unverified PYRTD MW/year (EE)
Whole Home	2,709	0.3

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Gross Impact Evaluation

To start off Phase III, the Whole Home Solution evaluation covers a 2-year period for both PY8 and PY9. Evaluation activities are currently underway, but there are no verified savings to report at this time. Results for the 2-year period will be reported in PY9. During this interim period, Navigant relies on the recent and relevant analysis results of PY7 to inform this year's results.

The Whole Home Solution evaluation will report verified savings as part of the PY9 annual compliance report. Those verified savings will be informed by engineering file reviews, onsite verifications, and phone verifications.

Net Impact Evaluation

Navigant applied the NTG ratio developed in PY7 for the Smart House Call program[53] to estimate the net impacts for the Whole Home Solution of PY8. The NTG ratio is 0.94 and reflects 13% of participants as free riders and 7% additional savings in the form of spillover.

Similar to the schedule for gross impacts, this solution will report on verified net findings as part of the PY9 reporting cycle.

Process Evaluation

As discussed in Section 3.1.5, Navigant performed an early feedback process evaluation for the Residential EE Program and its solutions during PY8. For the Whole Home Solution, this early feedback process evaluation work included PECO and CSP staff interviews.

As part of the 2-year evaluation, Navigant will conduct a survey of participant customers to assess experience and satisfaction with the Whole Home Solution. Comprehensive PY8 and PY9 results for the solution will be reported through the PY9 annual report.

[53] Details on the PY7 analysis and resulting NTG ratio for the Smart House Call program can be found within Section 3 of the PY7 Annual Compliance Report: https://www.peco.com/SiteCollectionDocuments/My%20Account/Annual%20Reports/11.15.16%20PECO%20EE_CP%20PY7%20Annual%20Report%20Final%20wo%20cover%20letter.pdf

Status of Recommendations

The following provides a summary of Navigant's findings and recommendations resulting from the PY8 evaluation of the Whole Home Solution.

- **Finding:** Customer-facing program materials describe the monetary value of audit participation rather than the financial and comfort benefits of completing efficiency projects through the solution. In addition, PECO staff reports that customer satisfaction and motivation to participate are driven by factors that are not promoted in the program materials. These include the following:
    - Direct installation of products during audits
    - Unbiased analysis and recommendations
    - Access to PECO's certified contractors, with QC mechanisms
    - EE education: one-on-one experience with auditor, personal interaction, specific to each home
    - Overall customer service/experience
        - **Recommendation:** PECO should adjust customer-facing promotional materials to describe benefits in terms of completed project results, provide a strong call to action, and encourage completed project conversion. Messaging should use themes that customers have reported as core drivers of satisfaction and motivation to promote participation and project completion.
- **Finding:** PECO does not track the conversion rate from audit recommendations of major mechanical measures (heat pumps, water heaters, pool pumps, etc.) to customer project completions. This is due, in part, to the complexities of multiple CSPs implementing the solution. This is expected to change in January 2018, when a single CSP, CLEAResult, will be responsible for implementing the entire solution.
    - **Recommendation**: PECO and the CSP should develop a tracking system to record major measure recommendations at the time of the audit and monitor conversion rates to major measure installations. PECO and the CSP should use the data to determine the success rate of audit recommendations and identify potential areas where customers may get dropped between audit and major measure installations.
- **Finding:** In PY8, the Whole Home Solution allowed certified contractors to bring their customers into the program rather than requiring an in-home assessment first.
    - **Recommendation:** PECO, the CSP, and Navigant should monitor and compare satisfaction and conversion rates for customers who enter the solution through the traditional phone center and PECO marketing outreach as compared to those customers entering directly through Whole Home-certified contractors.
- **Finding:** The project database does not identify key date fields to track customer progress through the program. This is due, in part, to the complexities of separate call centers and implementation CSPs.
    - **Recommendation:** The CSP should develop tracking date fields to monitor customer progress and program performance. Consider tracking dates to monitor elapsed time between:
        - Customer inquiry to PECO and audit site visit

- Audit site visit to major measure installation
- Major measure installation to incentive payment completed

D.4 New Construction Solution

Builders who are building a new single-family or multifamily homes can take advantage of the Residential New Construction Solution's incentive offerings to incorporate energy efficiency. This solution is intended to accelerate the adoption of EE in the design, construction, and operation of new single-family and multifamily homes by leveraging the US Environmental Protection Agency's (EPA's) ENERGY STAR Homes certification. The solution also offers incentives for Code Plus homes. A Code Plus home achieves savings of 30% above a code-level home and provides builders an additional incentive tier that is below the ENERGY STAR-certified home level.

Performance Systems Development (PSD) is the CSP for this solution. A participant is a new home.

Participation and Reported Savings

Table I-5 in Appendix I provides the total New Construction Solution results for PY8 that contribute to the Residential EE Program accomplishments. The solution results include participation, energy and demand savings, and incentive costs.

Gross Impact Evaluation

Navigant applied the RRs developed in PY7 for the Smart Builder Rebates program.[54] The New Construction Solution of PY8 and the Smart Builder Rebates program of PY7 are virtually the same. The energy and demand RRs are 0.99 and 0.76, respectively; reported and verified savings were developed with DOE-2-based modeling software. The lower demand RR reflects the use of calculations for reported demand savings that did not align with TRM protocols.

Given that the New Construction Solution is virtually unchanged (other than the name) and that it is a small contributor to Residential EE Program savings, Navigant deferred the start of evaluations to PY9. However, during PY8, Navigant conducted a review of a sample of REM/Rate reports as part of its verification and due diligence activities. Specifically, the team confirmed that energy savings generated in the CSP's REM/Rate files matched savings reported in PECO's data tracking systems. No discrepancies were found that might warrant additional investigations or changes to the evaluation schedule.

The New Construction Solution will be evaluated during PY9; the evaluation activities will include a review of both PY8 and PY9 projects to verify gross impacts.

[54] Details on the PY7 analysis and resulting RRs for the Smart Builder Rebates program can be found within Section 7 of the PY7 Annual Compliance Report: https://www.peco.com/SiteCollectionDocuments/My%20Account/Annual%20Reports/11.15.16%20PECO%20EE_CP%20PY7%20Annual%20Report%20Final%20wo%20cover%20letter.pdf

Net Impact Evaluation

Similar to the gross impacts, Navigant applied the NTG ratio developed in PY7 for the Smart Builder Rebates program[55] to estimate the net impacts for the New Construction Solution of PY8. The NTG ratio is 0.50, reflecting half of the builders as free riders as they were already building to ENERGY STAR standards prior to joining PECO's program. The PY7 evaluation found no spillover savings attributed to the program.

Similar to the schedule for gross impacts, this solution will be evaluated during PY9 to verify net impact.

Process Evaluation

Navigant did not complete a targeted process evaluation for the New Construction Solution during PY8. Instead, a solution-specific process evaluation will be conducted as part of the PY9 evaluation. Navigant's Residential EE Program process evaluation efforts and findings, detailed in Section 3.1.5, targeted the program and cross-solution levels. Findings and insights from that effort are intended to inform PECO about all Residential EE Program solutions, including the New Construction Solution.

Status of Recommendations

Navigant makes no recommendations that are specific or unique to the New Construction Solution for PY8. Navigant anticipates making these recommendations following the PY9 evaluation activities.

D.5 Behavioral Solution

A major objective of the Residential EE Program is to provide education, awareness, and motivation to customers that want easy entry into the energy efficiency market and want to benefit from energy efficient products. To achieve these ends, the Behavioral Solution partners with Oracle to implement a randomized control trial (RCT) that provides a select set of residential customers with home energy reports (HERs). The reports provide participants with helpful information about the ways they use energy. HERs also use social norms to compare the customer's energy use to the average energy use of other households like theirs, so customers have a better sense of whether their energy use patterns fall above or below the norm. Finally, these reports provide targeted recommendations or tips to customers that suggest actions that customers can take to reduce consumption. The combination of HER content serves to enhance a customer's understanding of their energy use, encourage them to reduce their consumption using targeted tips and social norms, and enhance customer engagement and satisfaction. The reports are sent to a targeted subset of customers on an opt-out basis. Currently, the reports are being provided to more than 350,000 PECO customers.

In addition to the RCT, the Behavioral Solution also provides HERs to households enrolled in PECO's AC Saver Program. The AC Saver Program is a residential demand response (DR) initiative that primarily seeks to reduce the peak demands (kW) of participants. The HERs sent to these participants are

[55] Details on the PY7 analysis and resulting NTG ratio for the Smart Builder Rebates program can be found within Section 7 of the PY7 Annual Compliance Report: https://www.peco.com/SiteCollectionDocuments/My%20Account/Annual%20Reports/11.15.16%20PECO%20EE_CP%20PY7%20Annual%20Report%20Final%20wo%20cover%20letter.pdf

intended to maintain customer satisfaction while enhancing customer education and awareness related to energy efficiency benefits.

- Oracle is the CSP for this solution.
- One participant is counted as a utility account included in the program's treatment group, including those accounts associated with the AC Saver program.

Participation and Reported Savings

Table I-6 in Appendix I provides the total Behavioral Solution results for PY8 including participation, energy savings, and incentive costs by customer segment and carve-out. There are no claimed or verified demand reductions for the Behavioral Solution.

Gross Impact Evaluation

This section provides additional details regarding the approaches and results for the PY8 Residential EE Program's Behavioral Solution evaluation activities. The Behavioral Solution is primarily focused on the delivery of HERs to four sets of randomly selected households using an RCT design. Participants in the RCT are responsible for the majority of the energy savings reported in this document. A separate group of non-RCT participants was added to the Behavioral Solution in PY8. These households represent all participants in the AC Saver program who had not been selected to participate in any wave of the RCT as either test or control group participants. In this report, the team refers to the non-RCT households as the AC Saver Cohort. Given that an RCT design was not used for the AC Saver Cohort, Navigant uses a different means of estimating the impact of the Behavioral Solution for this group. The following discussion provides a more detailed description of the evaluation procedure and results for participants in both the RCT Cohorts (Waves 1-4) and the AC Saver Cohort.

Evaluation Process for Households in the Randomized Control Trial
In performing the evaluation of the Behavioral Solution, Navigant relied primarily on the SWE guidelines for evaluating RCTs. These guidelines indicate that, in the case of RCTs, evaluations should be performed by comparing the changes in energy consumption among participants in both the test and control groups of the RCT without the need for NTG calculations. The approach relies on the use of an RCT design in which each wave of participants is randomly selected from a specified population and then participants are randomly assigned to either a test or control group. The inclusion of the control group in the RCT design results directly in an estimate of the net impact, while the creation of independent RCTs for each wave of participants (cohorts) allows for the independent evaluation of impacts for each wave in addition to the combined impact.

The SWE's guidelines for estimating Behavioral Solution impacts begin with the validation of the equivalence between test and control groups for each cohort, a review of the amount of variation in energy consumption among participants (pre-intervention) for each cohort, and an assessment of the absolute precision of program impacts. Prior to the analysis reported here, Navigant also conducted identical verifications for the four waves of the program established in PY5, PY6, PY7, and PY8. For all four waves, Navigant concluded that the allocations of the treatment and control groups were consistent with an RCT design. These validations were communicated to the SWE in separate memoranda. Once the samples were validated, the next steps in the evaluation include the following:

1. Identifying the regression model that will be used to estimate the program impacts (e.g., lagged dependent variable (LDV))

2. Providing summary statistics by cohort (number of homes, start date, and average annual kWh prior to participation)
3. Examining the equivalence of treatment and control groups by cohort
4. Estimating the absolute precision of program impacts (must be ≤0.5% at the 95% confidence level [two-tailed at the onset of treatment])

Evaluation Process for Households in the AC Saver Cohort

In addition to the RCT evaluation, this appendix also describes the separate evaluation approaches and results associated with the delivery of HERs to a select group of households outside of the RCT program. In PY8, PECO began delivering HERs to all participants of the AC Saver program who were not already participating in the HER RCT (as either a member of the test group or control group for any of the four waves of participants). Given that none of the participants in this AC Saver Cohort were randomly assigned to a control group, the standard RCT approach could not be used as a mechanism for estimating the impact of HERs for members of this cohort. As a result, an alternative, SWE-approved evaluation methodology was developed. This approach uses a Regression with Pre-Program Matching (RPPM) method—a quasi-experimental design that is described in more detail later in this appendix. Although not as rigorous as a RCT, the RPPM method provides a reliable method for estimating the impact of the AC Saver Cohort, particularly given that the AC Saver Cohort represents a minority of energy (kWh) savings for the Behavioral Solution.

Impact Evaluation Methodology

As noted above, Navigant estimated the Behavioral Solution impacts for the RCT Cohorts and the AC Saver Cohort separately using different techniques. All subsequent tables provide separate findings for each of the two groups. Table D-24 summarizes the numbers of unique treatment and control group homes by cohort and month for those households included within the PY8 scope of evaluation activities. The reader should note that for the AC Saver Cohort, unique control counts are lower than the treatment counts as matching was done where more than one treatment customer can be assigned to one control customer.

Table D-24. Behavioral Solution Cohort Summaries

Month (during PY8)	Treat. W1	Cont. W1	Treat. W2	Cont. W2	Treat. W3	Cont. W3	Treat. W4	Cont. W4	Treat. AC Saver*	Cont. AC Saver*
June 2016	31,102	19,470	37,313	15,516	64,234	19,495	218,985	19,922	40,591	34,618
July 2016	30,771	19,273	37,012	15,388	63,700	19,366	216,674	19,727	40,297	34,301
August 2016	30,464	19,106	36,782	15,255	63,297	19,246	214,403	19,532	40,039	33,992
September 2016	30,202	18,953	36,504	15,147	62,894	19,109	212,245	19,333	39,819	33,712
October 2016	29,966	18,805	36,298	15,066	62,566	19,023	210,548	19,189	39,621	33,464
November 2016	29,773	18,670	36,143	15,000	62,259	18,926	209,038	19,046	39,449	33,238
December 2016	29,557	18,578	36,005	14,927	62,004	18,839	207,740	18,920	39,289	32,995
January 2017	29,410	18,474	35,855	14,873	61,788	18,768	206,620	18,825	39,135	32,801
February 2017	29,265	18,398	35,740	14,834	61,586	18,711	205,679	18,738	39,001	32,630
March 2017	29,136	18,321	35,633	14,797	61,422	18,666	204,840	18,657	38,912	32,488
April 2017	28,970	18,232	35,510	14,733	61,207	18,608	203,777	18,555	38,743	32,298
May 2017	28,818	18,133	35,381	14,668	60,954	18,543	202,680	18,449	38,548	32,088
Total for Analysis	**31,008**	**19,413**	**36,984**	**15,386**	**64,068**	**19,461**	**216,683**	**19,718**	**40,611**	**34,592**

Treat. = Treatment Group; Cont. = Control Group

*AC Saver controls are selected via pre-program matching and can match to more than one treatment customer.

Source: Navigant analysis

RCT Impact Evaluation Methodology

Navigant conducted statistical tests on the difference in the monthly average usage for the participants and controls in the RCT, as well as on the distribution of monthly energy usage for participants and controls. The team's analysis utilized billing data, tracking data for the solution, and tracking data for other solutions in the Residential EE Program. The evaluation team obtained billing data and tracking data directly from the CSP. Billing data spanned at least 12 months prior to the solution start date through the end of each program year and included all customers designated as participants and controls. Tracking data included the wave to which each customer is assigned and information about opt outs and closed accounts

Navigant estimated Behavioral Solution impacts for the RCT Cohorts using two approaches applied to monthly billing data: a LDV analysis with lagged controls, and a linear fixed-effects regression (LFER) analysis. The team uses the LDV results for reporting total program savings but runs both models as a robustness check. Although the two models are structurally very different, assuming the RCT is well balanced with respect to the drivers of energy use, in a single sample the two approaches generate very similar estimates of solution savings.

Navigant prefers to report out the LDV model for two reasons. First, the implementer (Oracle) is also using a similar approach (a post-only model) for evaluation. Second, although both the LFER and LDV models generate unbiased estimates of program savings, as an empirical matter—based on Navigant's

past analyses and those in the academic literature—estimated savings from the LDV model tend to have lower standard errors than those from the LFER model, though the differences are usually small.[56]

The LDV model, also known as a post-program regression (PPR) model, combines both cross-sectional and time-series data in a panel format. It uses post-program data as the dependent variable, with lagged energy use from the same calendar month of the pre-program period serving as a control for any small, systematic differences between the treatment and control customers. The lagged energy use term is similar to the customer-specific fixed effect included in the LFER model (explained below).

As with the LDV model, the LFER model combines both cross-sectional and time-series data in a panel format. The regression essentially compares pre- and post-program billing data for participants and controls to identify the program's effect. The customer-specific fixed effect is a key feature of the LFER analysis and captures all customer-specific factors affecting electricity usage that do not change over time, including those that are unobservable. Examples include the square footage of a residence or the home's physical location. The fixed effect represents an attempt to control for small, systematic differences between treatment and control customers that might occur due to chance.

AC Saver Impact Evaluation Methodology

The Behavioral Solution impact evaluation also includes a separate evaluation of savings from the AC Saver Cohort given that households in the AC Saver Cohort are not part of the RCT design. PECO decided to enroll these participants in the HER program in PY8, with the goal of mitigating potential declines in customer satisfaction associated with the planned reduction in the AC Saver credit being provided to AC Saver households. The reduction in the household credit took effect in Phase III (June 2016).

As has been noted earlier, the evaluation team used a different evaluation approach to estimate savings for this component of the Behavioral Solution. Given the lack of an RCT, Navigant used the RPPM method (a quasi-experimental design) to estimate savings for members of the AC Saver Cohort. The team's estimates are the only impact estimates that are available for the AC Saver Cohort because they fall outside of the traditional RCT design used by the implementer (Oracle/Opower). While the implementer was responsible for sending reports to these customers, they were not required to estimate savings for this cohort on an ongoing basis.

Detailed Impact Methodology for RCT

The following sections present the specifications for both models Navigant uses to estimate the impact of RCT participants: a LDV model and a LFER model.

LDV Model

The LDV model controls for non-treatment differences in energy use between treatment and control customers using lagged energy use as an explanatory variable. In particular, the model frames energy use in calendar month *t* of the post-program period as a function of both the treatment variable and

[56] The Navigant team's regression model's specification for estimating energy savings is consistent with the recommendations in the State and Local Energy Efficiency Action Network (SEE Action) protocol. Todd, A., E. Stuart, S. Schiller, and C. Goldman. *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*, Lawrence Berkeley National Laboratory, May 2012. Available at: http://behavioranalytics.lbl.gov/.

energy use in the same calendar month of the pre-program period. The underlying logic is that systematic differences between control and treatment customers will be reflected in differences in their past energy use, which is highly correlated with their current energy use. Formally, the model is shown in Equation D-3.

Equation D-3. Lagged Dependent Variable Model

$$ADU_{kt} = \beta_1 Treatment_k + \sum_J \beta_{2j} Month_{jt} + \sum_J \beta_{4j} Month_{jt} \cdot ADUlag_{kt} + \varepsilon_{kt}$$

Where:

ADU_{kt}	is average daily consumption of kWh by household *k* in bill period *t*
$Treatment_k$	is a binary variable taking a value of 0 if household k is assigned to the control group, and 1 if assigned to the treatment group
$ADUlag_{kt}$	is household *k*'s energy use in the same calendar month of the pre-program year as the calendar month of month *t*
$Month_{jt}$	is a binary variable taking a value of 1 when j = t and 0 otherwise[57]
ε_{kt}	is the cluster-robust error term for household *k* during billing cycle *t;* cluster-robust errors account for heteroscedasticity and autocorrelation at the household level[58]

The coefficient β_1 is the estimate of average daily kWh energy savings due to the program.

LFER Model

The LFER model used by Navigant is one in which average daily consumption of kWh by household *k* in bill period *t*, denoted by ADU_{kt}, is a function of the following three terms:

1. The binary variable $Treatment_k$
2. The binary variable $Post_t$, taking a value of 0 if month *t* is in the pre-treatment period, and 1 if in the post-treatment period
3. The interaction between these variables, $Treatment_k \cdot Post_t$

Formally, the LFER model is shown in Equation D-4.

Equation D-4. Linear Fixed Effects Regression Model

$$ADU_{kt} = \alpha_{0k} + \alpha_1 Post_t + \alpha_2 Treatment_k \cdot Post_t + \varepsilon_{kt}$$

Three observations about this specification deserve comment. First, the coefficient α_{0k} captures all household-specific effects on energy use that do not change over time, including those that are

[57] In other words, if there are *T* post-program months, there are *T* monthly dummy variables in the model, with the dummy variable $Month_{tt}$ the only one to take a value of 1 at time t. These are, in other words, monthly fixed effects.

[58] Ordinary Least Squares (OLS) regression models assume that the data are homoskedastic and not auto correlated. If either of these assumptions is violated, the resulting standard errors of the parameter estimates are incorrect (usually underestimated). A random variable is heteroskedastic when the variance is not constant. A random variable is auto correlated when the error term in one period is correlated with the error terms in at least some of the previous periods.

unobservable. Second, α_1 captures the average effect *across all households* of being in the post-treatment period. Third, the effect of being both in the treatment group and in the post period—i.e., the effect directly attributable to the program—is captured by the coefficient α_2. In other words, whereas the coefficient α_1 captures the change in average daily kWh use across the pre- and post-treatment periods for the control group, the sum $\alpha_1 + \alpha_2$ captures this change for the treatment group; thus, α_2 is the estimate of average daily kWh energy savings due to the program.

Detailed Impact Methodology for the AC Saver Cohort

The status of AC Saver participants who were involved in the Behavioral Solution's RCT prior to PY8 remains unchanged during PY8. In other words, AC Saver participants who were selected as either test or control group participants in prior waves of the RCT continue to participate as originally assigned. For the remainder of the AC Saver program participants (those enrolled in the non-RCT portion of the Behavioral Solution at the beginning of PY8), Navigant used a quasi-experimental design (specifically the RPPM method) to evaluate their energy savings.

For this PY8 evaluation, Navigant requested billing data for participants in the AC Saver Cohort and for a large pool of non-AC Saver, non-HER recipients. For each participant in the AC Saver Cohort, the team selected the customer from the pool of non-participants who had the most similar energy usage in the 12 months prior to the AC Saver participant being enrolled in the Behavioral Solution as that participant's matched control. The logic is that two customers who had very similar energy usage in the year prior to one of them being enrolled in the Behavioral Solution would have continued to have similar usage in the absence of the program. Once the matched controls are selected, Navigant ran a billing analysis using an LDV model as described in Equation D-4 to estimate savings.

