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November 15, 2021

**Via E-Filing**

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 Final Annual Report for June 1, 2020  
through May 31, 2021**

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 Final Annual Energy Efficiency & Conservation Report for the period June 1, 2020 through May 31, 2021.

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.

Due to the ongoing COVID-19 pandemic, PECO's office personnel are working remotely. Accordingly, PECO will not have its usual access to photocopying and U.S. mail, among other services. PECO requests that all communications with PECO be transmitted by email.

Thank you for your assistance in this matter and please direct any questions regarding the above to Richard Schlesinger, Manager, Retail Rates at (215) 841-5771 or via email: rich.schlesinger@peco-energy.com.

Sincerely,



cc: K. G. Sophy, 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



# **Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129**

**Program Year 12  
(June 1, 2020 – May 31, 2021)**

**For Pennsylvania Act 129 of 2008  
Energy Efficiency and Conservation Plan**

**Prepared for:**



An Exelon Company

**Submitted by:**

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November 15, 2021

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This deliverable was prepared by Guidehouse Inc. for the sole use and benefit of, and pursuant to a client relationship exclusively with PECO ("Client"). The work presented in this deliverable represents Guidehouse's professional judgement based on the information available at the time this report was prepared. Guidehouse is not responsible for a third party's use of, or reliance upon, the deliverable, nor any decisions based on the report. Readers of the report are advised that they assume all liabilities incurred by them, or third parties, as a result of their reliance on the report, or the data, information, findings and opinions contained in the report.

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## Acronyms

AC	Air Conditioner
ASHP	Air Source Heat Pump
C&I	Commercial and Industrial
CACS	Central Air Conditioner Switch
CADR	Clean Air Delivery Rate
CAP	Customer Assistance Program
CF	Coincidence Factor
CFL	Compact Fluorescent Lamp
CHP	Combined Heat and Power
CI	Confidence Interval
CO	Carryover
CSP	Conservation Service Provider, 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	Energy Efficiency
EE&C	Energy Efficiency and Conservation
EEMF	Energy Efficiency Marketing Firm
EISA	Energy Independence and Security Act of 2007
EM&V	Evaluation, Measurement, and Verification
EPA	U.S. Environmental Protection Agency
EUL	Effective Useful Life
FPL	Federal Poverty Level
G/E/NP	Government, Education, and Nonprofit
HER	Home Energy Report
HERS	Home Energy Rating System
HIM	High Impact Measure
HOU	Hours of Use
HSPF	Heating Seasonal Performance Factor
HVAC	Heating, Ventilation, and Air Conditioning
ICSP	Implementation Conservation Service Provider
IMEF	Integrated Modified Energy Factor
IMP	Interim Measure Protocols
KFVSD	Kitchen Fan Variable Speed Drive
kW	Kilowatt
kWh	Kilowatt-Hour



L	Liter
LAH	Lighting, Appliances, and HVAC
LDV	Lagged Dependent Variable
LED	Light-Emitting Diode
LIURP	Low-Income Usage Reduction Program
M&V	Measurement and Verification
MMBtu	Million British Thermal Units
MSRP	Manufacturer Suggested Retail Price
MW	Megawatt
MWh	Megawatt-Hour
MWh/yr	Megawatt-Hour per Year
NPV	Net Present Value
NTG	Net-to-Gross
O&M	Operations and Maintenance
P3TD	Phase III to Date
PA PUC	Pennsylvania Public Utility Commission
PILD	PECO Instant Lighting Discounts
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
PYTD	Program Year to Date
PYVTD	Program Year Verified to Date
QC	Quality Control
RCT	Randomized Control Trial
RCx	Retrocommissioning
RTD	Phase III to Date Reported Gross Savings
RTO	Regional Transmission Organization
RUL	Remaining Useful Lifetime
SEER	Seasonal Energy Efficiency Ratio
SF	Single-Family
SIDS	Smart Ideas Data System
SKU	Stock Keeping Unit
SSMVP	Site-Specific Measurement and Verification Plan
SWE	Statewide Evaluator
T&D	Transmission and Distribution
TRC	Total Resource Cost
TRM	Technical Reference Manual
UEC	Unit Energy Consumption

VFD	Variable Frequency Drive
VTD	Phase III to Date Verified Gross Savings
VTD+CO	Phase III to Date Verified Gross Savings plus Carryover from Phase II
W	Watt

## Types of Savings

**Gross Savings:** The change in energy consumption and 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 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 change 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 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/yr or MW/yr. 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. Program year to date (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).
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.