Adjusting for Demand Conservation

Because the net energy savings associated with AC Saver test events in PY6 and PY7 were likely to be at or near zero, Navigant is not concerned about the usage of AC Saver participants being considerably different from that of PECO's broader residential base during the matching period. Thus, the team does not believe that the selection of matched controls for the estimation of savings from the HER program is precluded by participation in the AC Saver program. There is a concern of self-selection bias[59] into the AC Saver program since the program is opt in—i.e., customers voluntarily chose to participate. While the only way to control for self-selection bias is to use an RCT, Navigant believes that in the absence of an RCT, the RPPM method is the best evaluation solution. Additionally, because the AC Saver participants are being automatically enrolled into the Behavioral Solution, as opposed to opting in, there is no concern about self-selection bias into the Behavioral Solution.

If AC Saver demand conservation events are called to achieve demand reductions (kW), the associated energy (kWh) savings from said events should and will be measured and reflected in the Behavioral Solution impacts. That is, energy savings will not be captured under the PECO Residential DR Program or double counted under both. During PY8, only two test events were called for a total of 3 hours of control. Moreover, no demand reductions were reported or verified, so this issue is minimized. However, appropriate accounting will be considered during future program years if/when the Residential DR Program is active. Additionally, Navigant estimates that any energy savings from demand conservation events are largely diminished by snapback effects. Ultimately, the energy savings resulting from any

[59] Self-selection bias refers to bias driven by the fact that customers who choose to opt into a program are inherently different from those who do not.

demand conservation events are captured via the RPPM analysis because the AC Saver control group consists of non-participants who are not experiencing demand conservation events.

Summary Statistics and Results

Table D-25 summarizes the regression outputs and summary statistics by cohort within both the RCT and AC Saver groups. The summary also includes the absolute precision results for each wave. The Phase III Evaluation Framework document (at Section 6.1.1.1.1) requires the solution-level verification achieve an absolute precision of ±0.5% at the 95% confidence level (two-tailed), while individual waves may have a wider margin of error. Given that Behavioral Solution analysis examines the solution's entire population, a census evaluation, the precisions reported in Table D-25 reflect the error of the regression analysis estimate rather than a sampling uncertainty. The reader should also note that this uncertainty is reflected within the Behavioral analysis only. That is, the regression analysis estimation error is not reflected within the Residential EE Program or the PY8 portfolio total savings uncertainty. Those rolled up uncertainties only reflect sampling uncertainties that may be associated with other solutions.

Table D-25. Behavioral Solution Cohort Regression Details

Metric	Wave 1	Wave 2	Wave 3	Wave 4	AC Saver
Treatment Coefficient	-0.77	-1.20	-0.88	-0.31	-0.31
Cluster Robust Standard Error	0.09	0.13	0.08	0.04	0.05
Percent Savings	1.75%	1.74%	1.87%	0.92%	1.23%
Absolute Precision (95% Confidence Level)	0.39%	0.38%	0.32%	0.24%	0.36%

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table D-26 summarizes the impact evaluation results that are informed by the regression analysis activities. These results reflect the impacts before any consideration of the overlap analysis that is described in the next section. The relatively lower savings for the Wave 4 and AC Saver Cohorts are to be expected given that these cohorts only started receiving HERs in PY8, reflecting 1 year of treatment. Behavior modification is not instantaneous, and the adoption of energy efficiency activities takes time. The other waves have been receiving HERs for more than a year—between 2 and 4 years.

Table D-26. Behavioral Solution Regression Findings

Metric	Wave 1	Wave 2	Wave 3	Wave 4	AC Saver
Percent Savings	1.75%	1.74%	1.87%	0.92%	1.23%
Average Daily Post-Period kWh	43.11	67.60	46.41	33.18	24.69
Average Daily Post-Period kWh Savings	0.77	1.20	0.88	0.31	0.31
Average Annual Savings (kWh)	280	437	323	112	112
Gross Savings (MWh)	8,307	15,793	20,076	23,424	4,413

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Overlap Analysis

To the extent that the Behavioral Solution increases participation in other solutions, some savings from the regression analysis could be double counted if appropriate adjustments are not made. Double counting can be avoided for solutions that track participation at the customer level by generating estimates of uplift—that is, the increase in participation in the solution among Behavioral Solution participants. This is also known as the overlap savings.

To generate estimates of uplift, Navigant followed the Phase III Evaluation Framework guidance on completing dual participation analyses. The Phase III Evaluation Framework conveys that exposure to the Behavioral Solution messaging often motivates participants to take advantage of other solution offerings that may be promoted through Behavioral Solution promotional materials. This exposure creates a situation where households in the treatment groups tend to participate in other solutions at a higher rate than households in the control groups.[60] The Phase III Evaluation Framework methodology calls for program-specific uplift calculations, and the SWE requests those values be reported.

Given PECO's reorganization of Phase I and Phase II programs into solutions for Phase III, Navigant estimated aggregate uplift across residential programs. From a theoretical standpoint, the program uplift, associated with suggestions provided in the HERs, may be allocated to either the Behavioral Solution or the other EE solution involved in its realization since the savings would not have occurred in the absence of either solution. Notably, however, the industry standard approach is to subtract the amount of the double counted savings (DCS) from the Behavioral Solution savings; the Navigant team followed this approach. This approach is also consistent with the detailed methodology described in Section 6.1.1.8.1 of the Phase III Evaluation Framework.

Navigant's overlap analysis also accounts for upstream EE solutions. The calculation of DCS from upstream solutions is complicated by the fact that participation is not tracked at the customer level and, therefore, the approaches described previously for specific homes are infeasible. Per Section 6.1.1.8.2 of the Phase III Evaluation Framework, the team utilized an assumed upstream reduction factor that was subtracted from the estimate of energy savings for each wave of Behavioral Solution participants after downstream DCS had been removed. The specific reduction factors utilized for the waves are shown in Table D-27.

[60] Phase III Evaluation Framework Section 6.1.1.8. Dual Participation Analysis
http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

Table D-27. Default Upstream Adjustment Factors

Years Since Cohort Inception	Default Upstream Reduction Factor	Behavior Waves
1	0.75%	W4, AC Saver
2	1.50%	W3
3	2.25%	W2
4 and beyond	3.00%	W1

Source: Navigant analysis. Phase III Evaluation Framework for Pennsylvania Act 129 Phase III Energy Efficiency and Conservation Programs, Prepared by The Statewide Evaluation Team: NMR Group, Inc., EcoMetric Consulting, LLC, and Demand Side Analytics, LLC. Contracted Under the Pennsylvania Public Utility Commission's RFP 2015-3 for the Statewide Evaluator, October 21, 2016
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Table D-28 summarizes the overlap or uplift savings associated with downstream and upstream EE solutions found for each of the Behavioral Solution waves. These savings are subtracted from the total savings previously shown in Table D-27.

Table D-28. Downstream and Upstream Savings Adjustments

Behavior Waves	Downstream Overlap (MWh)	Upstream Overlap (MWh)	Total Overlap (MWh)
1	545.52	232.84	778.36
2	1,184.08	328.70	1,512.78
3	763.54	289.68	1,053.22
4	184.50	174.29	358.79
AC Saver	173.73	31.79	205.52

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Behavioral Program Impacts

Finally, by combining the results of the regression analysis and the overlap analysis, Navigant created a final set of estimates of the PY8 Behavioral Solution impacts. These energy savings reflect the net impacts for each of the four waves of RCT participants. Additionally, a key feature of the matched control group method used to estimate savings for the AC Saver cohort is that the analysis assumes that with respect to unobserved variables that may affect program savings, on average, program enrollees are no different than customers matched to them. In other words, in the absence of the solution the expectation is that participants in the AC Saver Cohort and their matched controls would have exhibited the same energy usage. In particular, in the absence of the solution the expectation is that participants and matched controls would exhibit the same degree of energy-conserving behaviors. Therefore, this RPPM method estimates net savings and no further NTG adjustment is necessary. Navigant uses a NTG ratio of 1.00.

Table D-29. Behavioral Solution Net Impact

Behavior Waves	Savings (MWh)
1	7,528
2	14,280
3	19,022
4	23,065
AC Saver	4,207
Total	**68,103**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Solution-reported savings are 62,424 MWh, resulting in an RR of 1.09. The higher RR is primarily driven by the AC Saver Cohort's verified savings, which are included in the impacts. These are not reported by PECO. Excluding these from the verified impacts results in savings of 63,896 MWh and an RR of 1.02.

Net Impact Evaluation

Given that the Behavioral Solution relies on a unique program design that is rooted in the use of a control group, the solution's net impact and gross impact are assumed to be equivalent by design. The random assignment of households to either a test or control group provides the means of determining the counterfactual (i.e., how much energy a cohort of households would have consumed in the absence of the program). In the case of the AC Saver Cohort, the creation of the matched control group serves the same purpose. In short, the existence of the control group in both the RCT and RPPM eliminates the need to calculate net impact or NTG ratios for the Behavioral Solution.

Process Evaluation

As of the writing of this report, process evaluation data is being collected through a phone survey of 700 participants in the Behavioral Solution. Navigant will provide information about these survey results in a follow-up memo once the data collection process has been completed.

Status of Recommendations

Navigant will provide solution-specific recommendations once the impact and process evaluations have been completed. Recommendations will be documented in the follow-up memo referenced above. Recommendations will be made after the full consideration of all Behavioral Solution evaluation activities.

D.6 Multifamily Targeted Market Segment

Renters and owners in multifamily buildings have the opportunity to participate in both low-cost, in-unit, direct install measures (e.g., LEDs, CFLs, power strips, showerheads, and faucet aerators) and incentivized measures such as appliance replacements through PECO's Multifamily Targeted Market Segment. Given that the targeted market segment bridges across the Residential, Small C&I, and Large C&I Programs, Appendix H includes detail about the Multifamily Targeted Market Segment.

APPENDIX E. RESIDENTIAL LOW-INCOME EE PROGRAM

The following appendix sections detail the evaluation activities and findings for the Residential Low-Income EE Program for PY8. Summary discussions and program-level, overarching findings can be found in Section 3.2. This section includes detailed findings for the following solutions:

- Lighting Solution
- Whole Home Solution

E.1 Lighting Solution

The Low-Income EE Program's Lighting Solution includes enhanced incentives for low-income customers through a retail pathway that reduces financial barriers to purchasing the most efficient technology when customers shop for new products. While complementary to the Residential EE Program, the low-income upstream retail incentives have been targeted specifically to stores with a high intensity of low-income customers. The Low-Income EE Program differs slightly from the standard Residential EE Program offering through the Lighting, Appliances & HVAC Solution.

- Lighting products offered through the Low-Income EE Program are consistent with those in the Residential EE Program[61] but with higher product incentives than the non-low-income targeted retail products.
- There is no messaging to make customers aware that the enhanced Low-Income EE Program incentives are different from incentives in Residential EE Program participating stores.
- The enhanced upstream retail incentives have been targeted specifically to stores serving lower-income neighborhoods, identified through analysis of PECO's Customer Assistance Program (CAP) rate customer data.
- The solution tracking data identifies participating stores as either being part of the Residential EE Program Lighting, Appliances & HVAC Solution or as being part of the Low-Income EE Program Lighting Solution.
- Savings from stores participating in the Residential EE Program are not allocated toward the low-income savings carve-out.
- The Residential EE Program Lighting, Appliances & HVAC Solution and the Low-Income EE Program Lighting Solution are both implemented through a single CSP: Ecova.

Participation and Reported Savings

Table I-9 in Appendix I provides the total Lighting Solution results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

[61] The Residential EE Program Lighting, Appliances & HVAC Solution offers some products that are not offered through the Low-Income program. In cases where the lighting products are the same, the incentives are higher for the Low-Income program.

Gross Impact Evaluation

The focus of the impact evaluation for this solution is confirming participant income levels meet the definition of low-income as less than or equal to 150% of FPL and measuring the degree to which reported and verified gross savings are consistent with planned savings. In cases where reported savings differ from planned savings, Navigant identified the drivers of these differences. For this evaluation, the Navigant team:

- Compared quarterly tracking data extracts against scanned manufacturer invoices for a census of all program bulbs to independently verify bulb counts in the tracking data and found no issues.
- Conducted a record-level review of reported lighting savings and found no issues.
- Conducted a GIS analysis of census data to assess participating retailer customer income levels to allocate the savings applied to customers at or below 150% of the FPL. The overall savings attributed to the low-income carve-out were reduced according to the results of the analysis.

The invoice reviews and record-level savings calculations did not result in any changes to reported savings.

The GIS analysis assessing customer income level resulted in a 70% reduction in the savings allocated to the low-income carve-out. The reduction is due to analysis of retailer locations and the income levels in neighboring areas as described in the Process Evaluation section below. Allocation of Low-Income EE Program Lighting Solution savings to the low-income carve out are shown in Table E-1 as Impact Evaluation results. Savings not allocated to the low-income carve-out are reported as part of the Low-Income EE Program. Description of the specific evaluation techniques and detailed findings are in the Process Evaluation section below.

Table E-1. Allocation of Low-Income Lighting Solution Savings to Low-Income Carve-Out

Savings Type	Energy Savings (kWh)	Demand Savings (kW)
Tracking System Savings	3,141,277	370
Gross Verified Savings (<150% FPL, Low-Income Carve-Out)	930,029	110

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Net Impact Evaluation

Navigant did not conduct NTG analysis as part of the Low-Income EE Program evaluation.

Process Evaluation

As discussed in Section 3.2.5, Navigant performed an early feedback process evaluation for the Residential EE Program and its solutions during PY8. For the Lighting Solution, this early feedback process evaluation work included the following:

- PECO and CSP staff interviews

- Program materials review
- GIS analysis to assess customer income level

This solution targets general service stores, where the lighting volume may not be sufficient to support evaluation representatives collecting customer surveys to assess customer income levels. Therefore, the evaluation team conducted a GIS analysis across all participating program retailers. The GIS analysis assessed the percentage of low-income (up to 150% FPL) and very low-income (≤50% FPL) residents surrounding each store.

Through the nature of the mass market Lighting Solution, participating low-income households may or may not also be enrolled in PECO's CAP rate. The GIS analysis identified and attributed savings to PECO's low-income customers and the carve-out, regardless of CAP participation, by using US Census Bureau household income data aggregated at the census-block level. Each census-block is approximately the size of one city block and is typically drawn in reference to natural or artificial barriers, such as streets, rivers, or parks. Navigant also evaluated the degree to which PECO CAP rate customers align with Census Bureau income data as a part of this analysis.

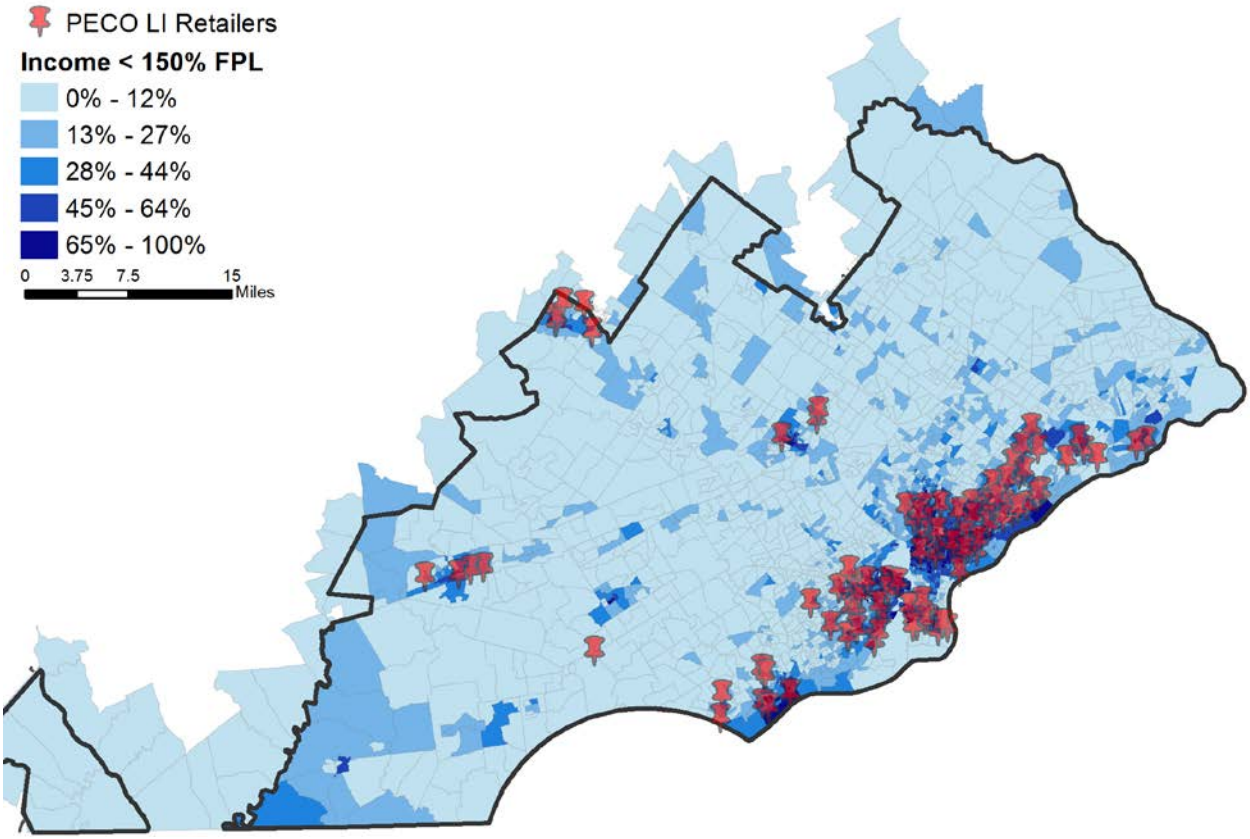
Although individual retailers were found to serve between 4% and 64% low-income populations (see Figure E-1), overall Navigant estimates that 30% of the program's savings can be attributed to low-income qualifying households (≤150% FPL).

To determine the percentage of low-income households participating in the Lighting Solution, Navigant followed a five-part approach, implemented in Python and ArcGIS. Navigant, as described below: 1) geocoded retailer addresses, 2) calculated isochrones, or drive-time service areas, around those retailer locations, 3) estimated the probability of a customer visiting a retailer based on travel time to the retailer location, 4) calculated low-income market population for each retailer, and 5) applied the low-income market percentages to each participating retailers' total bulb sales to calculate the savings attributed to low-income customers.

1. **Geocoding Retailer Locations**

   PECO reported the street address of each participating Low-Income EE Program retailer. Through scripted calls to the Google Maps API, Navigant developed latitude and longitude coordinates for 100% of the 116 participating retailers. The majority of retailer participant locations are in Philadelphia and primarily clustered around the downtown area, as shown in Figure E-1. Most retailers are located near concentrations of CAP rate customers; overall, this tends to correspond with low-income populations identified by the US Census Bureau. Of households in the overall PECO service territory, 22% are estimated to be low-income qualifying (income ≤150% FPL).

Figure E-1. Participant Retailers and Low-Income Populations

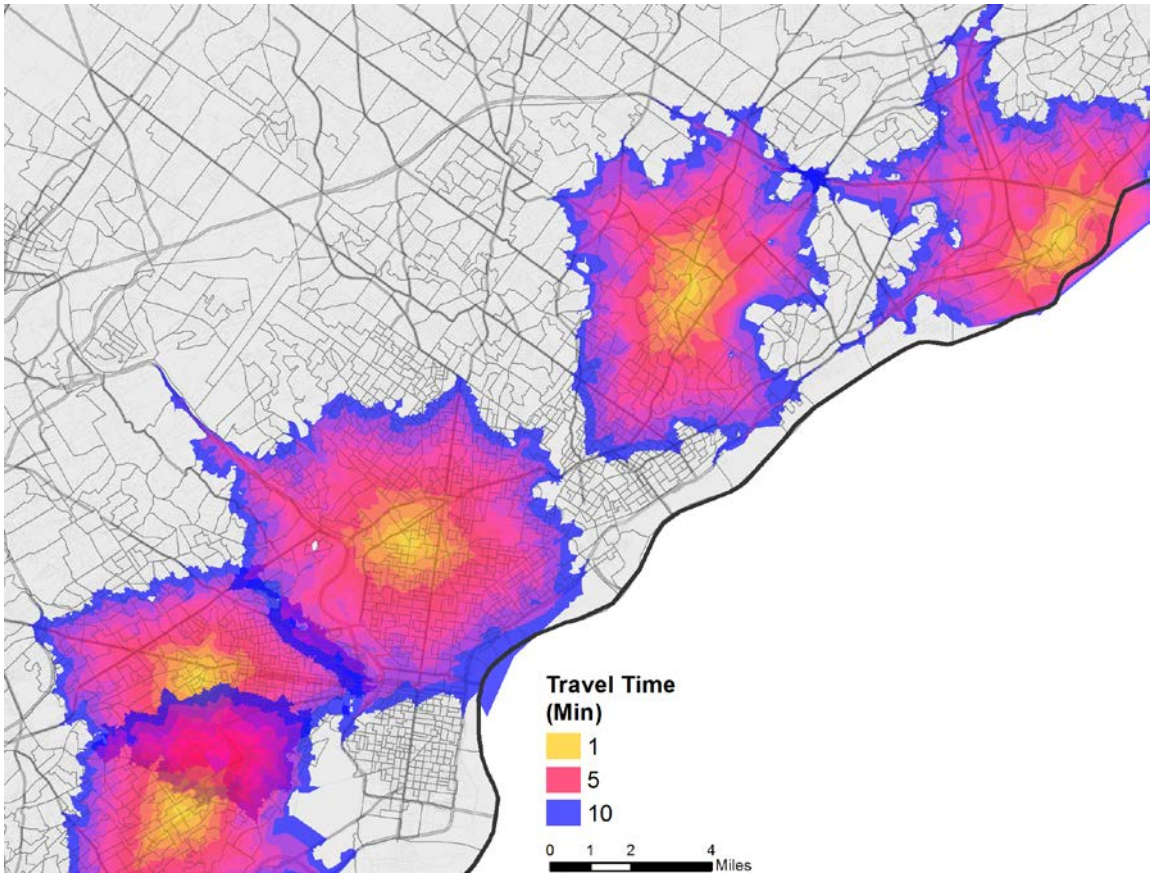


Source: Navigant analysis

2. Developing Isochrones (Drive Time Analysis)

Navigant created isochrones, or drive time service areas, around each geocoded retailer to determine the amount of time it would take a customer to travel from their home to each store location. Navigant utilized a GIS dataset of the Pennsylvania's streets to calculate the isochrones. Navigant modeled the total time outward from each retailer along the street network. Figure E-2 illustrates the isochrones created for select retailers.