Per guidance from the Pennsylvania Statewide Evaluator (SWE), all demand savings that were achieved from energy efficiency measures are shown in this report without line losses (i.e., at the meter). All demand savings that were achieved from demand response (DR) measures are shown in this report with line losses (i.e., at the generator).

***Note that all values in the report are summed prior to rounding. Therefore, table totals may not equal the sum of all rows.***

# 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 (2008-2013). 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<sup>1</sup> 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 PA 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 12 (PY12), as well as the cumulative accomplishments of the Phase III programs since inception. This report also 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 PY12.<sup>2</sup> Compliance with Act 129 savings goals is ultimately based on verified gross savings. This report also includes estimates of cost-effectiveness according to the total resource cost (TRC) test.<sup>3</sup> PECO has retained Guidehouse Inc. (Guidehouse)<sup>4</sup> as an independent evaluation contractor for Phase III of Act 129. Guidehouse is responsible for the measurement and verification (M&V) of the savings and the calculation of gross verified and net verified savings.

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 program year. Because the DR season is completed early in the program year, it is possible to complete the independent evaluation of verified gross savings for DR sooner than for the EE programs. PECO reported the verified gross DR impacts for PY12 and the cumulative DR performance of the EE&C program to date for Phase III of Act 129 in the *Semiannual Report to the Pennsylvania Public Utility Commission*<sup>5</sup> filed March 15, 2021. Section 3.6 of this report includes PECO's previously reported DR performance results for PY12.

Guidehouse worked with the Statewide Evaluator (SWE) throughout the report's development to address questions related to compliance as they arose, and it appreciates the SWE's collaboration to confirm this final report is accurate and agreeable to relevant parties.

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<sup>1</sup> PECO. *PECO Program Years 2016-2020 Act 129 – Phase III Energy Efficiency and Conservation Plan*. Revised March 31, 2016. <https://www.puc.pa.gov/pcdocs/1444592.pdf>.

<sup>2</sup> In alignment with the PY12 evaluation plan, Guidehouse did not perform process evaluation activities in PY12.

<sup>3</sup> 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 was later 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.

<sup>4</sup> On October 11, 2019, Guidehouse LLP completed its acquisition of Navigant Consulting, Inc. and its operating subsidiaries. For more information, see: <https://guidehouse.com/news/corporate-news/2019/guidehouse-completes-acquisition-of-navigant>.

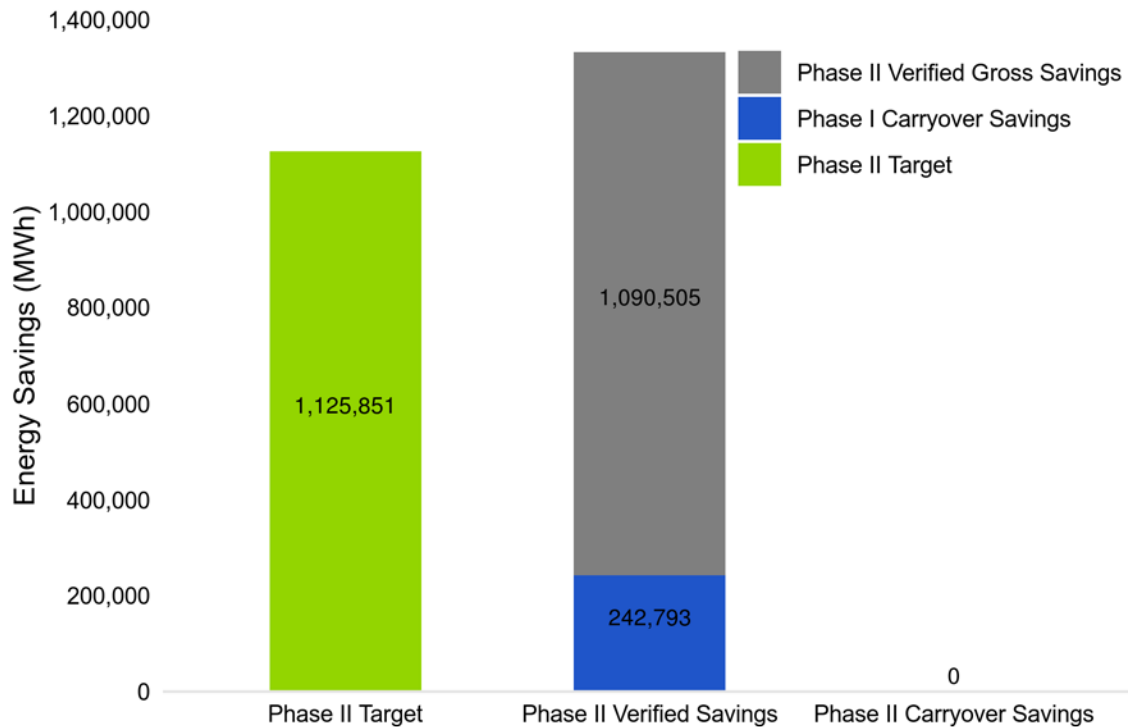
<sup>5</sup> PECO. *Semiannual Report to the Pennsylvania Public Utility Commission*. July 15, 2021. <http://www.puc.pa.gov/pcdocs/1670274.pdf>.