Figure E-2. PECO Low-Income EE Lighting Solution Retailer Drive Time Analysis



Source: Navigant analysis

3. Estimating Visitation Probability

After completing the drive time analysis and developing isochrones for each of the 116 retailers, Navigant estimated the relationship between travel time to the retailer in minutes, and the probability of a customer visiting that retailer. Navigant modeled this relationship in line with Destination Choice Theory,[62] which suggests that because time is a limited resource, all other things (such as price and product quality) being equal, an agent will prefer the destination with the lowest travel time.

4. Calculating Low-Income Market Population (Reachable Population)

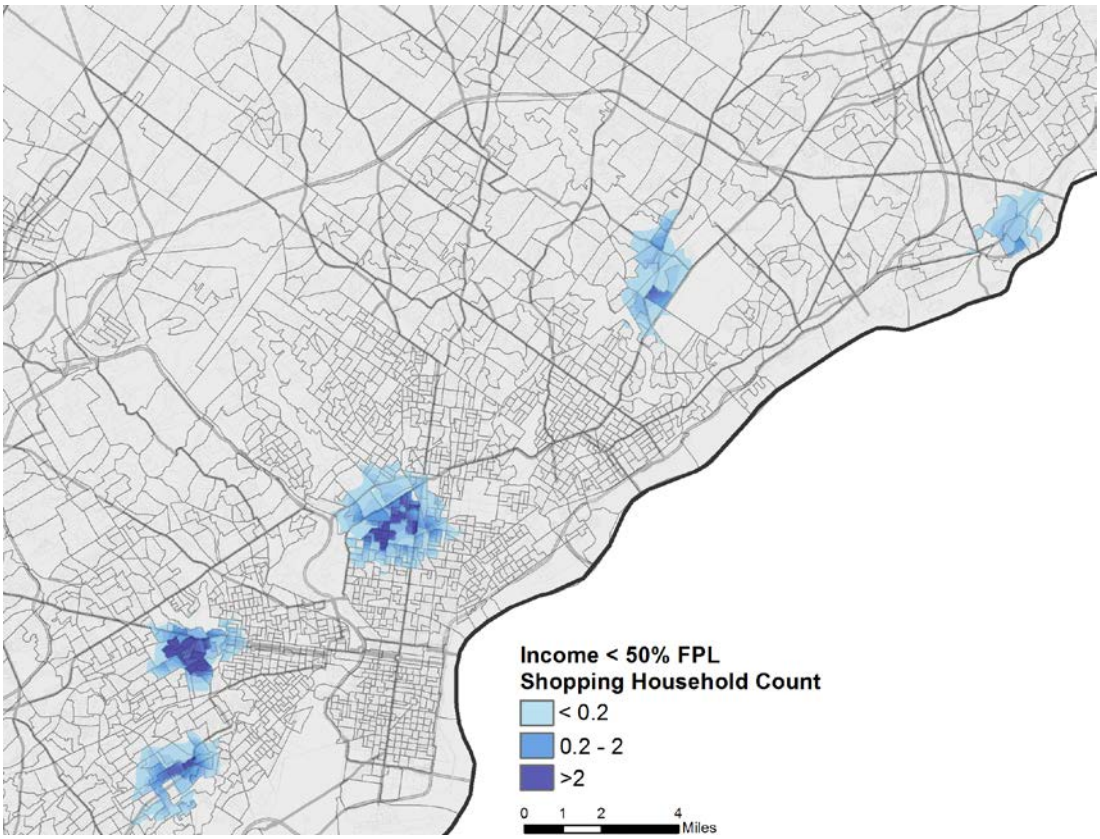
To determine the population by income bin associated with each of the retailer's service areas, Navigant overlaid the probability, population, and drive time raster layers. Using 2015 census

[62] Wilson, A.G., "A Statistical Theory of Spatial Distribution Models", Chapter 3 in R. Quandt (ed) The Demand for Travel: Theory and Measurement, Lexington, Mass: Lexington Books, 1970.55-82.; Fotheringham, A. S. Modeling Hierarchical Destination Choice. Environment and Planning, Vol. 18A, 1986, pp. 401–418.

data from the US Census Bureau, the team determined the total number of households per each census block in PECO's territory.[63]

After determining the income designations per census block throughout the entire PECO service territory, Navigant determined the designation per retailer service area.

Figure E-3. Example PECO Low-Income EE Program Lighting Solution Retailer, Low-Income Market Population



Source: Navigant analysis

Navigant calculated the market population, or reachable population, for each of the retailer's drive time service areas for each income category. The team then converted the layers into a tabular format with the total reachable population by retailer for each income category, as a percentage of households.

5. Calculating Savings Attributable to Low-Income Customers

After calculating the low-income population served by each retailer (the reachable population), Navigant joined these data to the program tracking data by retailer ID. Total low-income attributable savings were calculated by multiplying the total savings by the percentage of low-income qualifying households calculated in Step 4.

[63] US Census Bureau American Fact Finder, "Table C17002 – Ratio of Income to Poverty Level in the Past 12 Months," 2015.

Navigant applied the low-income participation results from the GIS analysis to the entire Low-Income EE Program Lighting Solution to allocate final savings claims. Navigant estimates that 30% of the program's savings can be attributed to low-income qualifying households (≤150% FPL). The savings were allocated with the following assumptions:

- Savings and costs associated with non-low-income participants identified through this evaluation will remain in the Low-Income EE Program Lighting Solution; however, the savings do not count toward PECO's low-income carve out.
- Savings identified from the very low-income category (≤50% FPL) are allocated toward the low-income carve out but are not credited to the 2016 EEC Settlement Agreement targets, as only those savings from the direct install solution count for the agreement.
- Lighting products purchased through the Low-Income Lighting Solution and installed in an individual multifamily apartment are allocated to the Low-Income EE Program Lighting Solution rather than the Multifamily Targeted Market Segment.[64]

Status of Recommendations

The following provides a summary of Navigant's findings and recommendations resulting from the PY8 evaluation of the Low-Income EE Program Solution.

- **Finding:** The concentration of low-income households in PECO territory is not uniform, and not all retailer participants are well positioned geographically to deliver savings to qualifying households.
    - **Recommendation:** PECO and the CSP should shift low performing retailers (in terms of low-income participation, shown in red dots in Figure E-1, above) to the Residential EE Program Lighting Solution. By eliminating retailers that serve a population with less than 30% low-income qualifying households, Navigant estimates that the program could increase the percentage of savings allocated to low-income qualifying households by over one-third—from 30% to 41%.
- **Finding:** There are likely unidentified retailers that are not program participants but are well positioned to reach low-income populations.
    - **Recommendation**: PECO and the CSP should update the process for choosing low-income retailer participants to incorporate the most recent census data and GIS methods. This may include GIS analysis of PECO's Residential EE Program lighting retailers, identifying new potential low-income retailer partners, adding different modes of transportation to the analysis, and conducting further comparisons of CAP rate participants with census populations by income.
- **Finding:** Some participating retailers are well positioned to deliver increased savings to low-income households.
    - **Recommendation:** The CSP should consider how to drive more savings through high performing participating retailers by increasing awareness of program activities among customers through marketing and in-store implementation tactics.

[64] Determining where the bulbs were installed (single-family or multifamily homes) was outside of the scope of this analysis.

E.2 Whole Home Solution

The Whole Home Solution consists of several different implementation activities described below.

- The foundational element of the Low-Income EE Program is the direct install, whole home activity that includes in-home energy check-ups and education, direct installation of measures, and measure giveaways at no cost to the customer. Customers are identified and served through several different channels:
    - **Outbound direct calls:** The call center and Low-Income Whole Home Solution CSP make direct calls to CAP rate customers to encourage participation and to sign customers up for the home energy checkups.
    - **Education and outreach**: The solution offers in-home energy check-p services to all households in a low-income apartment building; services are available to any, or all, interested, eligible households. Limited services are provided to common areas in low-income apartment buildings. (Non-low-income multifamily buildings are served through the Multifamily Targeted Market Segment).
    - **Free Energy Kit**: Low-income multifamily residents who cannot obtain permission from their property owner for site visits are eligible for a free energy kit. The kit is made up of the most common measures provided through a typical home energy checkup direct installation activity.
    - **Low-income Usage Reduction Program (LIURP) Collaboration:** The Whole Home Solution provides supplemental lighting products to LIURP program participants. LIURP is a statewide, utility-sponsored, residential usage reduction program, mandated by Pennsylvania Public Utility Commission regulations. LIURP provides similar services to the Whole Home energy checkups but with restrictions on the quantities of some products, such as light bulb replacements.
    - **Philadelphia Gas Works (PGW) collaboration:** PECO's in-home checkup services are delivered in collaboration with a PGW audit for eligible customers to deliver a single, comprehensive service.
    - **Appliance Recycling Referral**: Low-income customers targeted by the Low-Income EE Program Whole Home Solution are also referred to and served by the Residential EE Program Appliance Recycling Solution. These projects serving targeted low-income customers have been evaluated at the solution level; verified low-income savings have been reported through the Residential EE Program and applied toward the low-income energy saving carve out.
- The Whole Home Solution also has a giveaway activity, where customers can access efficient lighting products at no charge.
- The Whole Home Solution is implemented through a single CSP: CMC Energy Services.

Participation and Reported Savings

Table I-10 in Appendix I provides the total Whole Home Solution results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

Gross Impact Evaluation

The focus of the impact evaluation for this solution is on measuring the degree to which reported and verified gross savings are consistent with planned savings and in cases where they differ, identifying the drivers of these differences. The impact evaluation included the following:

- Reviewing project data collection instruments, calculations, and savings estimates and compared to TRM recommendations
- Conducting a TRM-based engineering review of the overall solution tracking database and a sample of direct installation projects
- Confirming reported measure installations with phone surveys to calculate verified gross savings values
- Identifying and combining individual projects within a single multifamily building into an additional Multifamily strata to improve the accuracy of the survey population sample

The impact evaluation resulted in small adjustments to reported savings through engineering file reviews and phone verification (for projects with direct install measures only). The following factors led to variation between the reported and verified savings and led to the observed RRs for the Low-Income Whole Home Solution.

- LED nightlights had an RR of 0.33 due to differences between reported savings and verified baseline products. Reported savings were based on the PA TRM: baseline LED nightlights are assumed to be a 7-watt bulb as compared to verification-identified 10-watt baseline bulbs. Due to the size of the measure savings and the quantify of measures reported, this had a negligible effect on the overall program savings.
- LED verified quantities were lower than reported quantities. Customer reasons varied; some were reported as burnouts, while others were removed due to dissatisfaction with light color.
- CFLs had an RR of 0.98 due to reported ISRs.
- Verification findings for showerhead restrictor valve water temperatures differed from the reported savings based on TRM assumptions.

Net Impact Evaluation

Navigant did not conduct a NTG analysis as part of the Low-Income EE Program evaluation.

Process Evaluation

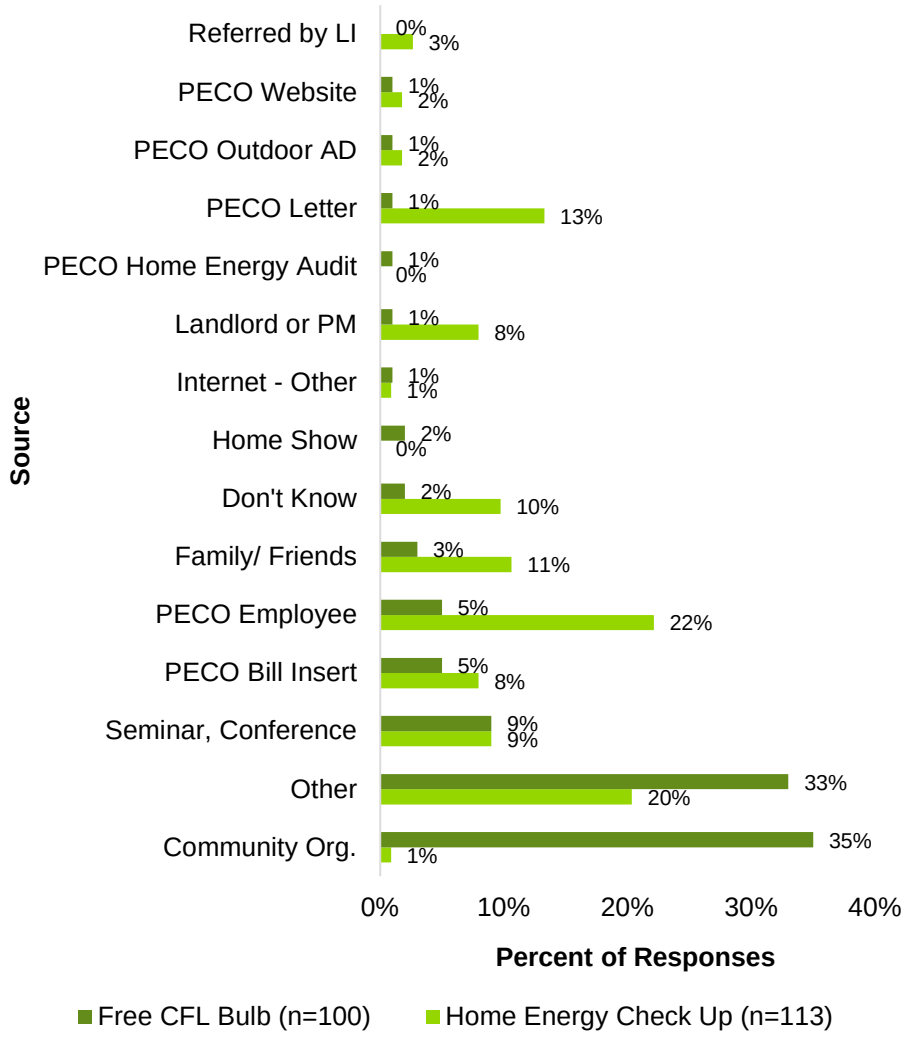
As discussed in Section 3.2.5, Navigant performed an early feedback process evaluation for the Residential Low-Income EE Program and its solutions during PY8. For the Whole Home Solution, this early feedback process evaluation work included the following:

- PECO and CSP staff interviews
- Program materials review
- Phone survey: Navigant used phone surveys to assess how customers heard about the PECO Low-Income EE Program and Whole Home Solution; their satisfaction with the program, solution,

and PECO overall; and awareness of other PECO solutions. The previously described cross-solution survey instrument was used to identify variances in customer experiences between the Free CFL and Free Home Energy Check-Up activities within the Whole Home Solution. Net impacts were not calculated for the Low-Income EE Program.

Participants became aware of the Whole Home Solution corresponding to the activity they participated in. Free Home Energy Check-Up participants learned of the program primarily through PECO employees, which is consistent with a reliance on outgoing calls for customer identification and scheduling. Free CFL participants learned of the program through community organizations, which is consistent with the Free CFL distribution through community events.

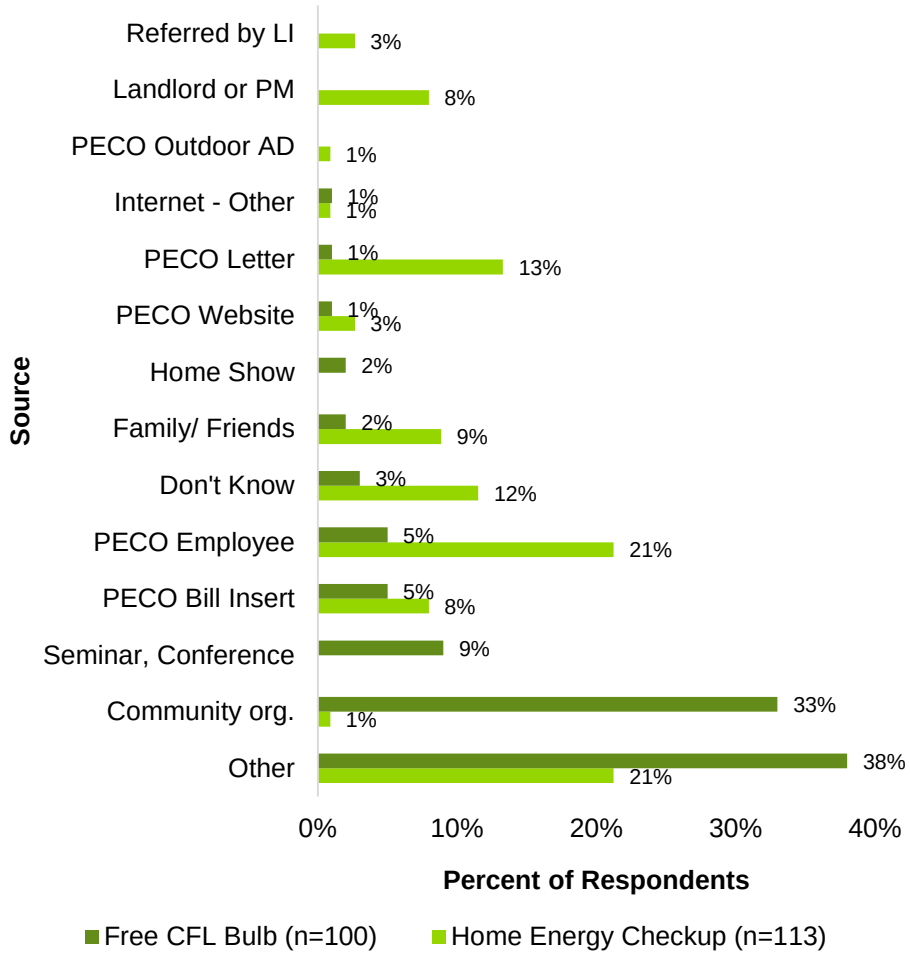
Figure E-4. Sources of Low-Income EE Whole Home Solution Participant Awareness



Question: "How did you learn about the [SOLUTION] program?"
Multiple responses allowed; sum of percentages will not add up to 100%.
Source: Navigant analysis

Customers indicated that the source of influence to participate in the solution activity correlates closely to how they learned of the activity.

Figure E-5. Awareness Source Influence on Low-Income EE Whole Home Solution Participation

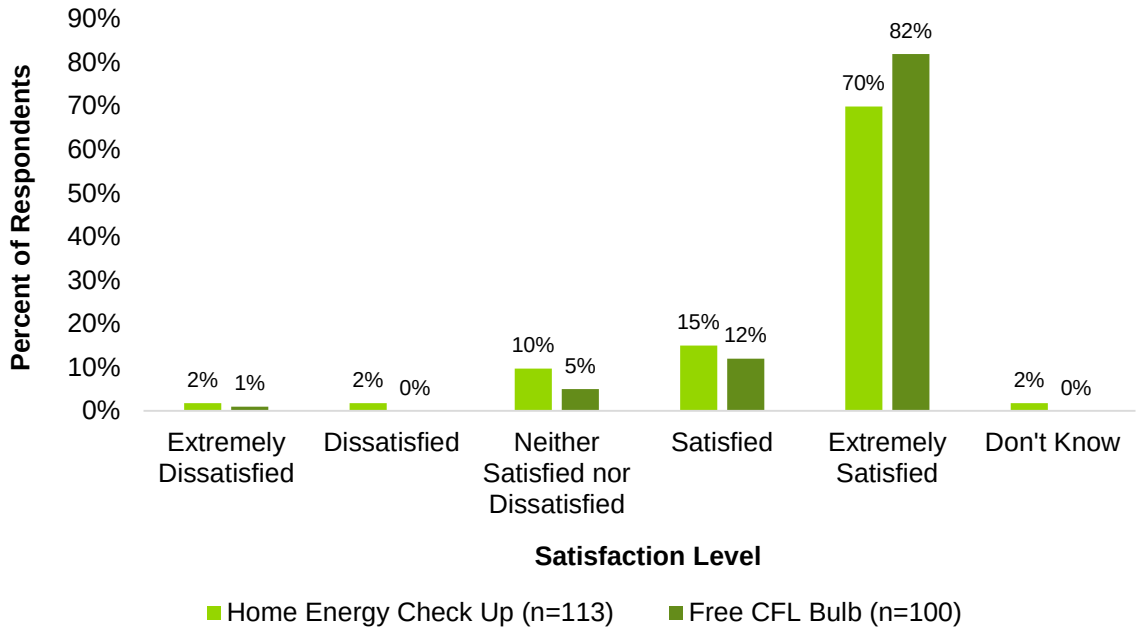


Question: "Thinking of the ways you heard about the [SOLUTION] program, which one was most influential in your decision to participate in the program?"

Source: Navigant analysis

Participants of both the Free CFL activity and the Free Home Energy Check-Up activity report high rates of satisfaction with the program, with only 5% reporting dissatisfaction. On a 1-5 scale, with 1 representing "extremely dissatisfied" and 5 representing "extremely satisfied," respondents rated the Free CFL activity an average of 4.7 and the Free Home Energy Check-Up activity an average of 4.5. Sources of dissatisfaction were principally with individual products, such as the refrigerator, power strip, or light bulbs installed.

Figure E-6. Overall Satisfaction with the Low-Income EE Program

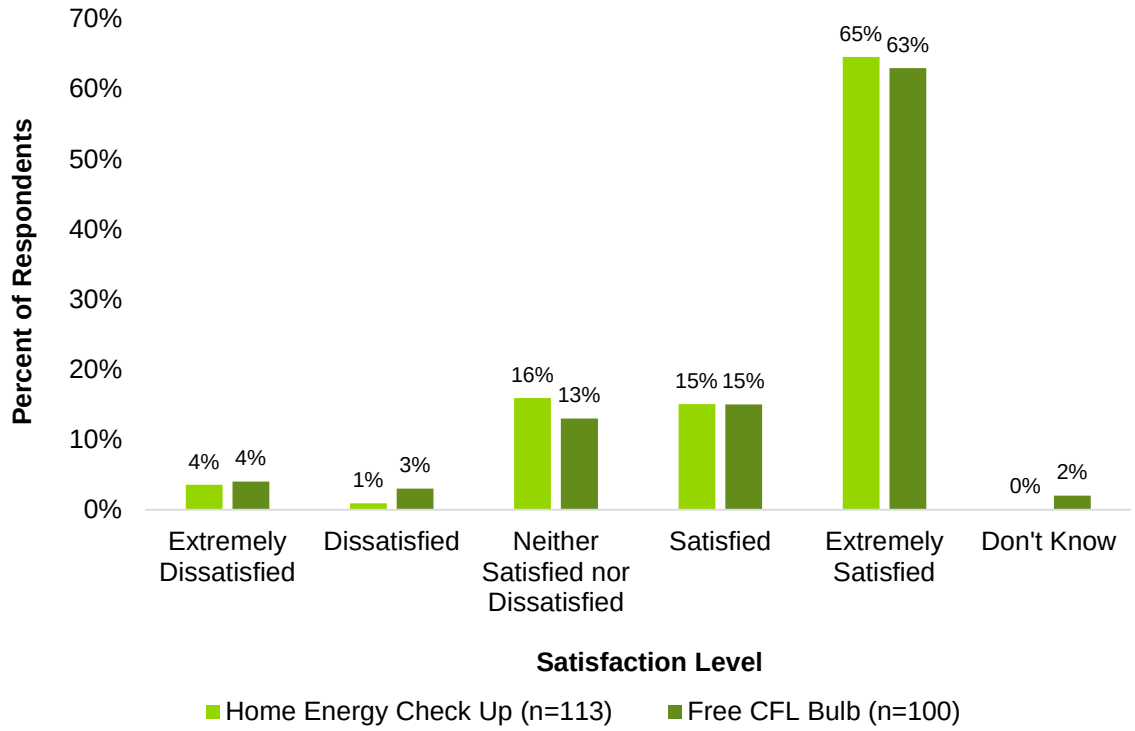


Question: "Using a scale of 1 to 5, with 5 meaning extremely satisfied and 1 meaning extremely dissatisfied, how would you rate your OVERALL satisfaction with the program?"

Source: Navigant analysis

Whole Home Solution participants also report high rates of satisfaction with PECO generally. On the same 1-5 scale as above, Free CFL activity respondents rated satisfaction an average of 4.3 and Free Home Energy Check-Up activity respondents an average of 4.4. Only 12 Whole Home Solution participants surveyed (5.7%) reported dissatisfaction with PECO.

Figure E-7. Low-Income EE Program Participant Satisfaction with PECO



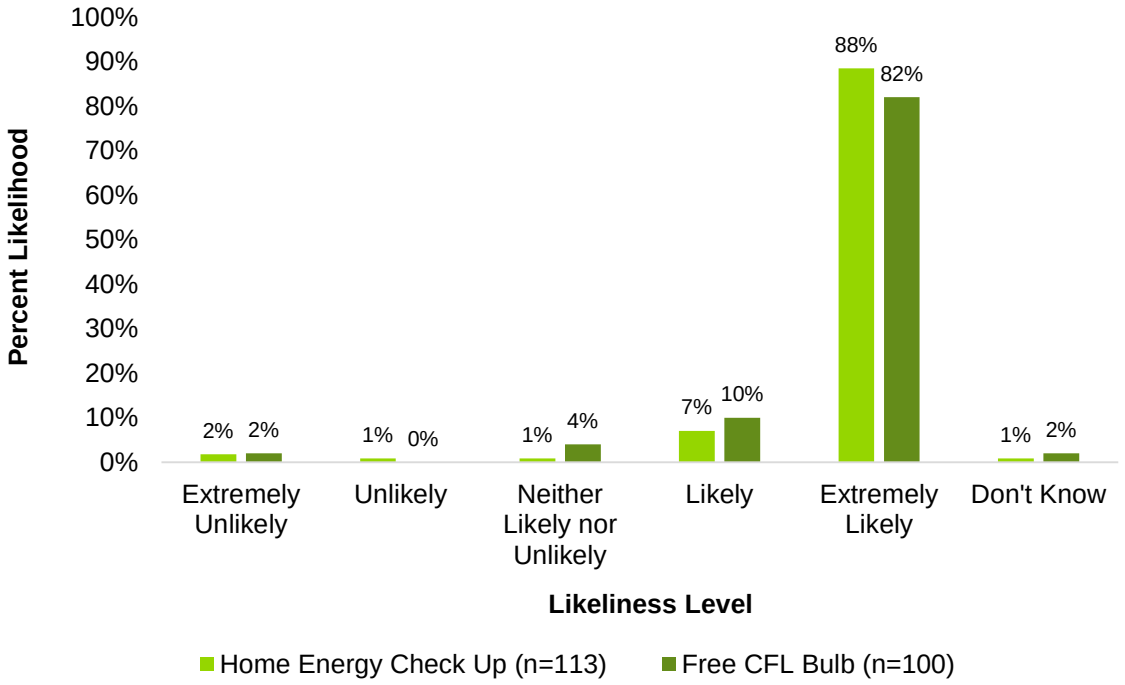
Question: "Thinking now about PECO the utility, and not just the program, on a scale of 1 to 5, with 5 meaning extremely satisfied and 1 meaning extremely dissatisfied, how satisfied are you with PECO in general?"

Source: Navigant analysis

Consistent with their high level of satisfaction with both the Whole Home Solution and PECO generally, a high percentage of Whole Home Solution participants would recommend the program to others. Respondents were asked on a 1- 5scale to rate their likelihood of recommending the activity to others, with 5 representing "extremely likely" to recommend the activity to others and 1 representing "extremely unlikely" to recommend the activity to others. Responses from participants in the Free CFL activity averaged 4.7, while Free Home Energy Check-Up responses averaged 4.8.

This finding supports interviews with program staff, indicating that word of mouth is an important source of new customers for the Low-Income EE Program. To increase participation, PECO could consider leveraging participants' high degree of willingness to recommend the program and encourage satisfied participants to promote their positive program experiences within their social network.

Figure E-8. Likelihood of Recommending Low-Income EE Whole Home Solution to Others

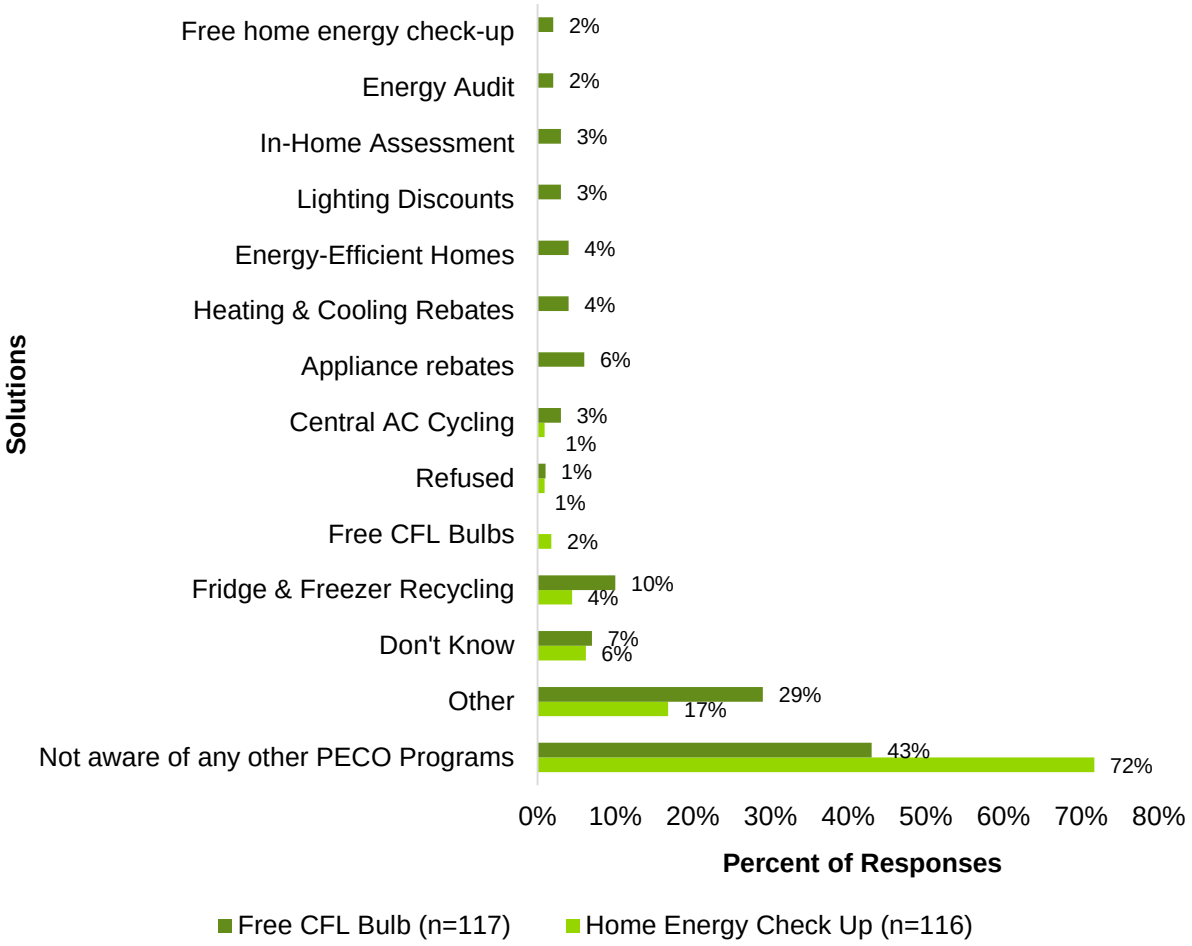


Question: "On a scale of 1-5, with 5 meaning extremely likely and 1 meaning extremely unlikely, overall, how likely are you to recommend PECOs Home Energy Check Up program to others?"

Source: Navigant analysis

Most participants in the Free CFL and Free Home Energy Check-Up activities were not aware of other PECO solutions. Significant to the Low-Income EE Program, even participants of one Whole Home Solution activity were unaware of other complementary activities. Of the 100 Free CFL activity respondents, 43 were unaware of other PECO EE programs and only two were aware of the Free Energy Check-Up activity. Fully, 72% of Free Home Energy Check-Up respondents were unaware of other PECO EE programs. Where the Free Home Energy Check-Up is designed to be a comprehensive activity, it is not expected that participants will require additional efficiency program services soon. However, as noted above, where participant satisfaction and willingness to recommend the program to others is high, this finding indicates a potential opportunity for PECO to promote its programs through satisfied customers. Participation in the broader Free CFL activity provides an excellent opportunity for PECO to encourage participation in the Free Home Energy Check-Up activity, particularly given the high satisfaction ratings of the solution illustrated in Figure E-9.

Figure E-9. Low-Income EE Program Participant Awareness of Other Solutions



Question: "Have you heard of any of PECO's other solutions to help you save energy and money in your home?"
Source: Navigant analysis

Status of Recommendations

The following provides a summary of Navigant's findings and recommendations resulting from the PY8 evaluation of the Low-Income Whole Home Solution.

- **Finding:** Free CFL activity participants are not aware of other PECO programs, including the Free Energy Check-Up activity. PECO could leverage the Free CFL activity, targeted to low-income communities through trusted community organizations, to encourage participation in complementary program activities. This is especially true given the high customer satisfaction reported by participants.
    - **Recommendation:** The CSP should increase education for Free CFL Bulb activity customers to inform them of PECO programs, particularly the Free Home Energy Check-Up. Community organization staff who manages the giveaways should have general knowledge about PECO programs and should be encouraged to recommend Free CFL Bulb participants contact PECO to determine if they are eligible for services.

- **Finding:** Multifamily buildings are not identified in the tracking database. Home Energy Check-Up services are delivered to apartments in multifamily buildings. Each apartment served is recorded in the tracking database as an individual project and cannot be readily distinguished as an apartment in a multifamily building. Without this distinction, the program cannot compare the performance of single-family projects with multifamily projects, or the percentage of a multifamily building that had participated. Additionally, Navigant's evaluation team had to rely on clustering individual projects into groups of projects with similar addresses to identify multifamily buildings as a separate evaluation strata.
    - **Recommendation:** PECO and the CSP should assign a multifamily building ID for projects that are in the same multifamily building.
- **Finding:** 255 Job_ID's in the measure table (Audit and Added Measures) have no associated customer information in the customer table. When querying the customer table using these 255-job IDs, no data is returned.
    - **Recommendation:** The CSP should develop quality assurance processes to ensure data is complete and accurate.
- **Finding:** Tracking database date entries are either erroneous or are unnecessary. More than 99% of LIURP, Audit, and Added Measure projects have "0" days elapsed between "Audit Scheduled" and "Audit Completed." More than 92% of Audit projects and 94% of LIURP projects report "0" days elapsed between "Audit Scheduled" and "Project Completed," and "Audit Completed" and "Project Completed."

  Best practice is to maintain accurate project records to enable managers to monitor program activity and production. It is highly unlikely that such a high percentage of projects transitioned from audit scheduled to audit completed and project completed in just 1 day. With the data provided, the program is not able to monitor customer progress or identify and remedy potential delays. Alternatively, if these fields are unnecessary for program management, remove them from staff input requirements to reduce project data entry burdens.
    - **Recommendation:** PECO and the CSP should review and update the database "Date" field inputs for relevance to individual projects and program management, specifically the "Audit Scheduled," "Audit Completed," and "Project Completed" fields.
- **Finding:** The Phase III customer marketing campaign has not generated the volume of incoming customer calls needed, and the call center has not prioritized outbound calls for this market. The CSP for this solution has continued to make outbound calls to CAP participants, leveraging their Phase II experience to generate projects. (The call center is delivering less than 25% of the needed appointments. The solution needs 50 Home Energy Check-Up appointments per day to meet its annual goals). The CSP reports that outbound calling is critical to engaging customers and overcoming barriers to participation. While the solution did not meet its PY8 goal, outbound phone calls conducted by the CSP have been instrumental to the program's PY8 results being as strong as they are.
    - **Recommendation:** PECO should continue to conduct outbound calling to customers and clarify responsibilities among stakeholders (CSP and call center).
- **Finding:** Program staff has identified opportunities to collaborate with complementary programs and initiatives to increase participation. These efforts include the following:
    - Prioritize identification of older, second appliances eligible for recycling and referral to the Appliance Recycling program.

- Collaboration with PGW and the Philadelphia Water Department on a pilot to provide a single home audits to customers delivering services for all three utilities.
- Collaboration with the LIURP and the Energy Coordinating Agency (ECA) to deliver electric EE products to low-income households participating in these complementary programs.
- PECO has provided energy kits to multifamily building tenants when their landlords have not completed a participation agreement. The kits provide a limited set of measures similar to direct install products.
- Marketing outreach targeted at low-income neighborhoods.
    - **Recommendation**: PECO and the CSP should continue to be innovative in identifying opportunities to collaborate with community, non-profit, governmental and utility organizations to identify and encourage low-income household participation.

APPENDIX F. SMALL C&I EE PROGRAM

The Small C&I EE Program offers a comprehensive and cross-cutting array of opportunities to assist small C&I customers in reducing their energy consumption and costs. The program encompasses a variety of energy solutions and measures to achieve this goal. The Small C&I EE Program is made up of four solutions and two targeted market segments. Each is detailed below.

F.1 Equipment and Systems Solution

The Equipment and Systems Solution offers incentives for existing building retrofit projects with either deemed, partially deemed, or custom measures. Typical measures include lighting, variable frequency drives (VFDs), HVAC systems, and controls. Participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level. In addition, a single customer is permitted to participate in multiple projects with unique project numbers. PECO's C&I or G/E/NP customers that own or rent their space are eligible to participate in this solution. Participating customers must first identify EE projects at their facility, including deemed, partially deemed, or custom measures. Next, the customer must submit a pre-application to ICF—the program implementer—before completing the project. Once approved, each project is implemented by the customer's own contractor, and either the customer or the contractor submits the rebate paperwork to the implementer.

Participation and Reported Savings

Table I-12 in Appendix I provides Equipment and Systems Solution results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

Gross Impact Evaluation

Phone Verification. Navigant conducted desk reviews for all projects in the evaluation sample. All of the small stratum and half of the medium stratum projects received phone verification via live interviews with knowledgeable site contacts. The desk reviews made use of project applications, project-specific analysis files and associated calculation sheets, measure invoices, measure specification sheets, construction plans, and other construction documents provided by PECO. Documentation included scanned files of hard copy forms, as well as electronic files of CSP inspection reports, photos of installed measures, important emails, and memoranda. In the case of whole building projects and some new construction projects, executable modeling files and related model output files were also provided, as applicable. The team supplemented the desk reviews with phone verifications, consisting of interviews with customers about their projects. Common points of discussion included information about the quantities and type of each measure installed, the operating status of the measures, equipment nameplate data, operating schedules, a careful description of site conditions, and overall verification of the information contained in the project files.

Onsite Verification. Navigant conducted onsite verification for all projects in the large stratum and half of the projects in the medium stratum. The team visited medium stratum projects with particular complexity or variability in ex ante energy or demand savings documentation. Navigant also applied the desk review process outlined in the Phone Verification section to any projects receiving onsite verification. The

primary objective of the site visits was to collect the data identified in the Phase III Evaluation Framework[65], including verification of the quantities and type of each measure, equipment nameplate data, operating schedules, and a careful description of site conditions. Navigant achieved the verification through visual inspection of the measures and by interviewing the customers.

Onsite Verification with Metering. For projects that surpassed the expected kWh savings thresholds set in Table 1-2 of the 2016 PA TRM, the team—in addition to performing all of the tasks outlined in the Onsite M&V section—collected site-specific information for open variables used in the calculation of energy and demand savings. Site-specific information included end-use metered data and trend data from building management systems (BMSs).

Summary of Sampling Methodology. Using tracking data from PY8, Navigant obtained the total number of projects and the total amount of energy savings in the population. With this project data on hand, Navigant created four strata of sample projects.

All projects above 3 million kWh per year of annual savings make up a census stratum (Stratum 1 – Very Large Projects). In the Small C&I Program, there were no projects that fit this description. Navigant then excluded all projects making up the lowest 2% of total solution energy savings, sorted the projects by size, and divided the population into three strata: those projects making up the top third, the middle third, and the lowest third of the total energy savings.

- **Stratum 1:** Very high impact and/or very high uncertainty measures. Projects over 3 million kWh/year energy savings.
- **Stratum 2:** High impact and/or high uncertainty measures. Projects between 120,000 kWh/year and 3 million kWh/year energy savings.
- **Stratum 3:** Medium impact and/or medium uncertainty measures. Projects between 50,000 kWh/year and 120,000 kWh/year energy savings.
- **Stratum 4:** Low impact measures. Projects between 3,500 kWh/year and 50,000 kWh/year energy savings.
- **Stratum 5:** Very low impact measures. Projects lower than 3,500 kWh/year energy savings.

Net Impact Evaluation

Navigant applied the NTG ratio from PY7 Smart Equipment Incentives program to the PY8 Equipment and Systems Solution's impact evaluation results. A separate NTG calculation will be conducted for the Equipment and Systems Solution in PY9.

Process Evaluation

See Section 3.4.5 for a discussion of the process evaluation for the Small C&I EE Program's solutions.

[65] Phase III Evaluation Framework. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

Status of Recommendations

The following provides a summary of Navigant's findings and recommendations resulting from the PY8 evaluation of the Equipment and Systems Solution.

- **Finding:** Customers and incentive administrators have indicated that the TRM Appendix C calculator is difficult to customize and has limited the number of space types. This may lead to customer frustration with PECO and/or lower program participation.
    - **Recommendation:** PECO and Navigant should explore and suggest improvements to the TRM Appendix C calculator to allow for easier savings calculations and a better customer experience.
- **Finding:** The CSP sometimes reported hours of use using deemed hours even though the CSP had more accurate hours of use from logger data or via customer feedback available. This may lead to inaccurate ex ante calculations and a risk of low RRs upon verification.
    - **Recommendation:** PECO should require the CSP to use customer-reported hours or logger data when available.
- **Finding:** Some ex ante projects did not have transparent savings calculations in their project files. This was especially common among variable speed drive projects and often led to low RRs, presenting a risk of missing targets upon verification.
    - **Recommendation:** PECO should require the CSP to include transparent savings calculation files for all sampled projects.

F.2 New Construction Solution

The C&I New Construction Solution is designed to instill and accelerate adoption of energy efficient design and construction practices so new C&I facilities in the PECO territory are more energy efficient than the current stock. The program covers both new construction and buildings undergoing major renovation, which is defined as construction projects that involve the complete removal, redesign, and replacement of two or more major building systems. The program provides facility designers and builders with training, design assistance, and financial incentives to incorporate energy efficient systems into their building designs. Many of the projects within the C&I New Construction Solution involve efficient lighting and heating and cooling technologies and controls. The eligible customer population for the program includes all C&I and G/E/NP new construction and major renovation projects in the PECO service territory or accounts provided with electricity by PECO, including the aforementioned G/E/NP facilities. Participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level, and a single customer is permitted to participate in multiple projects with unique project numbers. ICF is the implementer for the New Construction Solution.

Participation and Reported Savings

Table I-13 in Appendix I provides New Construction Solution results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

Gross Impact Evaluation

Phone Verification. Navigant conducted desk reviews for all projects in the evaluation sample. All of the small stratum and half of the medium stratum projects received phone verification via live interviews with knowledgeable site contacts. The desk reviews made use of project applications, project-specific analysis files and associated calculation sheets, measure invoices, measure specification sheets, construction plans, and other construction documents provided by PECO. Documentation included scanned files of hard copy forms, as well as electronic files of CSP inspection reports, photos of installed measures, important emails, and memoranda. In the case of whole building projects and some new construction projects, executable modeling files and related model output files were also provided, as applicable. The team supplemented the desk reviews with phone verifications, consisting of interviews with customers about their projects. Common points of discussion included information about the quantities and type of each measure installed, the operating status of the measures, equipment nameplate data, operating schedules, a careful description of site conditions, and overall verification of the information contained in the project files.

Onsite Verification. Navigant conducted onsite verification for all projects in the large stratum and half of the projects in the medium stratum. The team visited medium stratum projects with particular complexity or variability in ex ante energy or demand savings documentation. Navigant also applied the desk review process outlined in the Phone Verification section to any projects receiving onsite verification. The primary objective of the site visits was to collect the data identified in the Phase III Evaluation Framework, including verification of the quantities and type of each measure, equipment nameplate data, operating schedules, and a careful description of site conditions. Navigant achieved the verification through visual inspection of the measures and by interviewing the customers.

Onsite Verification with Metering. For projects that surpassed the expected kWh savings thresholds set in Table 1-2 of the 2016 PA TRM, the team—in addition to performing all of the tasks outlined in the Onsite M&V section—collected site-specific information for open variables used in the calculation of energy and demand savings. Site-specific information included end-use metered data and trend data from BMSs.

Summary of Sampling Methodology. Using tracking data from PY8, Navigant estimated the total number of projects and the total amount of energy savings in the population across the 2-year sampling period. With this project data, Navigant created four strata of sample projects.

All projects above 3 million kWh per year of annual savings make up a census stratum (Stratum 1 – Very Large Projects). In the New Construction Solution—across the Small and Large C&I Programs—there were no projects that fit this description. Navigant then excluded all projects making up the lowest 2% of total solution energy savings, sorted the projects by size, and divided the population into three strata: those projects making up the top third, the middle third, and the lowest third of total energy savings.

- **Stratum 1:** Very high impact and/or very high uncertainty measures. Projects over 3 million kWh/year energy savings.
- **Stratum 2:** High impact and/or high uncertainty measures. Projects between 300,000 kWh/year and 3 million kWh/year energy savings.
- **Stratum 3:** Medium impact and/or medium uncertainty measures. Projects between 200,000 kWh/year and 300,000 kWh/year energy savings.