## 2. Summary of Achievements

### 2.1 The Carryover Savings from Phase II of Act 129

PECO reported 0 MWh/yr of portfolio-level carryover savings from Phase II to Phase III. The PA PUC’s Phase III Implementation Order<sup>6</sup> 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 the 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, it was not eligible to carry over savings from Phase II toward its Phase III overall compliance target.<sup>7</sup>

**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 PA PUC’s Phase III Implementation Order<sup>8</sup> also allowed EDCs to carry over savings in excess of the Phase II Government, Education, and Nonprofit (G/E/NP) savings goal and excess savings from the Low-Income customer segment.<sup>9</sup> PECO carried over 0 MWh/yr of

<sup>6</sup> PA PUC. *Energy Efficiency and Conservation Program Implementation Order* at Docket No. M-2014-2424864 (*Phase III Implementation Order*). Entered June 11, 2015.

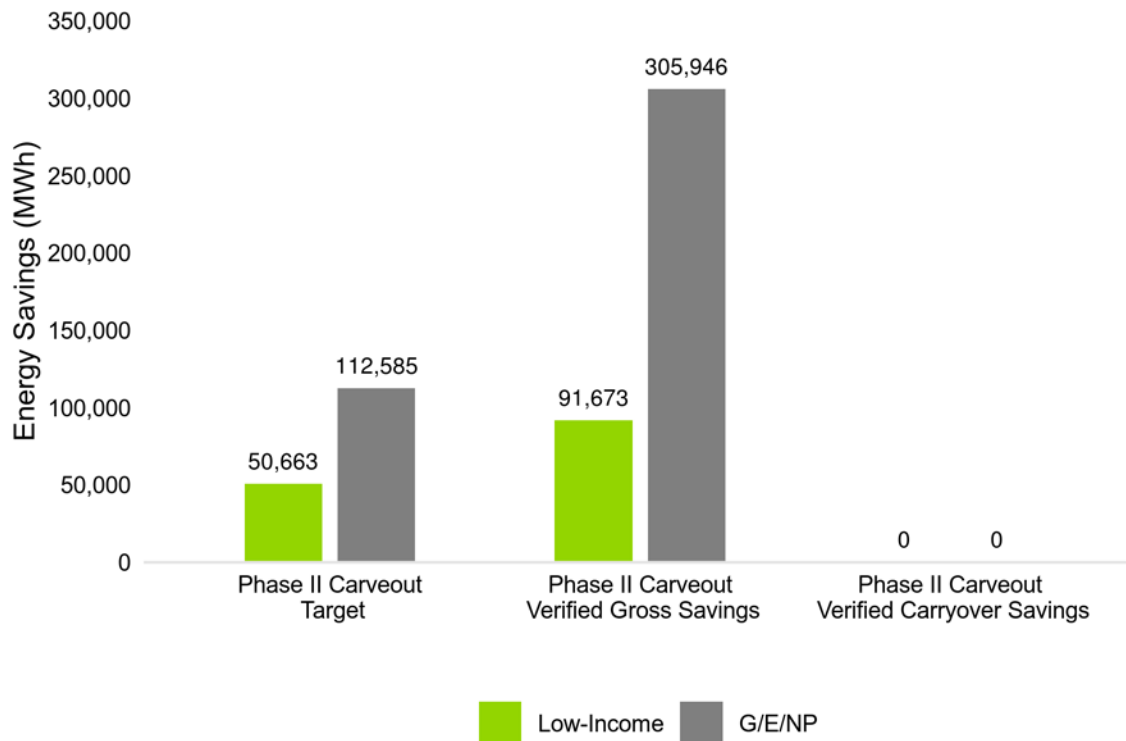
<sup>7</sup> PA PUC. *Energy Efficiency and Conservation Program Compliance Order* at Docket No. M-2012-2289411 (*Phase II Compliance Determination Order*). Entered August 3, 2017.