- **Stratum 4:** Low impact measures. Projects between 20,000 kWh/year and 200,000 kWh/year energy savings.

Net Impact Evaluation

Navigant applied the NTG ratio from PY7 Smart Construction Incentives program to the PY8 C&I New Construction Solution's impact evaluation results. A separate NTG calculation will be conducted for the C&I New Construction Solution in PY9.

Process Evaluation

See Section 3.4.5 for a discussion of the process evaluation for the Small C&I EE Program's solutions.

Status of Recommendations

The following provides a summary of Navigant's findings and recommendations resulting from the PY8 evaluation of the New Construction Solution.

- **Finding:** Five of the 17 new construction projects sampled for the gross impact evaluation used lighting variables from the 2015 TRM rather than the 2016 TRM. Three of these projects are in the Large C&I EE Program and two are in the Small C&I EE Program. Specifically, the ex ante calculations for these projects applied interaction factors from the 2015 TRM. For three of the five projects, the building permit date in the tracking system confirmed the correct use of the 2015 TRM. For the remaining two projects, the building permit date was not populated in the tracking system. For all five projects, the provided project documentation did not include files clearly indicating or labeling the building permit date.
    - **Recommendation:** PECO should ensure that the tracking system includes building permit dates for all new construction projects and provide documentation that clearly indicates the building permit date. This will allow confirmation of the correct version of the TRM and all associated variables.
- **Finding:** In PY7, the energy and demand savings from several new construction projects were excluded from official program totals due to less than 100% building occupancy at the close of the program year. Although Navigant did not find any incomplete projects during the site inspection process in PY8, building occupancy remains an important issue in Phase III.
    - **Recommendation:** PECO should continue to review this issue and consider future revisions to the TRM.

F.3 Whole Building Solution

The Whole Building Solution offers the direct installation of comprehensive EE measures to customers who want to understand how to improve the overall energy performance of their small businesses. PECO and the CSP—SmartWatt—identify eligible small C&I customers using rate class descriptions and those with a demand load of less than 100 kW. The CSP conducts a comprehensive audit of the eligible customer's site and creates a proposal detailing the potential project upgrades, costs, and simple payback estimates. On average, PECO covers between 30% and 40% of the cost of the upgrades, up to a minimum of a 1-year simple payback to the customer. PECO funds a portion of the project cost, as long as that funding does not reduce the payback to less than 1 year, as established in the rules for PY8. The

CSP then works with the customer to finalize a contract and implement the agreed-upon EE upgrades. This solution defines participation as an activity at a customer premise with a unique project number. A project can include more than one measure, with the impact evaluation sample defined at the project level.

Participation and Reported Savings

Table I-14 in Appendix I provides Whole Building Solution results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

Gross Impact Evaluation

Navigant will conduct a full impact evaluation for the Whole Building Solution in PY9.

Net Impact Evaluation

Navigant will conduct a NTG calculation for the Whole Building Solution in PY9.

Process Evaluation

See Section 3.4.5 for a discussion of the process evaluation for the Small C&I EE Program's solutions.

Status of Recommendations

Navigant did not evaluate the Whole Building Solution in PY8 but has received feedback that the program has been garnering participation and savings. Navigant does not have any recommendations at this time.

F.4 Data Centers Targeted Market Segment

Projects in the Data Centers Targeted Market Segment are eligible to participate in the Equipment and Systems or C&I New Construction Solutions, depending upon the details of the project. Data centers—on account of their high energy usage profiles and specialized technologies—are given special attention from the Small and Large C&I EE programs, allowing for tailored recruitment and implementation of such projects. Much of the energy savings in this segment come from cooling technologies, although the implementation of control systems and lighting are also possible. Participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level. ICF is the implementer for data center projects, given their entry into either the Equipment and Systems or New Construction Solutions.

Participation and Reported Savings

There was no PY8 participation; thus, there are no reported savings in the Data Centers Targeted Market Segment.

Gross Impact Evaluation

There was no recorded participation in the Data Centers Targeted Market Segment in PY8. Navigant will conduct a full impact evaluation in PY9, pending participation.

Net Impact Evaluation

Navigant will conduct a full NTG ratio calculation in PY9, pending participation.

Process Evaluation

See Section 3.3.4 for a discussion of the process evaluation for the Small C&I EE Program's solutions.

Status of Recommendations

The following provides a summary of Navigant's findings and recommendations resulting from the PY8 evaluation of the Data Centers Targeted Market Segment.

- **Finding:** Most data center energy savings are derived from load on the equipment—i.e., the greater the load, the larger the savings. This is potentially causing customers to delay program engagement until load is realized.
    - **Recommendation:** PECO should explore decision-making related to data center projects during future process evaluations through interviews with current and potential participants and reviews of other data center program evaluations. A focus of this review should be to understand whether a multistage incentive plan would be in the best interest of all parties.

F.5 Multifamily Targeted Market Segment

Renters and owners in multifamily buildings have the opportunity to participate in both low-cost, in-unit, direct install measures (e.g., LEDs, CFLs, power strips, showerheads, and faucet aerators) and incentivized measures such as appliance replacements through PECO's Multifamily Targeted Market Segment. Given that the targeted market segment bridges across the Residential, Small C&I, and Large C&I Programs, Appendix H includes detail about the Multifamily Targeted Market Segment.

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APPENDIX G. LARGE C&I EE PROGRAM

The Large C&I EE Program offers a comprehensive and cross-cutting array of opportunities to assist large C&I customers in reducing their energy consumption and costs. The program encompasses a variety of energy solutions and measures to achieve this goal. The Large C&I EE Program is made up of four solutions and two targeted market segments, shown with the solution implementers below.

G.1 Equipment and Systems Solution

The Equipment and Systems Solution offers incentives for existing building retrofit projects with either deemed, partially deemed, or custom measures. Typical measures include lighting, VFDs, HVAC systems, and controls. Participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level. In addition, a single customer is permitted to participate in multiple projects with unique project numbers. PECO's C&I or G/E/NP customers that own or rent their space are eligible to participate in this solution. Participating customers must first identify EE projects at their facility, including deemed, partially deemed, or custom measures. Next, the customer must submit a pre-application to ICF—the program implementer—before completing the project. Once approved, each project is implemented by the customer's own contractor, and either the customer or the contractor submits the rebate paperwork to the implementer.

Participation and Reported Savings

Table I-18 in Appendix I provides Equipment and Systems Solution results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

Gross Impact Evaluation

Phone Verification. Navigant conducted desk reviews for all projects in the evaluation sample. All of the small stratum and half of the medium stratum projects received phone verification via live interviews with knowledgeable site contacts. The desk reviews made use of project applications, project-specific analysis files and associated calculation sheets, measure invoices, measure specification sheets, construction plans, and other construction documents provided by PECO. Documentation included scanned files of hard copy forms, as well as electronic files of CSP inspection reports, photos of installed measures, important emails, and memoranda. The team supplemented the desk reviews with phone verifications, consisting of interviews with customers about their projects. Common points of discussion included information about the quantities and type of each measure installed, the operating status of the measures, equipment nameplate data, operating schedules, a careful description of site conditions, and overall verification of the information contained in the project files.

Onsite Verification. Navigant conducted onsite verification for all projects in the large stratum and half of the projects in the medium stratum. The team visited medium stratum projects with particular complexity or variability in ex ante energy or demand savings documentation. Navigant also applied the desk review process outlined in the Phone Verification section to any projects receiving onsite verification. The primary objective of the site visits was to collect the data identified in the Phase III Evaluation

Framework[66], including verification of the quantities and type of each measure installed, equipment nameplate data, operating schedules, and a careful description of site conditions. Navigant achieved the verification through visual inspection of the measures and by interviewing the customers.

Onsite Verification with Metering. For projects that surpassed the expected kWh savings thresholds set in Table 1-2 of the 2016 PA TRM, the team—in addition to performing all of the tasks outlined in the Onsite M&V section—collected site-specific information for open variables used in the calculation of energy and demand savings. Site-specific information included end-use metered data and trend data from BMSs.

Summary of Verification Activities – Equipment and Systems. Navigant conducted ex post verification for 29 projects in the Large C&I Equipment and Systems PY8 evaluation sample. The onsite verification of these 29 projects aligns with the Large C&I Evaluation Plan for Phase III, which called for a total Large C&I Equipment and Systems sample of 30 projects.

Using tracking data from PY8, Navigant obtained the total number of projects and the total amount of energy savings in the population. With this project data, Navigant created four strata of sample projects.

All projects above 3 million kWh per year of annual savings make up a census stratum (Stratum 1 – Very Large Projects). In the Large C&I Program, there were no projects that fit this description. Navigant then excluded all projects making up the lowest 2% of total solution energy savings, sorted the projects by size, and divided the population into three strata: those projects making up the top third, the middle third, and the lowest third of the total energy savings.

- **Stratum 1:** Very high impact and/or very high uncertainty measures. Projects over 3 million kWh/year energy savings.
- **Stratum 2:** High impact and/or high uncertainty measures. Projects between 700,000 kWh/year and 3 million kWh/year energy savings.
- **Stratum 3:** Medium impact and/or medium uncertainty measures. Projects between 300,000 kWh/year and 700,000 kWh/year energy savings.
- **Stratum 4:** Low impact measures. Projects between 30,000 kWh/year and 300,000 kWh/year energy savings.

Net Impact Evaluation

Navigant applied the NTG ratio from PY7 Smart Equipment Incentives program to the PY8 Equipment and Systems Solution's impact evaluation results. A separate NTG calculation will be conducted for the Equipment and Systems Solution in PY9.

Process Evaluation

See Section 3.4.5 for a discussion of the process evaluation for the Large C&I EE Program's solutions.

[66] Phase III Evaluation Framework. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

Status of Recommendations

The evaluation activities in PY8 led to the following findings and recommendations from Navigant to PECO, along with a summary of how PECO plans to address the recommendation in program delivery.

- **Finding:** Customers and incentive administrators have indicated that the TRM Appendix C calculator is difficult to customize and has limited the number of space types. This may lead to customer frustration with PECO and/or lower program participation.
    - **Recommendation:** PECO and Navigant should explore and suggest improvements to the TRM Appendix C calculator to allow for easier savings calculations and a better customer experience.
- **Finding:** The CSP sometimes reported hours of use using deemed hours even though the CSP had more accurate hours of use from logger data or via customer feedback available. This may lead to inaccurate ex ante calculations and a risk of low RRs upon verification.
    - **Recommendation:** PECO should require the CSP to use customer-reported hours or logger data when available.
- **Finding:** Some ex ante projects did not have transparent savings calculations in their project files. This was especially common among variable speed drive projects and often led to low RRs, presenting a risk of missing targets upon verification.
    - **Recommendation:** PECO should require the CSP to include transparent savings calculation files for all sampled projects.
- **Finding:** Evaluating sites via phone verification may not be providing significant value to the program's evaluation. Typical phone verification results do not differ greatly from the reported values and do not provide significant insight into individual projects or the program as a whole.
    - **Recommendation:** Navigant recommends shifting resources away from verifying projects via a phone conversation with the customer to doing more onsite and file review work. Specifically, Navigant sees value in shifting resources to doing onsite work for small strata customers.

G.2 New Construction Solution

The C&I New Construction Solution is designed to instill and accelerate adoption of energy efficient design and construction practices so new C&I facilities in the PECO territory are more energy efficient than the current stock. The program covers both new construction and buildings undergoing major renovation, which is defined as construction projects that involve the complete removal, redesign, and replacement of two or more major building systems. The program provides facility designers and builders with training, design assistance, and financial incentives to incorporate energy efficient systems into their building designs. Many of the projects within the C&I New Construction Solution involve efficient lighting and heating and cooling technologies and controls. The eligible customer population for the program includes all C&I and G/E/NP new construction and major renovation projects in the PECO service territory or accounts provided with electricity by PECO, including the aforementioned G/E/NP facilities. Participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level, and a single customer is permitted to participate in multiple projects with unique project numbers. ICF is the implementer for the New Construction Solution.

Participation and Reported Savings

Table I-19 in Appendix I provides New Construction Solution results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

Gross Impact Evaluation

Phone Verification. Navigant conducted desk reviews for all projects in the evaluation sample. All of the small stratum and half of the medium stratum projects received phone verification via live interviews with knowledgeable site contacts. The desk reviews made use of project applications, project-specific analysis files and associated calculation sheets, measure invoices, measure specification sheets, construction plans, and other construction documents provided by PECO. Documentation included scanned files of hard copy forms, as well as electronic files of CSP inspection reports, photos of installed measures, important emails, and memoranda. In the case of whole building projects and some new construction projects, executable modeling files and related model output files were also provided, as applicable. The team supplemented the desk reviews with phone verifications, consisting of interviews with customers about their projects. Common points of discussion included information about the quantities and type of each measure installed, the operating status of the measures, equipment nameplate data, operating schedules, a careful description of site conditions, and overall verification of the information contained in the project files.

Onsite Verification. Navigant conducted onsite verification for all projects in the large stratum and half of the projects in the medium stratum. The team visited medium stratum projects with particular complexity or variability in ex ante energy or demand savings documentation. Navigant also applied the desk review process outlined in the Phone Verification section to any projects receiving onsite verification. The primary objective of the site visits was to collect the data identified in the Phase III Evaluation Framework[67], including verification of the quantities and type of each measure, equipment nameplate data, operating schedules, and a careful description of site conditions. Navigant achieved the verification through visual inspection of the measures and by interviewing the customers.

Onsite Verification with Metering. For projects that surpassed the expected kWh savings thresholds set in Table 1-2 of the 2016 PA TRM, the team—in addition to performing all of the tasks outlined in the Onsite M&V section—collected site-specific information for open variables used in the calculation of energy and demand savings. Site-specific information included end-use metered data and trend data from bBMSs.

Summary of Sampling Methodology. Using tracking data from PY8, Navigant estimated the total number of projects and the total amount of energy savings in the population across the 2-year sampling period. With this project data, the team created four strata of sample projects.

All projects above 3 million kWh per year of annual savings make up a census stratum (Stratum 1 – Very Large Projects). In the New Construction Solution—across the Small and Large C&I Programs—there were no projects that fit this description. Navigant then excluded all projects making up the lowest 2% of

[67] Phase III Evaluation Framework. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

total solution energy savings, sorted the projects by size, and divided the population into three strata: those projects making up the top third, the middle third, and the lowest third of total energy savings.

- **Stratum 1:** Very high impact and/or very high uncertainty measures. Projects over 3 million kWh/year energy savings.
- **Stratum 2:** High impact and/or high uncertainty measures. Projects between 300,000 kWh/year and 3 million kWh/year energy savings.
- **Stratum 3:** Medium impact and/or medium uncertainty measures. Projects between 200,000 kWh/year and 300,000 kWh/year energy savings.
- **Stratum 4:** Low impact measures. Projects between 20,000 kWh/year and 200,000 kWh/year energy savings.

Net Impact Evaluation

Navigant applied the NTG ratio from the PY7 Smart Construction Incentives program to the PY8 C&I New Construction Solution impact evaluation results. A separate NTG calculation will be conducted for C&I New Construction Solution in PY9.

Process Evaluation

See Section 3.4.5 for discussion of process evaluation for the Large C&I EE Program solutions.

Status of Recommendations
The evaluation activities in PY8 led to the following findings and recommendations from Navigant to PECO, along with a summary of how PECO plans to address the recommendation in program delivery.

- **Finding:** Five of the 17 new construction projects sampled for the gross impact evaluation used lighting variables from the 2015 TRM rather than the 2016 TRM. Three of these projects are in the Large C&I EE Program and two are in the Small C&I EE Program. Specifically, the ex ante calculations for these projects applied interaction factors from the 2015 TRM. For three of the five projects, the building permit date in the tracking system confirmed the correct use of the 2015 TRM. For the remaining two projects, the building permit date was not populated in the tracking system. For all five projects, the provided project documentation did not include files clearly indicating or labeling the building permit date.
    - **Recommendation:** PECO should ensure that the tracking system includes building permit dates for all new construction projects and provide documentation that clearly indicates the building permit date. This will allow confirmation of the correct version of the TRM and all associated variables.
- **Finding:** In PY7, the energy and demand savings from several new construction projects were excluded from official program totals due to less than 100% building occupancy at the close of the program year. Although Navigant did not find any incomplete projects during the site inspection process in PY8, building occupancy remains an important issue in Phase III.
    - **Recommendation:** PECO should continue to review this issue and consider future revisions to the TRM.

G.3 Data Centers Targeted Market Segment

Projects in the Data Centers Targeted Market Segment are eligible to participate in the Equipment and Systems or C&I New Construction Solutions, depending upon the details of the project. Data centers—on account of their high energy usage profiles and specialized technologies—are given special attention from the Small and Large C&I EE Programs, allowing for tailored recruitment and implementation of such projects. Much of the energy savings in this segment come from cooling technologies, although the implementation of control systems and lighting are also possible. Participation is defined as an activity with a unique project number. More than one measure per participant is permitted, with the impact sample defined on the project level. ICF is the implementer for data center projects, given their entry into either the Equipment and Systems or New Construction Solutions.

Participation and Reported Savings

There was no PY8 participation; thus there are no reported savings for the Data Centers Targeted Market Segment.

Gross Impact Evaluation

There was no recorded participation in the Data Centers Targeted Market Segment in PY8. Navigant will conduct a full impact evaluation in PY9, pending participation.

Net Impact Evaluation

Navigant will conduct a full NTG ratio calculation in PY9, pending participation.

Process Evaluation

See Section 3.4.5 for a discussion of the process evaluation for the Large C&I EE Program's solutions.

Status of Recommendations

- **Finding:** Most data center energy savings are derived from load on the equipment—i.e. the greater the load, the larger the savings. This is potentially causing customers to delay program engagement until load is realized.
    - **Recommendation:** PECO should explore decision-making related to data center projects during future process evaluations through interviews with current and potential participants and reviews of other data center program evaluations. A focus of this review should be to understand whether a multistage incentive plan would be in the best interest of all parties.

G.4 Multifamily Targeted Market Segment

Renters and owners in multifamily buildings have the opportunity to participate in both low-cost, in-unit, direct install measures (e.g., LEDs, CFLs, power strips, showerheads, and faucet aerators) and incentivized measures such as appliance replacements through PECO's Multifamily Targeted Market

Segment. Given that the targeted market segment bridges across the Residential, Small C&I, and Large C&I Programs, Appendix H includes detail about the Multifamily Targeted Market Segment.

APPENDIX H. MULTIFAMILY TARGETED MARKET SEGMENT

Renters and owners in multifamily buildings have the opportunity to participate in both low-cost, in-unit, direct install measures (e.g., LEDs, CFLs, power strips, showerheads, and faucet aerators) and incentivized measures such as appliance replacements through PECO's Multifamily Targeted Market Segment. Building owners also have the opportunity to leverage incentives to support investments in efficient whole building components such as HVAC improvements, HVAC maintenance, and building shell upgrades. Franklin Energy Services is the CSP for this targeted market segment. A participant is a unique project number as described in PECO's program tracking database. A project can relate to a residential unit or a common area space in individually metered and master-metered buildings.

The Multifamily Targeted Market Segment is unique in that it contributes savings to the Residential EE, Small C&I EE, and Large C&I EE Programs.

Participation and Reported Savings

Tables I-7, I-16, and I-21 in Appendix I provides Multifamily Targeted Market Segment results for PY8 including participation, energy and demand savings, and incentive costs by customer segment and carve-out.

Gross Impact Evaluation

Navigant conducted the following activities to verify the gross impacts and to review the CSP database for reporting accuracy:

- Tracking database review
- Desk reviews and onsite verification for the projects contributing to the Small and Large C&I EE Programs
- Phone verification of installed measures for projects contributing to the Residential EE Program
    - These phone surveys also inform the net impact and process evaluations

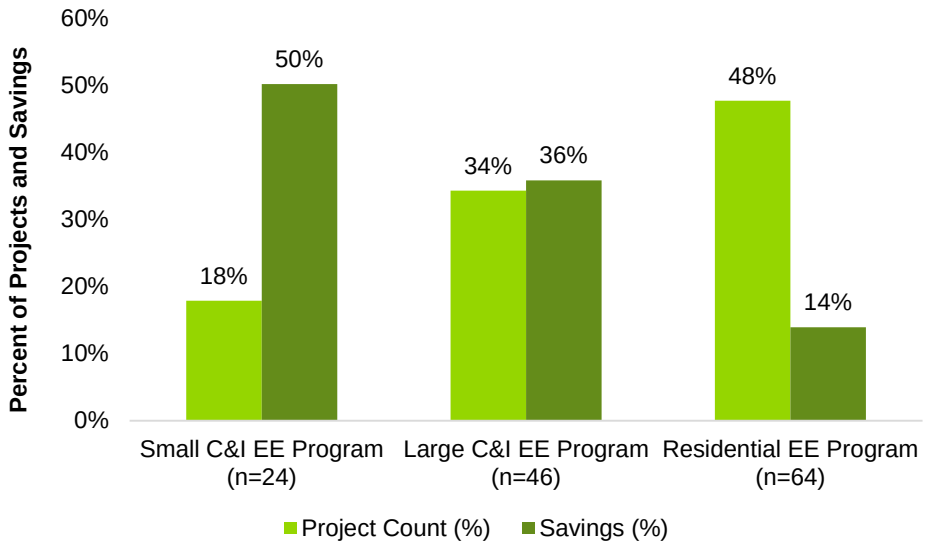
Tracking Database Review

Navigant conducted a tracking system and database review after receiving data from the CSP for PY8. The Multifamily Targeted Market Segment spans across three different programs: Small C&I EE, Large C&I EE, and Residential EE; Navigant's review included all data across all programs. For PY8, the measure mix for the targeted market segment includes direct install LEDs and CFLs and direct install faucet aerators and showerheads. Savings from these latter two water conservation measures originate from electric hot water heater savings.

Figure H-1 shows the distribution of the projects and the gross verified savings across the programs. Although the Residential EE Program has more projects, all of these are smaller projects for in-unit installs of lighting or water conservation measures. Conversely, the Small C&I and Large C&I EE Programs have fewer projects with larger savings associated with each. The Large C&I EE Program covers projects in master-metered buildings with a larger number of units and their common areas. The

Small C&I EE Program covers smaller master-metered buildings and their common area projects. On top of this, the Small C&I EE Program also includes common area projects in buildings where the associated units are individually metered and contribute to the Residential EE Program.

Figure H-1. Multifamily Targeted Market Segment Project Count and Gross Verified Savings by Program



Source: Navigant analysis

Sampling Considerations

During the database review, Navigant found that the contact information for program participants varied among the three EE programs. The team found that tenant-level contact information was only available for individually metered units that are assigned to the Residential EE Program. The projects in the Small and Large C&I EE Programs only had the property manager or site contact information in the tracking database. No tenant-level contact information was available. As a result, Navigant created a sampling approach under which the Residential EE projects were verified through phone conversations with tenants. The sampling approach for the Small and Large C&I EE projects called for verification through site visits and interactions with the property manager or site contact given that tenant contact information was not available. Table H-1 includes a summary of the sample. The sample was designed to meet a relative precision of 15% at the 85% confidence interval. The 12 buildings that were randomly selected in the Small – C&I, Large – C&I and Multisector – C&I strata for the Small and Large C&I EE Programs were further sub-sampled at the project level. Verifying all the projects at a building was not feasible, and Navigant deemed it to be unnecessary. As an alternative, the team sub-sampled the projects at a building level to meet the relative precision requirement of 15% at a confidence interval of 85%. The revised sampling approach covers all the combinations of program type, space types, measure mix, and stratification by savings that was originally submitted in the Phase III Evaluation Sampling Plan seen in Table 4-17.

Table H-1. Sampling Design for Multifamily Targeted Market Segment

Stratum Name	Stratum Description	Market Segments	Unit Basis	Population Size	Targeted Sample Size	Achieved Sample Size	Stratum Savings (kWh)	Impact Verification Method
Large – C&I	Upper half of savings across the C&I segments	Small C&I, Large C&I	Building	5	4	3	1,163,778	File Review and Onsite
Small – C&I	Lower half of savings across the C&I segments	Small C&I, Large C&I	Building	13	4	4	552,874	File Review and Onsite
Multisector – C&I	Buildings with common areas in the C&I segments and units in residential segment	Small C&I, Large C&I	Building	23	4	4	336,119	File Review and Onsite
Large – Residential	Upper half of savings across the residential segment including residential units in multisector buildings	Residential	Project (in-unit)	767	40	31	989,591	Phone Survey
Small – Residential	Lower half of savings across the residential segment including residential units in multisector buildings	Residential	Project (in-unit)	2,898	35	35	968,626	Phone Survey
Total	**All**	**Residential and C&I**	**Building or Project**	**3,996**	**87**	**0.5**	**4,010,988**	**Onsite and Phone Survey**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Desk Reviews and Onsite Preparations

Navigant conducted desk reviews of the sampled project files related to the 12 buildings in the Large – C&I, Small – C&I, and Multisector – C&I strata. Within those buildings, the team conducted desk reviews for 163 sub-sampled projects including a primary sample and an alternative sample across the three strata. The project files included the snapshot of all the measure-level data that was collected or calculated by the CSP during implementation. The majority of this information was available in the tracking data as the CSP used the same software system to generate the project files and the tracking data. The project files also had supplemental information about the location of the tenant unit, the contact information of the decision maker (i.e., the property manager or site contact), and some handwritten notes that were helpful in understanding the space type (e.g., common area descriptions) and measure installation locations.

Navigant's desk review was focused on the following tasks:

- Verifying information with the tracking data
    - Property type: G/E/NP vs. non-G/E/NP, LI vs. non-LI
        - Navigant used this information to confirm that all participants in the Multifamily Targeted Market Segment are non-G/E/NP and non-LI
    - Building heating type
    - Building cooling type
    - Type of metering (i.e., individual vs. master-metered)
    - Measure type
    - Measure count
- Creating field forms for onsite verification
    - Collecting data from project files to feed into site-specific M&V field forms for onsite verification.
    - Determining specific apartment numbers or common area locations for the projects to aid field technicians and reduce burdens and dependence on property managers and site contacts.
    - Capturing contact information for scheduling site visits and conducting process evaluation interviews while onsite.
    - Summarizing the handwritten notes to help the field technicians find the location of measures within the residential units and other information unique to the building or the project. This also helped reduce burdens and dependence on property managers and site contacts.

The project files created by the CSP did not include any engineering assumptions or savings estimates. Therefore, the team did not conduct a record-level TRM review until the onsite verification was completed and details were available to complete those reviews.

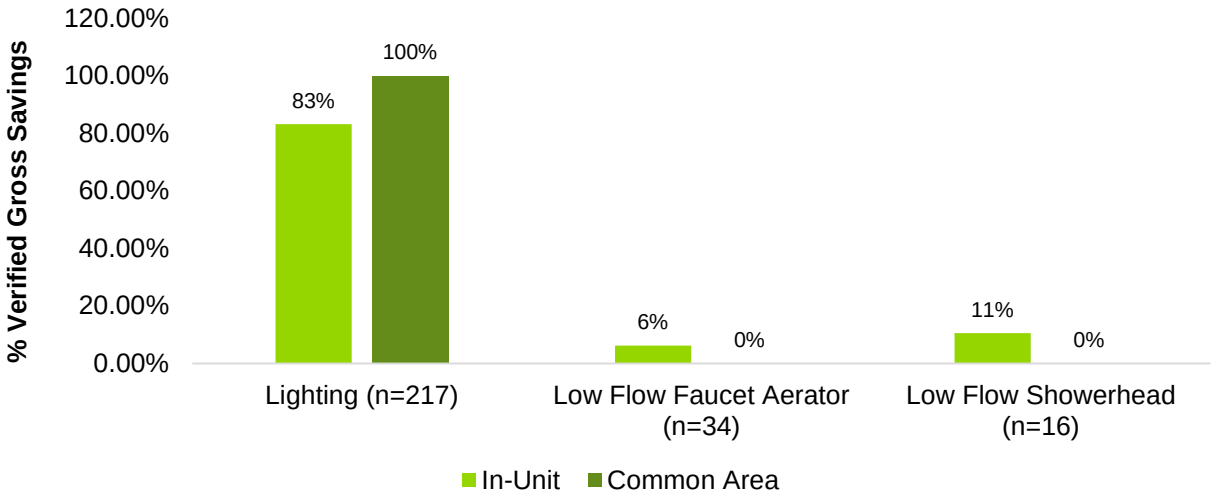
Onsite Verification

Navigant conducted onsite verification for the common areas and sub-sampled in-units for 11 out of 12 buildings in the Large – C&I, Small – C&I, and Multisector – C&I strata. During these site visits, the team verified the installation and operation of installed measures within each building and confirmed the measures' relevant parameters and assumptions sourced from the PA TRM to calculate savings. Navigant also confirmed the presence of other equipment within the building that interact with measures. For example, the team confirmed that electric water heaters supplied any installed water conservation measures so that electric energy savings are realized.

The team verified 70 different projects at these 11 buildings of the original 163 included in the initial desk review. Figure H-2 shows the verified gross savings for the sample by installation area and measure type. Water conservation measures represent approximately 17% of the in-unit savings, but no water conservation measures were installed in the common areas. Navigant groups the distribution of verified gross savings of the sampled Large – C&I, Small – C&I, and Multisector – C&I strata together in Figure H-2 given that these combined results inform the Small and Large C&I EE Program verifications.

Navigant was unable to complete site visits at one of the 12 sampled buildings because site contacts were unwilling to schedule a site visit and let the team come and verify the installations. Their primary reason was to not disturb the tenants with back-to-back verifications that were happening at their buidling.

Figure H-2. Multifamily Targeted Market Segment Onsite Sample Verified Savings Distributions by Installation Area and Measure Type



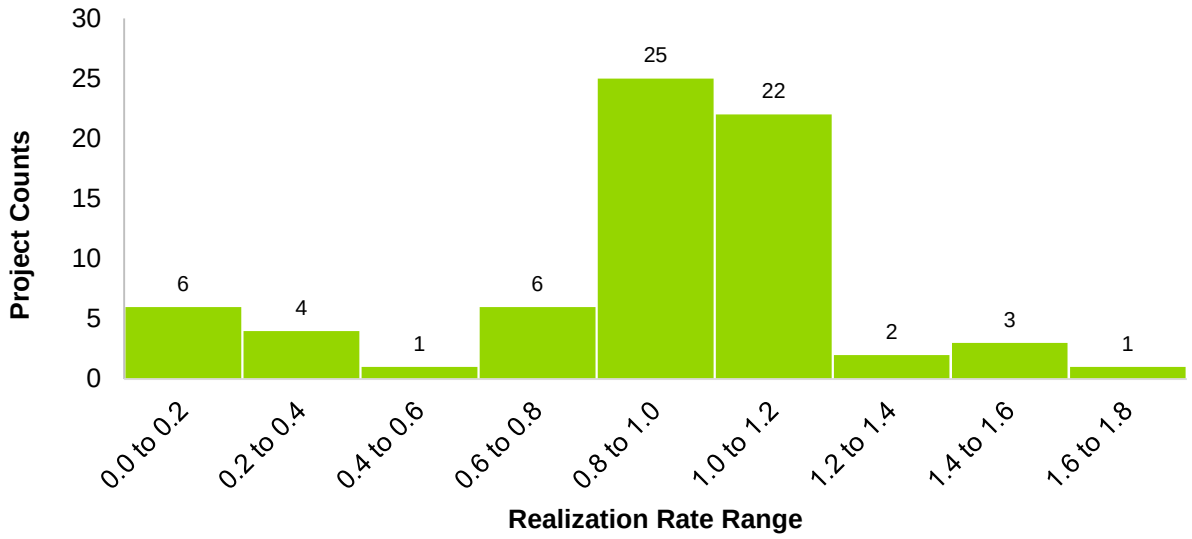
Source: Navigant analysis

Figure H-3 represents a histogram of the RRs observed for the 70 projects of the onsite sample. Figure H-4 further explains the primary reasons for the differences in reported verse verified savings. Twenty-six projects had either missing bulbs or extra bulbs installed. The field teams only visited a sub-sample of projects within each building, and these bulbs may have been installed at a different location within the same building. However, full searches of buildings for missing bulbs was not possible, and ultimately, the team noted these as missing given the documentation discrepancies.

At the building level, only five buildings showed discrepancy issues, including the one issue previously described. One building with six projects reported not receiving any measures in its common area as noted in the tracking database. Some projects in other buildings had other discrepancies related to bulbs of different wattages than reported being installed and bulbs burning out prematurely (and not being replaced with EE bulbs).

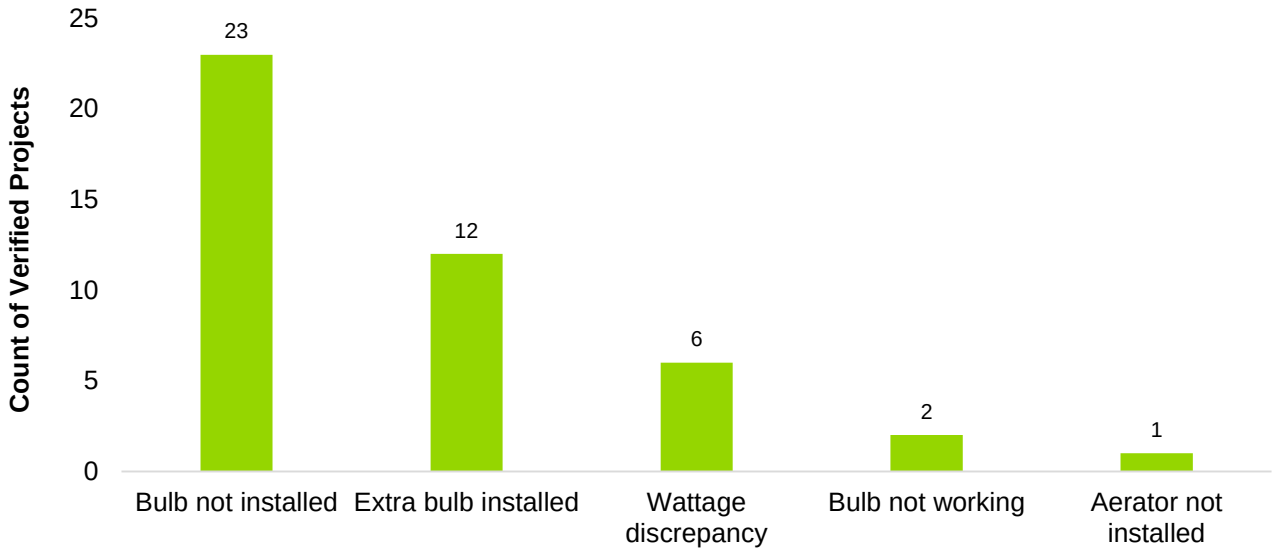
Water conservation measures, on the other hand, were typically found as expected. Navigant found only one instance where a tenant had voluntarily removed the kitchen faucet aerator. Overall, only one project had a discrepancy related to water conservation measures.

Figure H-3. Multifamily Targeted Market Segment Sampled Onsite Projects RRs



Source: Navigant analysis

Figure H-4. Multifamily Targeted Market Segment Reason for RR Discrepancies for Sampled Onsite Projects



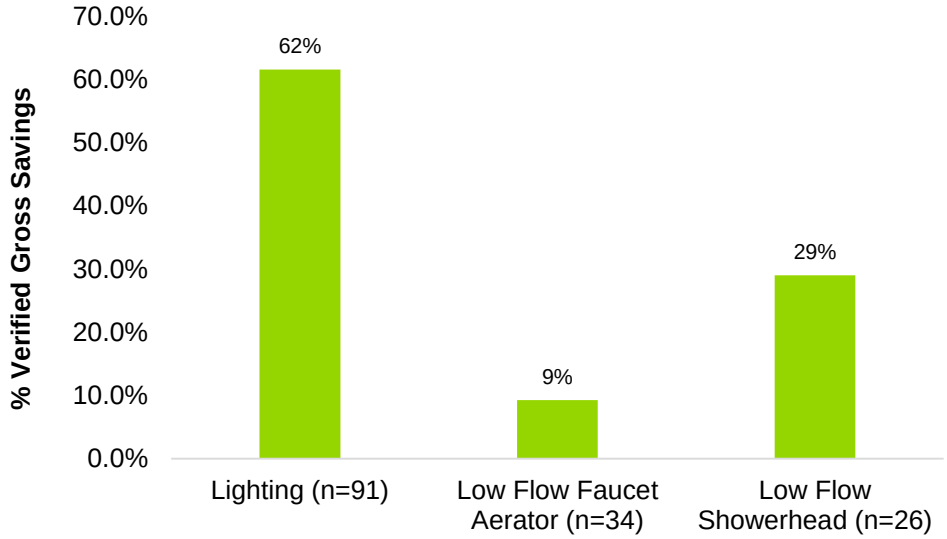
Source: Navigant analysis

Phone Verification

Navigant used the data from a sample of residentially metered project files to populate the algorithms for the PA TRM deemed and partially deemed savings measures. The team then verified measure installations with a phone survey for a sample of residential participants within the Large – Residential and Small – Residential strata. These strata consist of all the projects in units that are individually metered and are part of the Residential EE Program. The verification questions for the survey were included as a section in the overall phone survey instrument that also gathered information on customer experience, free ridership, spillover, and program processes. Of the 66 responses that the team collected for the overall survey, Navigant used verification responses from 29 projects in the Large – Residential stratum and 33 projects in the Small – Residential stratum. The verification questions asked if participants received the same quantity of measures as expected based on the tracking data. Although the team asked measure-specific questions like wattage of the bulb or gallons per minute (gpm) of the faucet aerator and showerhead, none of the respondents knew if the characteristics were different than what was expected. Therefore, Navigant only used responses informing quantity of the installed measures from the survey responses. The information about any equipment that may interact with the measures, such as electric water heaters for water conservation measures, was sourced from the tracking database, whereas all other assumptions were sourced from the PA TRM.

Figure H-5 shows the distribution of verified savings by measure type for the sample. Similar to the non-residential projects, lighting represents a majority of savings. The team stratified the sample by savings and to represent all types of residential units that received measures. These include townhouse-style multifamily buildings, condos, and tenant-occupied multistory buildings. Almost 39% of the verified savings represent water conservation measures among the Large – Residential and Small – Residential strata. Only four projects received a RR of less than 1.00, whereas 60 projects have an RR of 1.00. The respondents for the four projects confirmed quantities different from the program tracking data.

Figure H-5. Multifamily Targeted Market Segment Residential Phone Survey Verification Results



Question: According to our records, your home received [measures listed]. Is this correct?"
Source: Navigant analysis

Net Impact Evaluation

Navigant conducted the net impact evaluation for the Multifamily Targeted Market Segment through interviews for all the landlords in Large – C&I, Small – C&I, Multisector – C&I strata, and through the overall residential survey for tenants in the Large – Residential and Small – Residential strata. The team conducted interviews and surveys in concert with gross impact evaluation activities. Details on the targeted and achieved samples are described in Table 3-12, Table 3-51, and Table 3-70. Also, details on the approach to residential surveys are described in the previous Phone Verification section. For this net impact evaluation, Navigant estimated free ridership, spillover, and NTG values.

Free ridership is defined as the portion of participants who would have purchased the program measures anyway, without the program incentive. Spillover is defined as activity among participants who were influenced by the program to purchase and install additional energy efficient equipment that saves electricity without a rebate or incentive. The evaluation team used Equation H-1 to calculate the NTG ratio:

Equation H-1. Total NTG Ratio

$$NTG\ Ratio = 1 - Free\ Ridership\ Rate + Spillover\ Rate$$

Landlord and Property Manager Interviews

Navigant interviewed landlords of master-metered buildings to inform Navigant's net impact calculations. The survey team spoke with landlords either while the field technicians were onsite for verification

activities or later via phone interviews. The free ridership section of the landlord and property manager interviews was structured based on guidance from the Uniform Methods Project,[68] as detailed in the Phase III Evaluation Framework.[69] Using this methodology, landlords and property managers identified as decision makers were asked if they would have purchased all, some, or none of the same program measures in the absence of the direct install program; they were also asked to rate the influence of several key program elements in their decision to participate. The key questions determining free ridership focus on the influence of key program interventions such as free equipment, program information regarding efficient products, cost savings associated with the efficient equipment, program educational materials and marketing, as well as the interviewee's perception of what they would most likely have done in the absence of the program.

The program elements that customers were asked to rate on a 1-5 scale, where 1 meant "not at all influential" and 5 meant "extremely influential," included the free equipment, program information regarding efficient products, cost savings associated with the efficient equipment, and building management's decision to participate. Using the customer responses to the free ridership questions, the team calculated a non-program score and a program influence score, which could each have a value between 0 and 0.5 and when added together made up the overall free ridership score. Using this approach, free ridership can take on values ranging from 0.0 to 1.0 for each respondent and for the program overall. High free rider scores are associated with survey respondents who reported they would have purchased all of the same program measures in the absence of the program and who rated the influence of the program on their decision-making as very low or zero.

The net impacts evaluation also estimates spillover. Landlord and property manager interviews typically assess spillover by asking interviewees the extent to which their purchases were influenced by their experience with the Multifamily EE offering. The intent of the spillover questions is to identify what types and amounts of equipment customers purchased and installed on their own to inform a quantitative estimate of program spillover within the overall NTG calculation. Spillover was estimated from the landlord and property manager interviews based on the quantity and type of efficient equipment purchased without a rebate, the degree of self-reported influence of the program on the decision to purchase the equipment, and confirmation via the survey data, the program tracking data, and online lookups that the product in question was not rebated. The participant spillover rate was calculated by summing the spillover adoptions over all tenant survey respondents and then dividing it by the total reported savings.

Free ridership, spillover, and NTG values for the projects in the Small C&I EE Program and Large C&I EE Program are shown in Table H-2. The net impact evaluation yielded a 0.65 NTG ratio for the Small C&I and Large C&I Programs, showing a slight improvement over the PY7 NTG estimate of 0.62. No quantifiable spillover was identified in PY8. The HIM identified in the Small and Large C&I Programs, LEDs, produced a 0.65 NTG following the overall finding due to the census approach taken in estimating NTG.

[68] The Uniform Methods Project. Estimating Net Savings: Common Practices. NREL. https://www.nrel.gov/docs/fy14osti/62678.pdf

[69] Phase III Evaluation Framework. Section 3.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

Table H-2. Free Ridership, Spillover, and NTG for Small C&I EE and Large C&I EE Participants of Multifamily Targeted Market Segment

Strata	Free Ridership Result	Estimated Participant Spillover	NTG Ratio
Small and Large C&I [1]	0.35	0.00	0.65
LEDs (HIM)	0.35	0.00	0.65
Small C&I and Large C&I Programs	**0.35**	**0.00**	**0.65**

[1] For the Multifamily Targeted Market Segment NTG analysis, a census was attempted among participating landlords generating a single NTG estimate for both the Small and Large C&I Programs.
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.
Source: Navigant analysis

Tenant Phone Surveys

Participants living in residentially metered units were surveyed to gather information for the net impact evaluation. The free ridership section of the tenant surveys was structured based on guidance from the Uniform Methods Project,[70] as detailed in the Phase III Evaluation Framework.[71] Using this methodology, customers were asked if they would have purchased all, some, or none of the same program measures in the absence of the direct install program; they were also asked to rate the influence of several key program elements in their decision to participate. The key questions determining free ridership focused on the influence of key program interventions such as free equipment, program information regarding efficient products, cost savings associated with the efficient equipment, building management's decision to participate, and the customer's perception of what they would most likely have done in the absence of the program.

The program elements that customers were asked to rate on a 1-5 scale, where 1 meant "not at all influential" and 5 meant "extremely influential," included the free equipment, program information regarding efficient products, cost savings associated with the efficient equipment, and building management's decision to participate. Using the customer responses to the free ridership questions, the team calculated a non-program score and a program influence score, which could each have a value between 0 and 0.5 and when added together made up the overall free ridership score. Using this approach, free ridership can take on values ranging from 0.0 to 1.0 for each respondent and for the program overall. High free rider scores are associated with survey respondents who reported they would have purchased all of the same program measures in the absence of the program and who rated the influence of the program on their decision-making as very low or zero.

The net impact evaluation also estimates spillover. Tenant surveys typically assess spillover by asking customers the extent to which their purchases were influenced by their experience with the multifamily EE offering. The intent of the spillover questions is to identify what types and amounts of equipment customers purchased and installed on their own to inform a quantitative estimate of program spillover within the overall NTG calculation. Spillover was estimated from the tenant surveys based on the quantity

[70] The Uniform Methods Project. Estimating Net Savings: Common Practices. NREL. https://www.nrel.gov/docs/fy14osti/62678.pdf

[71] Phase III Evaluation Framework. Section 3.4. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

and type of efficient equipment purchased without a rebate, the degree of self-reported influence of the program on the decision to purchase the equipment, confirmation via the survey data and the program tracking data, and online lookups that the product in question was not rebated. The participant spillover rate was calculated by summing the spillover adoptions over all tenant survey respondents and then dividing it by the total reported savings.