<sup>8</sup> PA PUC. *Energy Efficiency and Conservation Program Implementation Order* at Docket No. M-2014-2424864 (*Phase III Implementation Order*). Entered June 11, 2015.

<sup>9</sup> Proportionate to those savings achieved by dedicated low-income programs in Phase III.

G/E/NP and 0 MWh/yr of Low-Income customer segment savings.<sup>10</sup> Figure 2-2 shows the calculation of carryover savings for the Low-Income and G/E/NP targets.<sup>11</sup>

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



Source: Guidehouse analysis

## 2.2 Phase III EE Achievements to Date

In PY12, starting June 1, 2020 and ending May 31, 2021, PECO has claimed the following savings:

- 614,060 MWh/yr of reported gross electric energy savings in the program year reported to date (PYRTD)
- 72.14 MW of reported gross peak demand savings (PYRTD) from EE programs
- 558,735 MWh/yr of verified gross electric energy savings in the program year verified to date (PYVTD)
- 84.45 MW of verified gross peak demand savings (PYVTD) from EE programs

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

<sup>10</sup> 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.

<sup>11</sup> Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program Compliance Order*.

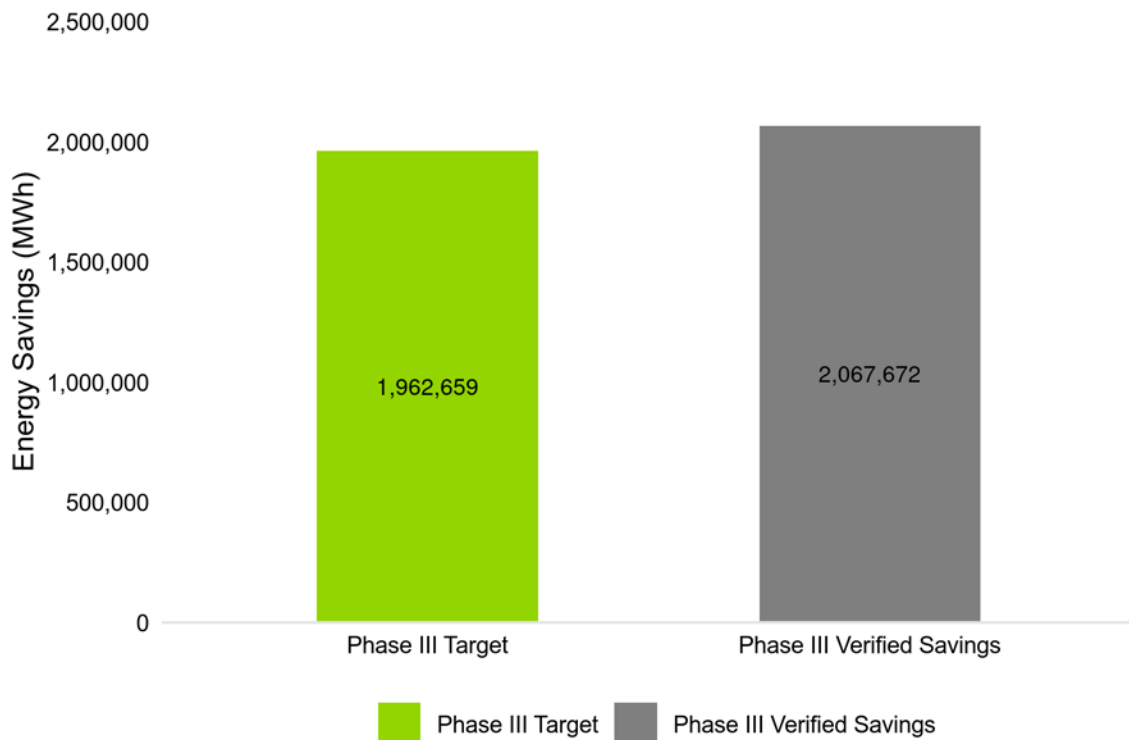
- 2,134,509 MWh/yr of reported gross electric energy savings for Phase III to date reported (RTD)
- 238.78 MW of reported gross peak demand savings (RTD) from EE programs
- 2,067,672 MWh/yr of verified gross electric energy savings for Phase III to date verified gross savings (VTD)
- 290.20 of verified gross peak demand savings (VTD) from EE programs

Including carryover savings from Phase II, PECO has achieved 2,067,672 MWh/yr of VTD plus portfolio-level carryover (CO) energy savings. This represents 105.4% of the May 31, 2021 energy savings compliance target of 1,962,659 MWh/yr.