Free ridership, spillover, and NTG values for the projects in the Residential EE Program are shown in Table H-3. Free ridership was lowest for Small – Residential at 0.12 and slightly higher for Large – Residential at 0.20. The free ridership for the highest impact measure in the offering, LEDs, is at 0.19. The difference between the Small and Large strata is because there are many owner residents, especially in condominium units, who made the decision to participate themselves. The Small strata has tenant-occupied units who are not decision makers. Many tenants understand the benefits of LEDs and, therefore, tend to make the purchases without any incentive; however, because these participants are mostly tenants who are not typically responsible for maintaining the bulbs in their units, their free ridership is lower than other residential programs.

Table H-3. Free Ridership, Spillover, and NTG for Residential EE Participants of Multifamily Targeted Market Segment

Strata	Free Ridership Result	Estimated Participant Spillover	NTG Ratio
Small – Residential	0.12	0.03	0.92
Large – Residential	0.20	0.01	0.81
LEDs (HIM)	0.19	0.03	0.84
Residential EE Program	**0.18**	**0.02**	**0.84**

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Process Evaluation

Navigant conducted in-depth interviews with PECO and CSP program managers, and landlord and property managers to understand their awareness of the program, assess their satisfaction with the energy assessment and program processes, and determine if the CSPs are channeling the participants toward other solutions and programs.

Navigant also surveyed tenants and condo owners to understand how the program was managed, how the participants learned about the program, why they participated, and their level of interest in participating in other direct install and prescriptive measures, and the barriers to participation.

To develop the sample for the phone surveys and interviews, Navigant conducted a thorough review of the PY8 program tracking data from the first three quarters of the year to determine how to stratify the population. The Small and Large C&I projects are divided into three strata: Large – C&I, Small – C&I, and Multisector – C&I. The Residential projects are divided across two strata Large – Residential and Small – Residential.

Sampling Considerations

During the database review, Navigant found that the contact information for program participants varied among the three EE programs. The team found that tenant-level contact information was only available for individually metered units that are assigned to the Residential EE Program. The projects in the Small and Large C&I EE Programs only had property manager or site contact information in the tracking database. No tenant-level contact information was available. As a result, Navigant created a sampling approach under which the Residential EE projects were verified through phone verifications with tenants. The sampling approach for the Small and Large C&I EE projects called for verification through site visits and interactions with the property manager or site contact given that tenant contact information was not available. Table H-1 includes a summary of the sample. The sample was designed to meet a relative precision of 15% at the 85% confidence interval. The tenant surveys and landlord survey sample were designed to achieve a relative precision of 10% at the 90% confidence interval.

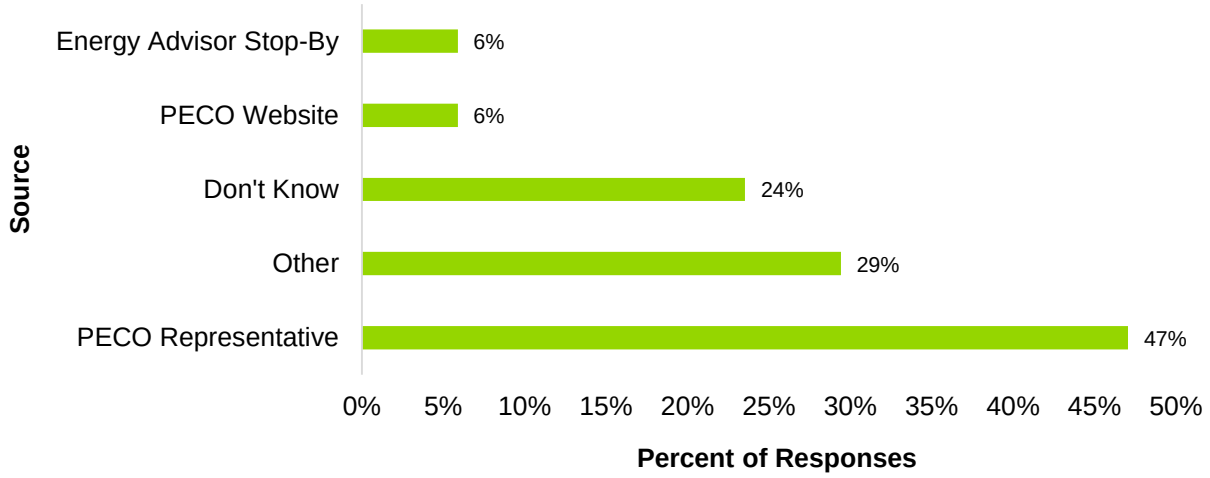
Navigant completed 35 tenant surveys in the Small – Residential stratum and 31 in the Large – Residential stratum. The landlord survey population was 52 buildings, with approximately 40 unique contacts associated with these buildings. These contacts included landlords, site maintenance staff, or property managers and decision makers at corporate firms. The team was able to contact and complete 17 landlord surveys from the available population of 40.

Process Evaluation

Navigant conducted phone interviews with 16 property managers and one decision maker from a larger firm that owns multiple buildings. The team also conducted phone surveys of 66 participant tenants, with 35 completes from the Small stratum and 31 surveys from the Large stratum. Small stratum respondents represented small rental units within larger buildings with deemed savings of 300 kWh/year, and large stratum respondents represented larger units or condominiums with higher deemed savings of 1,100 kWh/year. While owner-residents are typically the decision makers for their unit and landlords are the decision makers for units occupied by renters, it is important to capture feedback about the solution from all participant tenants, regardless of their ownership status.

According to the landlord interview responses in Figure H-6, over half (53%) of respondents stated they heard about the Multifamily Targeted Market Segment either through the PECO website (47%) or from the CSP's customer service/sales associates (6%). Twenty-nine percent of property manager respondents said they heard about the program through their corporate office. The one respondent who said they heard about the program through energy advisor stop-by was a decision maker from a large firm that owns multiple properties, indicating that the CSP is effectively marketing to larger property management firms where a single point of contact can make the decision for multiple buildings. Figure H-6 also indicates that other marketing efforts like bill inserts, displays on billboards or trucks, presentations, word of mouth marketing through the trade ally network or equipment vendors and retailers, etc. do not appear to resonate with these customers.

Figure H-6. Sources of Multifamily Targeted Market Segment Awareness Among Landlords, n=17

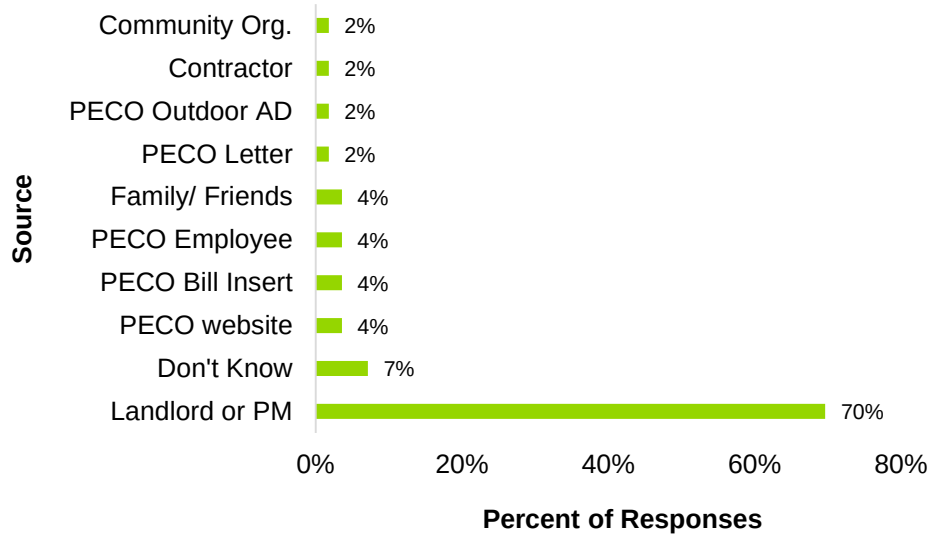


Question: "How did you learn about the program?" Multiple answers allowed.
Source: Navigant analysis

As seen in Figure H-7, a majority (70%) of tenant participants heard about the Multifamily Targeted Market Segment through their landlord or property manager; 16% heard about the program through a PECO letter, website, bill insert, or outdoor ads. Very few tenants heard about the offering through their family or friends or through their community organizations. This indicates that even though the tenants are not decision makers, PECO's marketing efforts and program materials are generally effective at raising customer awareness about the solution. Of tenants, 2% heard about the multifamily offering from the contractors.

Contractors from PECO's trade ally network are also aware of other measures that were not offered through the Multifamily Targeted Market Segment if they are authorized to install measures (e.g., appliances, HVAC equipment) through other solutions. Navigant recommends closely involving the trade ally network of contractors in their marketing efforts. This will not only establish awareness of the multifamily offering but also help in channeling the tenants to the incentives they really need.

Figure H-7. Sources of Multifamily Targeted Market Segment Awareness Among Tenants, n=55

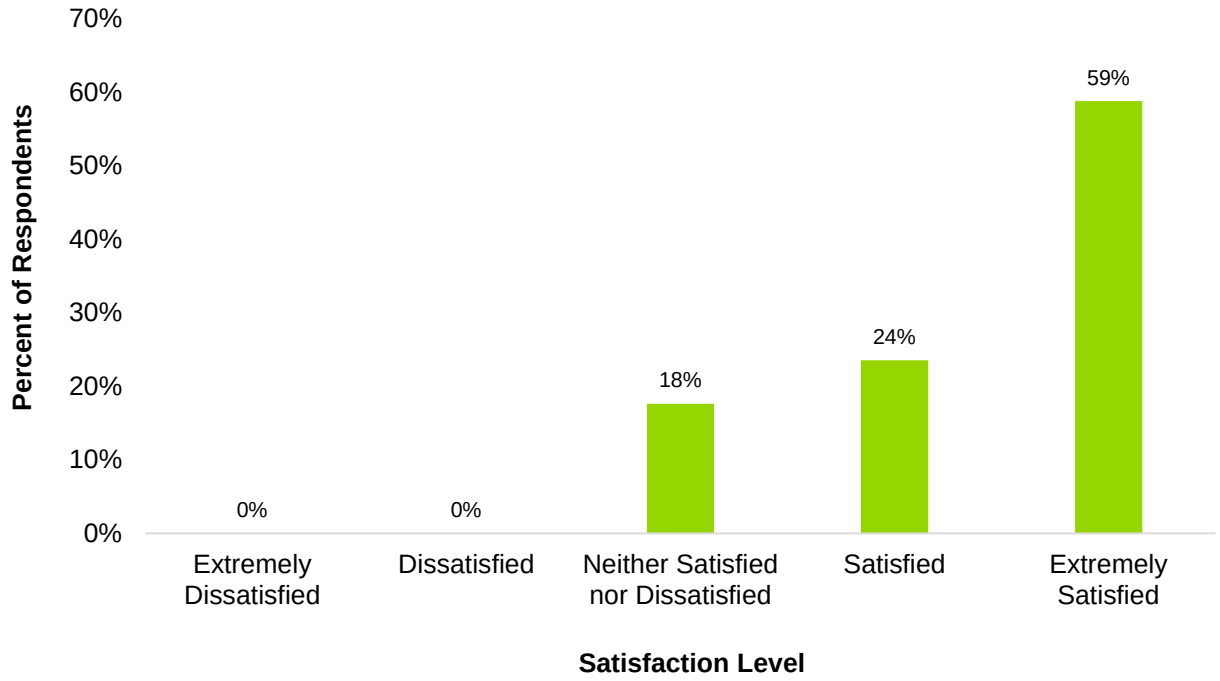


Question: "How did you learn about the program?"
Multiple answers allowed.
Source: Navigant analysis

As seen in Figure H-8, 83% of landlord respondents were satisfied or extremely satisfied with the Multifamily Targeted Market Segment. None said they were dissatisfied or extremely dissatisfied. This is likely because in PY8, the measure mix included free screw-based LEDs and water conservation measures for residential units and common areas at no cost to the customer. In addition, the CSP implemented a well defined process to install the measures. This process begins with signing the service agreement with the decision maker and then conducting the scheduling, installations, and quality assurance. PECO also provides program materials to ensure it is easy for the tenants to understand the installation process and their required time commitment. According to the CSP interviews, all of these efforts result in a low rate of tenant complaints, which is good for landlords.

To summarize, the landlords were happy with the service provided by PECO including the CSP's timeliness, communication, and value added to their buildings. Only one respondent said that they were neither satisfied nor dissatisfied with the program. This respondent provided that rating due to tenant complaints they received. The interviewer did not conduct further research on why the tenants complained. However, another respondent mentioned that the faucet aerators "made the water supply pipes vibrate." Also, during a site visit, one landlord participant mentioned that the CSP's energy advisor did not explain during the agreement process that pin base bulbs are not eligible to be replaced via the solution. This caused confusion and led to the landlord not participating in future PECO programs.

Figure H-8. Overall Landlord Satisfaction with Multifamily Targeted Market Segment, n=17



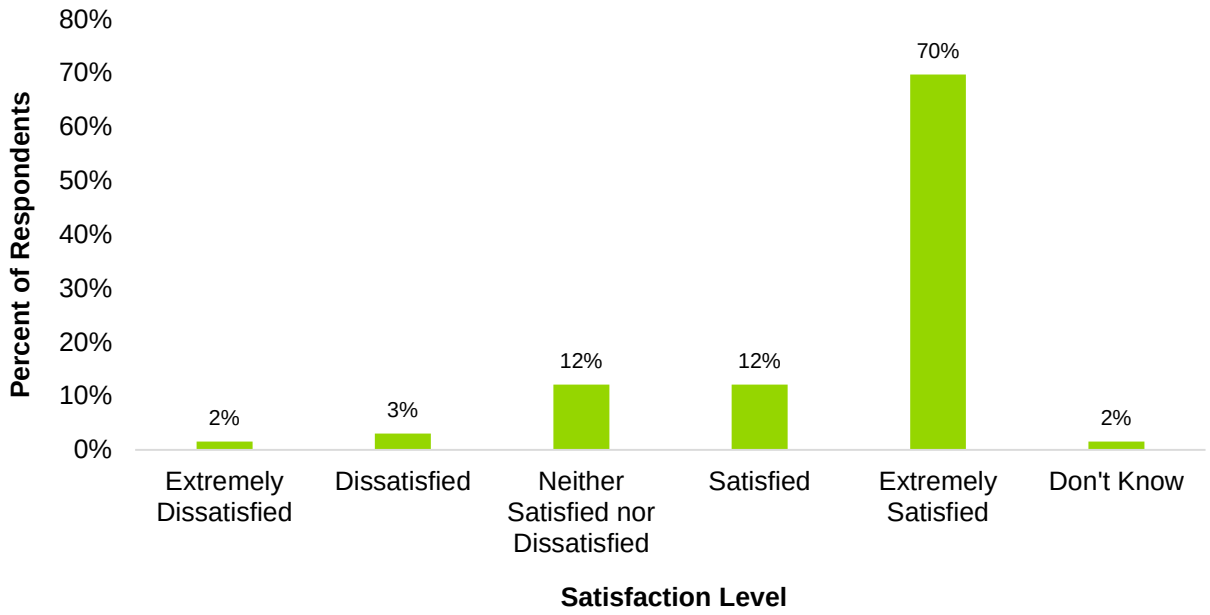
Question: "Using a scale of 1 to 5, with 5 meaning Extremely Satisfied and 1 meaning Extremely Dissatisfied, how would you rate your satisfaction with the Multifamily energy efficiency offering overall?"

Source: Navigant analysis

Similar to the landlords, 82% of tenants stated that they were either extremely satisfied or satisfied with the Multifamily Targeted Market Segment. However, a higher percentage of tenants than landlords expressed some dissatisfaction with the solution (5% compared to 0%). A common theme among the explanations for dissatisfaction was the quality of the LED and CFL bulbs. A few respondents stated that the LED bulbs burned out too soon, and one complained about the CFL bulbs being too slow to warm up and not bright enough.

A few respondents provided reasons related to their utility bill and implied that they did not see any substantial savings after installing the measures. Because this issue appears to be limited to a few customers and not a widespread issue, Navigant recommends continuing to monitor the rate at which the LED bulbs are burning out via customer complaints and future tenant surveys. If a substantial number of LED bulbs are burning out within the first year of operation, Navigant recommends replacing the bulb models that are in use with better quality bulbs.

Figure H-9. Overall Tenant Satisfaction with Multifamily Targeted Market Segment, n=66

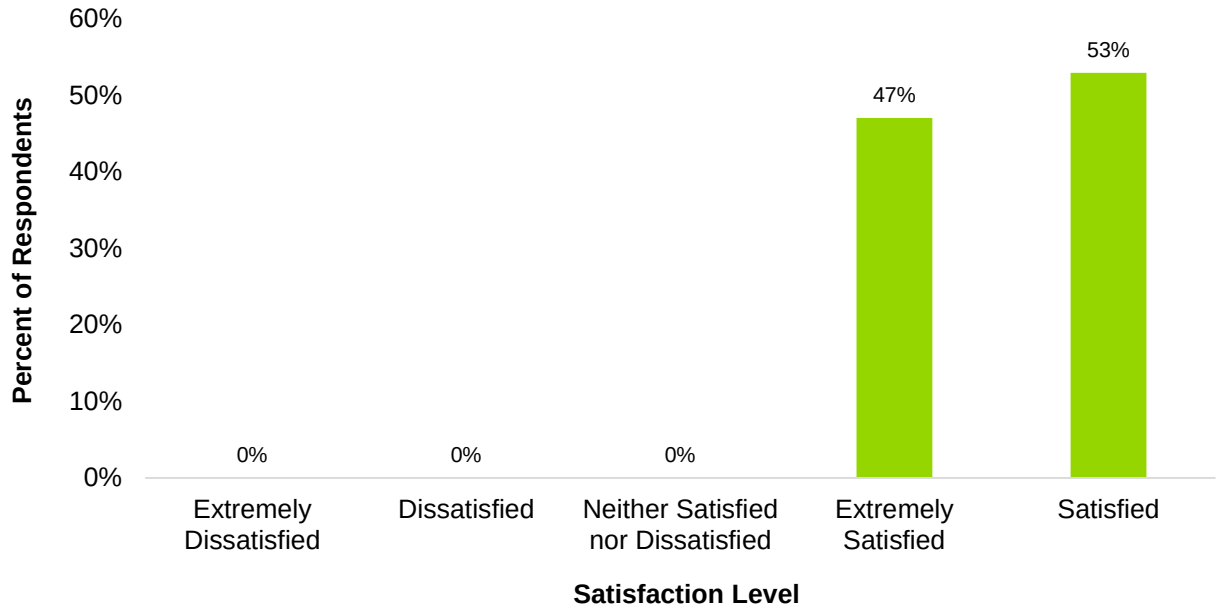


Question: "Using a scale of 1 to 5, with 5 meaning extremely satisfied and 1 meaning extremely dissatisfied, how would you rate your OVERALL satisfaction with the Multifamily program?"

Source: Navigant analysis

Figure H-10 shows that all (100%) of the landlord respondents were satisfied or extremely satisfied with PECO as a utility. Because the respondents were highly satisfied with PECO in general, Navigant did not ask any additional questions on this topic.

Figure H-10. Landlord Multifamily Targeted Market Segment Participant Satisfaction with PECO, n=17

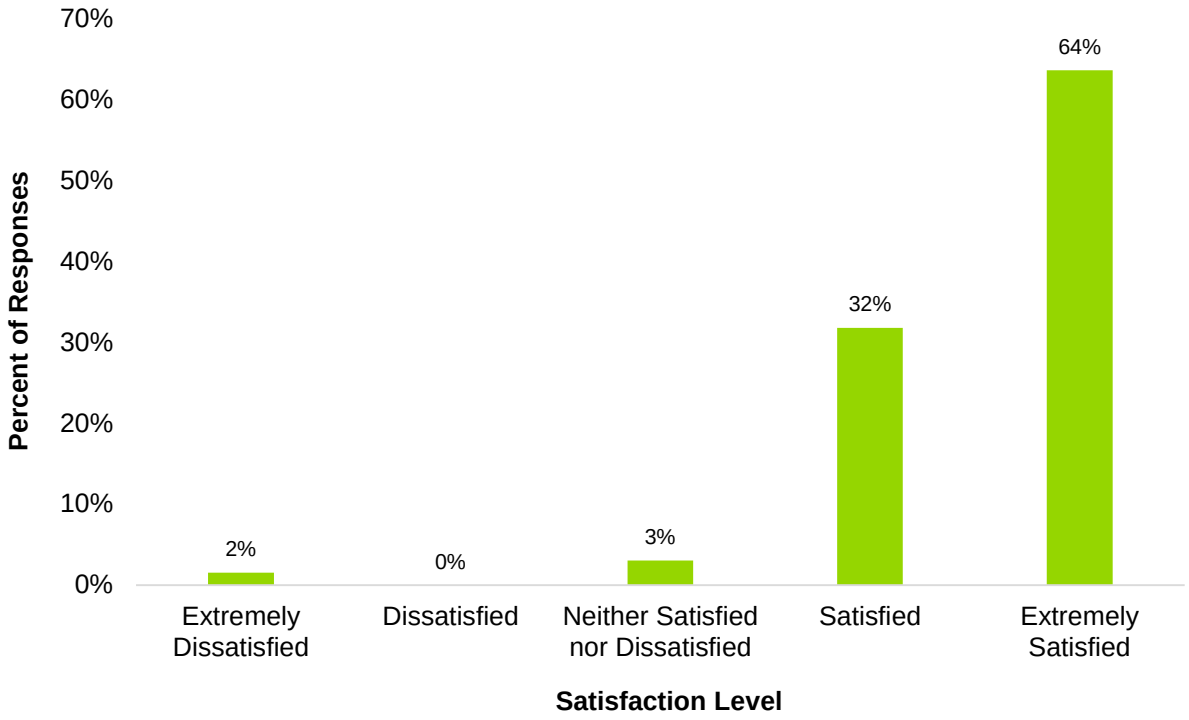


Question: " On a scale of 1 to 5, with 5 meaning Extremely Satisfied and 1 meaning Extremely Dissatisfied, how satisfied are you with PECO in general?"

Source: Navigant analysis

Again, similar to the landlords, almost all (96%) of the tenant respondents stated that they are satisfied or extremely satisfied with PECO as a utility, as seen in Figure H-11.

Figure H-11. Tenant Multifamily Targeted Market Segment Participant Satisfaction with PECO, n=66

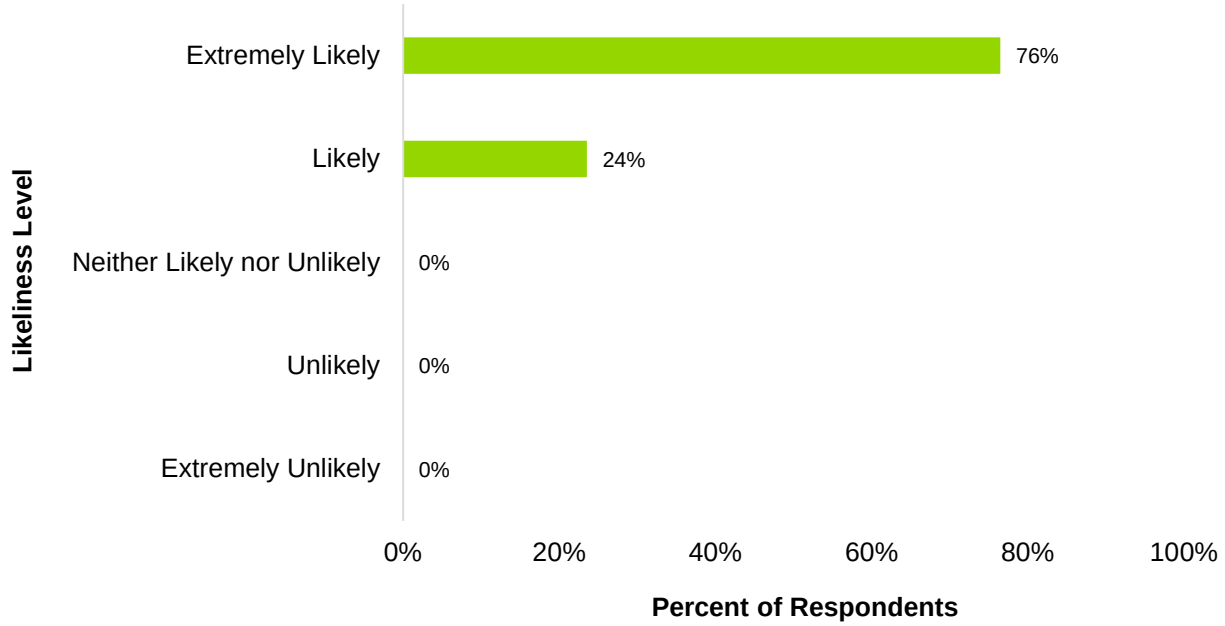


Question: " On a scale of 1 to 5, with 5 meaning Extremely Satisfied and 1 meaning Extremely Dissatisfied, how satisfied are you with PECO in general?"

Source: Navigant analysis

Similar to the high satisfaction score for PECO as a utility, all (100%) landlord respondents said they are likely to recommend the Multifamily Targeted Market Segment to others. As discussed earlier, the landlords were happy with the service provided by PECO including the CSP's timeliness, good communication, and value added to their buildings.

Figure H-12. Landlord Likelihood of Recommending the Multifamily Targeted Market Segment to Others, n=17

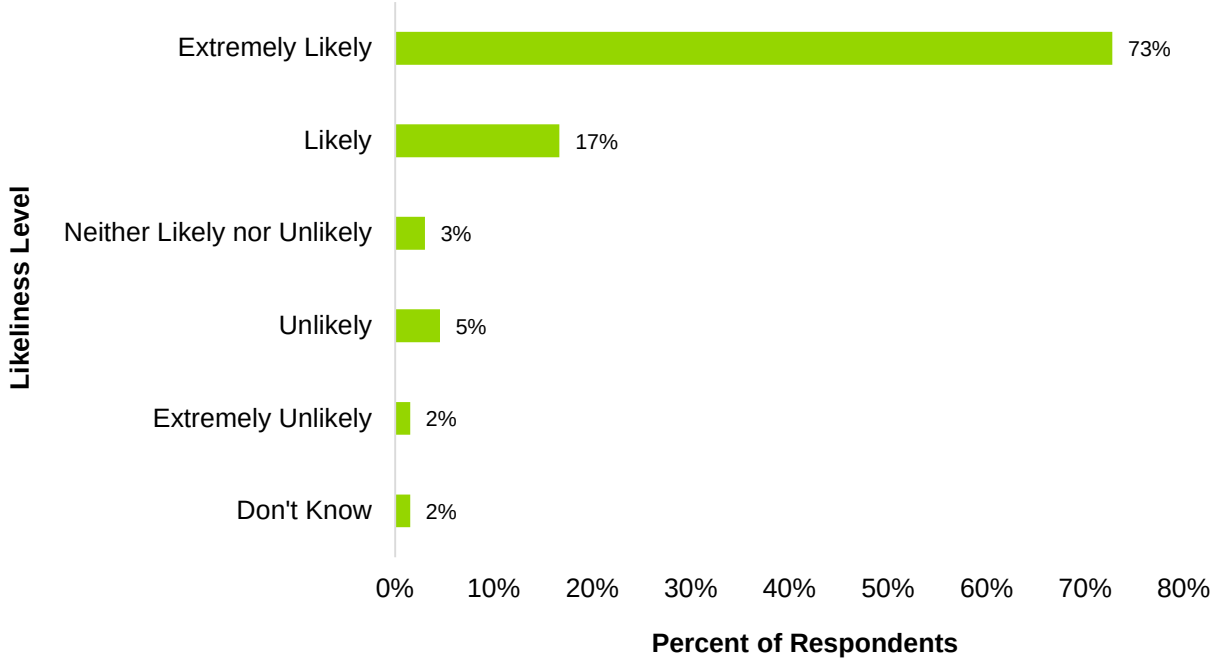


Question: "On a scale of 1-5, with 5 meaning extremely likely and 1 meaning extremely unlikely, overall, how likely are you to recommend PECOs Appliances and HVAC program to others?"

Source: Navigant analysis

Figure H-13 provides a similar picture regarding tenant likelihood of recommending the solution to others. Most tenants (84%) said they were either extremely likely or likely to recommend the solution to others. However, 10% of respondents said they were neutral or unlikely to recommend the solution to others. The main reasons for their low likelihood rating was the poor quality of bulbs experienced by a few tenants, while a few others said they did not see strong evidence of savings in their utility bills. A few people also complained about inconvenient kitchen aerators.

Figure H-13. Tenant Likelihood of Recommending the Multifamily Targeted Market Segment to Others, n=66

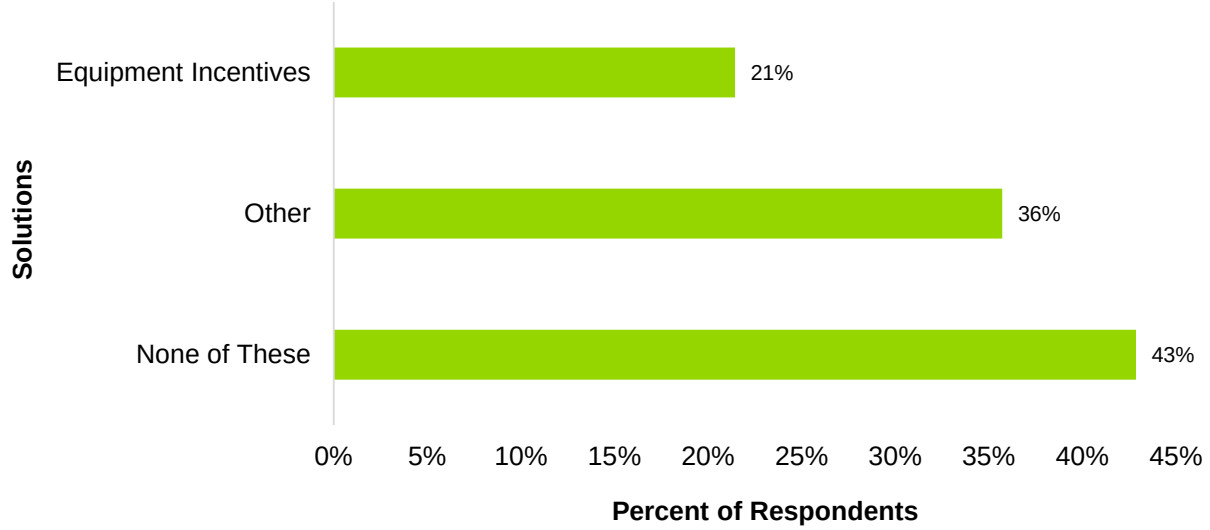


Question: "On a scale of 1-5, with 5 meaning extremely likely and 1 meaning extremely unlikely, overall, how likely are you to recommend PECOs Appliances and HVAC program to others?"

Source: Navigant analysis

Figure H-14 shows landlord participant awareness about other EE solutions that PECO offers. Navigant found that a little less than half of the participants (43%) had not heard about any of the other solutions, while 21% of were aware of equipment incentives and 36% were aware of other incentives. Other incentives covered a variety of individual responses but generally included mentions of the single-family home audits, the incentives for central AC units, and the incentives for linear fluorescents. When the energy advisors visit a property and conduct a high level assessment, they sometimes provide information about the other solutions that PECO offers based on the landlord's requirements. PECO should explore strategies to more effectively channel participants to appropriate programs based on their need. For example, the energy advisors could provide printed material about the other solutions, leave behind appropriate contact information for the PECO call center and relevant CSP(s), and share customer contact information with relevant CSPs for follow up.

Figure H-14. Landlord Multifamily Targeted Market Segment Participant Awareness of Other Solutions, n=17

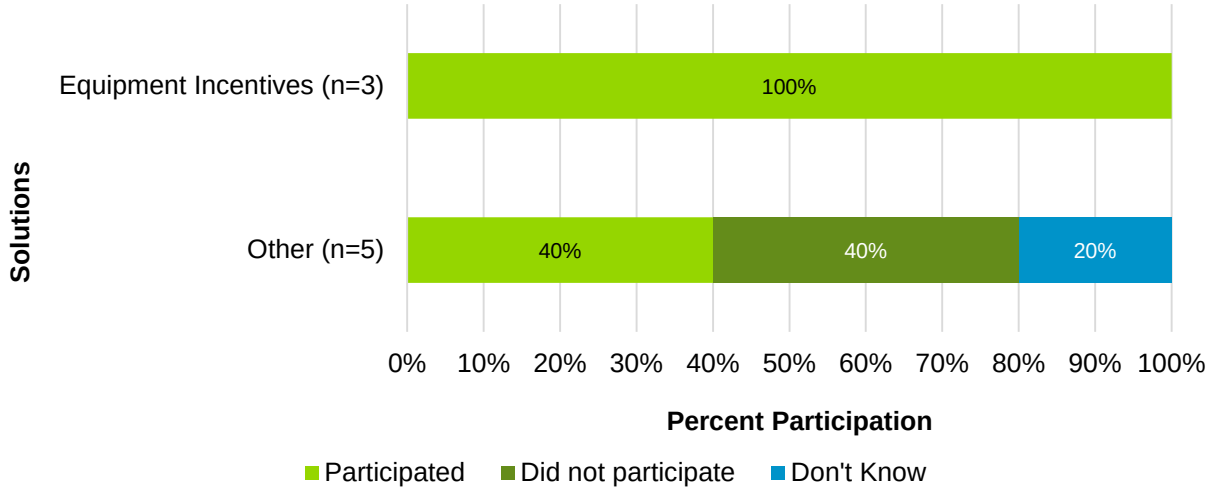


Question: ""Have you heard of any of PECOs other solutions to help you save energy and money in your home?"
Multiple responses allowed; sum of percentages will not add up to 100%.

Source: Navigant analysis

Figure H-15 shows the percentage of respondents that went on to participate in the other solution they recalled. Of the five landlords or property managers that recalled one of the other solutions, 40% said they went on to participate. Of the three respondents that recalled the equipment incentives, all (100%) went on to participate; one of those participants rated their experience with the Multifamily Targeted Market Segment as very influential when deciding whether to participate in the equipment incentives, and the other two said they did not know whether the Multifamily Targeted Market Segment experience was influential. While this information may not be representative of the larger population, these findings suggest that PECO should explore strategies to more effectively channel the Multifamily Targeted Market Segment participants into other solutions. Some landlords were aware of the equipment incentives solution, but that does not cover all the incentives PECO offers. As mentioned earlier, when the energy advisors stop by to conduct an energy assessment at a multifamily building, they should provide brochures or printed material about other solutions. This material should include the contact information of the PECO call center and relevant CSPs, as well as information about trade allies that can handle any needed equipment installations.

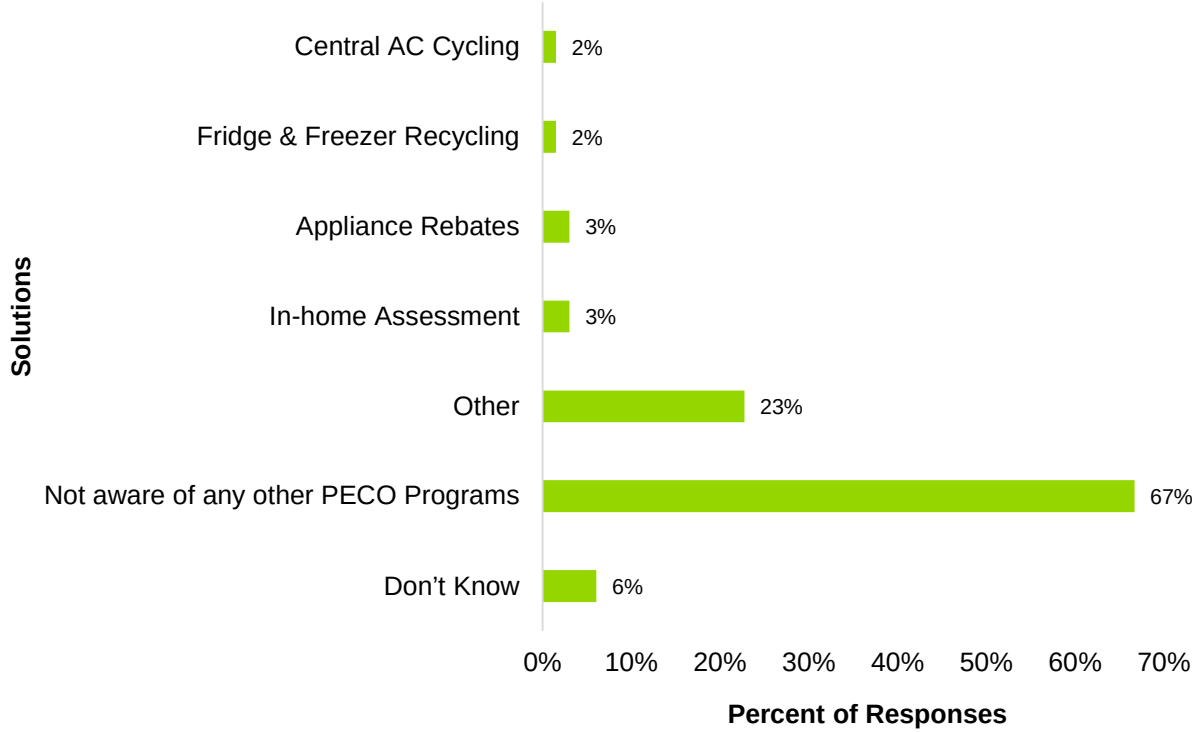
Figure H-15. Other Solution Participation Conditional on Awareness (Landlords)



Question: "Have you participated in PECO's [PREVIOUS RESPONSE] solution?"
Source: Navigant analysis

Figure H-16 shows that most of the tenants were not aware of other PECO solutions. This is not surprising for tenants in multifamily buildings because generally the landlords or property managers are responsible for deciding which measures to install. However, some tenants were aware of other offerings like central AC cycling, fridge and freezer recycling, appliance rebates, and the in-home assessment. Of respondents, 23% also said that they were aware of other programs like the low-income solutions and renewable energy opportunities. They mentioned receiving brochures or information about these other opportunities through their bills.

Figure H-16. Tenant Multifamily Targeted Market Segment Participant Awareness of Other Solutions, n=63

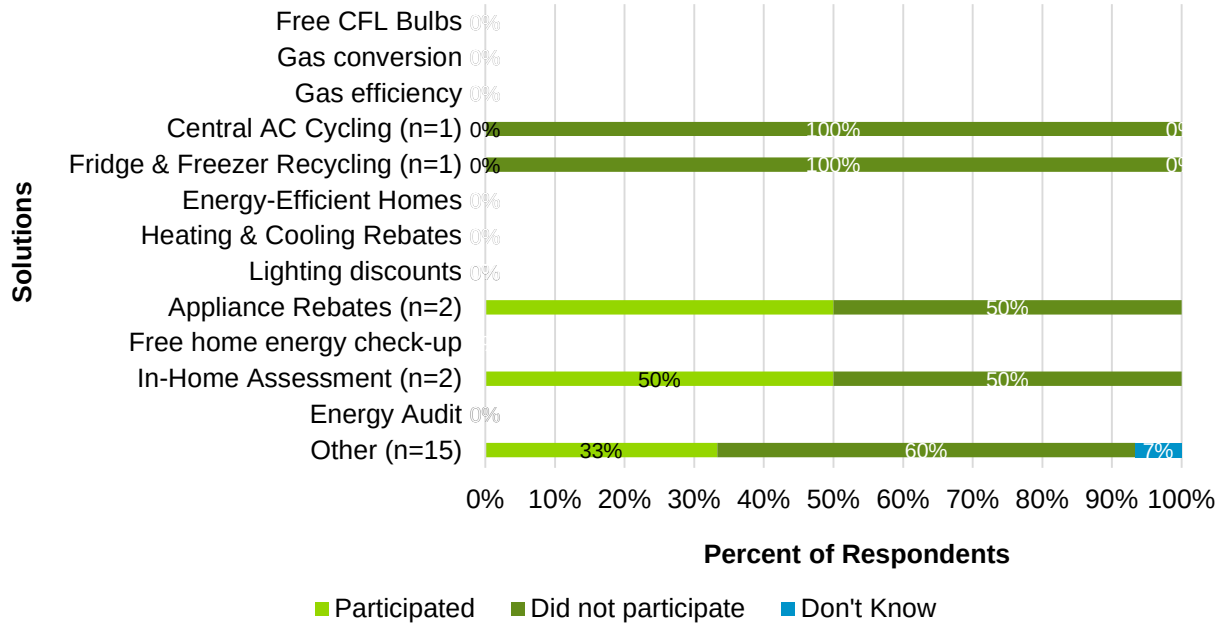


Question: ""Have you heard of any of PECOs other solutions to help you save energy and money in your home?"
Multiple responses allowed; sum of percentages will not add up to 100%.

Source: Navigant analysis

Figure H-17 shows that of the respondents who were aware of other solutions, only one tenant went on to participate in the appliance rebate program, while one other went on to participate in an in-home assessment. To increase tenant participation in other solutions, Navigant recommends PECO and the CSP implement the targeted marketing efforts suggested earlier in this section.

Figure H-17. Other Solution Participation Conditional on Awareness (Tenants)



Question: "Have you participated in PECO's [PREVIOUS RESPONSE] solution?"
Source: Navigant analysis

Status of Recommendations

The following provides a summary of Navigant's findings and recommendations resulting from the PY8 evaluation of the Multifamily Targeted Market Segment Solution.

- **Finding:** Property managers and tenants are generally not aware of other PECO program and solution offerings. In addition, the measure mix in PY8 only included direct install lighting and water conservation measures.
    - **Recommendation:** PECO should explore strategies to more effectively channel participants to appropriate programs and solution offerings based on their need. For example, the solution's energy advisors could provide printed material about the other solutions, leave behind appropriate contact information for the PECO call center and relevant CSP(s), and share customer contact information with relevant CSPs for follow up.
    - **Recommendation:** Channeling efforts should explain the benefits of prescriptive measures like high efficiency HVAC and shell improvements to property owners. The CSP should also focus on signing service agreements for prescriptive measures that are deemed beneficial to the property by the solution's energy advisor. To support such CSP efforts, the energy advisor's energy assessments can be enhanced to include a breakdown of available incentives, the cost to the customer, and the payback period for implementation. Enhancements should streamline the decision-making process for the customer.

APPENDIX I. PROGRAM- AND SOLUTION-LEVEL TABLES

See the attached Excel workbook with the following tables displaying results at the program- and solution-levels.

Table I-1. PY8 Residential EE Program Summary Statistics by Customer Segment and Carve-Out
Table I-2. PY8 Residential EE Program: Lighting, Appliances & HVAC Solution Summary Statistics by Customer Segment and Carve-Out
Table I-3. PY8 Residential EE Program: Appliance Recycling Solution Summary Statistics by Customer Segment and Carve-Out
Table I-4. PY8 Residential EE Program: Whole Home Solution Summary Statistics by Customer Segment and Carve-Out
Table I-5. PY8 Residential EE Program: New Construction Solution Summary Statistics by Customer Segment and Carve-Out
Table I-6. PY8 Residential EE Program: Behavioral Solution Summary Statistics by Customer Segment and Carve-Out
Table I-7. PY8 Residential EE Program: Multifamily Targeted Customer Segment Summary Statistics by Customer Segment and Carve-Out
Table I-8. PY8 Low-Income EE Program Summary Statistics by Customer Segment and Carve-Out
Table I-9. PY8 Low-Income EE Program: Lighting Solution Customer Segment Summary Statistics by Customer Segment and Carve-Out
Table I-10. PY8 Low-Income EE Program: Whole Home Solution Summary Statistics by Customer Segment and Carve-Out
Table I-11. PY8 Small C&I EE Program Summary Statistics by Customer Segment and Carve-Out
Table I-12. PY8 Small C&I EE Program: Equipment and Systems Solution Summary Statistics by Customer Segment and Carve-Out
Table I-13. PY8 Small C&I EE Program: New Construction Solution Summary Statistics by Customer Segment and Carve-Out
Table I-14. PY8 Small C&I EE Program: Whole Building Solution Summary Statistics by Customer Segment and Carve-Out
Table I-15. PY8 Small C&I EE Program: Data Centers Targeted Market Segment Summary Statistics by Customer Segment and Carve-Out
Table I-16. PY8 Small C&I EE Program: Multifamily Targeted Customer Segment Summary Statistics by Customer Segment and Carve-Out
Table I-17. PY8 Large C&I EE Program Summary Statistics by Customer Segment and Carve-Out
Table I-18. PY8 Large C&I EE Program: Equipment and Systems Solution Summary Statistics by Customer Segment and Carve-Out
Table I-19. PY8 Large C&I EE Program: New Construction Solution Summary Statistics by Customer Segment and Carve-Out
Table I-20. PY8 Large C&I EE Program: Data Centers Targeted Market Segment Summary Statistics by Customer Segment and Carve-Out
Table I-21. PY8 Large C&I EE Program: Multifamily Targeted Customer Segment Summary Statistics by Customer Segment and Carve-Out