Looking ahead to Phase IV, with 2,067,672 MWh/yr of VTD energy savings achieved during Phase III, PECO has achieved an estimated 104,953 MWh/yr of carryover energy savings from Phase III to Phase IV. This represents 6.5% of the Phase IV portfolio savings target of 1,605,958 MWh/yr.

Figure 2-3 summarizes PECO’s progress toward the Phase III portfolio compliance target.

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



Source: Guidehouse analysis

The Phase III Implementation Order<sup>12</sup> 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%.

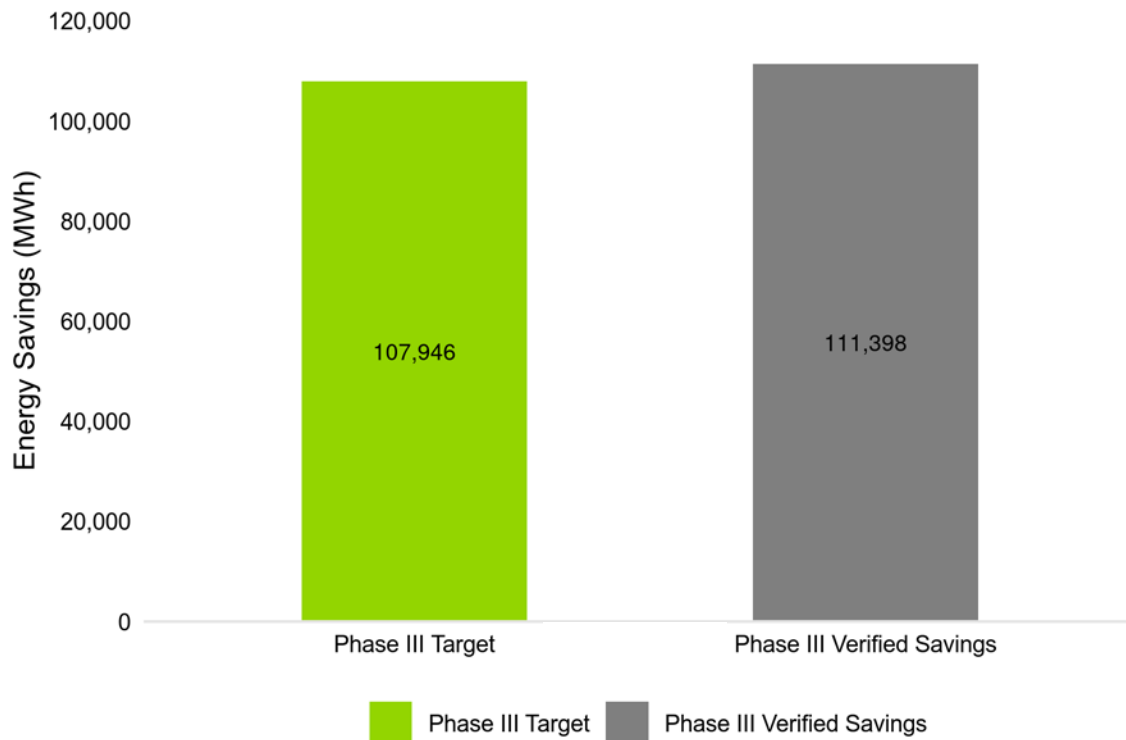
<sup>12</sup> PA PUC. *Energy Efficiency and Conservation Program Implementation Order* at Docket No. M-2014-2424864 (*Phase III Implementation Order*). Entered June 11, 2015.

PECO offers 269 EE&C measures to its Residential and Nonresidential customer classes. Of the 269 measures, 117 are available to the Low-Income customer segment at no cost to the customer. This number represents 43.5% of the total measures offered in the EE&C Plan<sup>13</sup> 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 verified gross low-income savings target for PECO is 107,946 MWh/yr. 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 103.2% of the Phase III low-income energy savings target.

Looking ahead to Phase IV, with 111,398 MWh/yr of VTD low-income energy savings achieved during Phase III, PECO has achieved an estimated 3,452 MWh/yr of low-income carryover energy savings from Phase III to Phase IV. This represents 4.0% of the Phase IV low-income carveout savings target of 85,692 MWh/yr.

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



Source: Guidehouse analysis

The Phase III Implementation Order<sup>14</sup> established a G/E/NP energy savings target of 3.5% of the portfolio savings goal. The verified gross G/E/NP savings target for PECO is 68,693 MWh/yr. Figure 2-5 compares the VTD performance for the G/E/NP customer segment

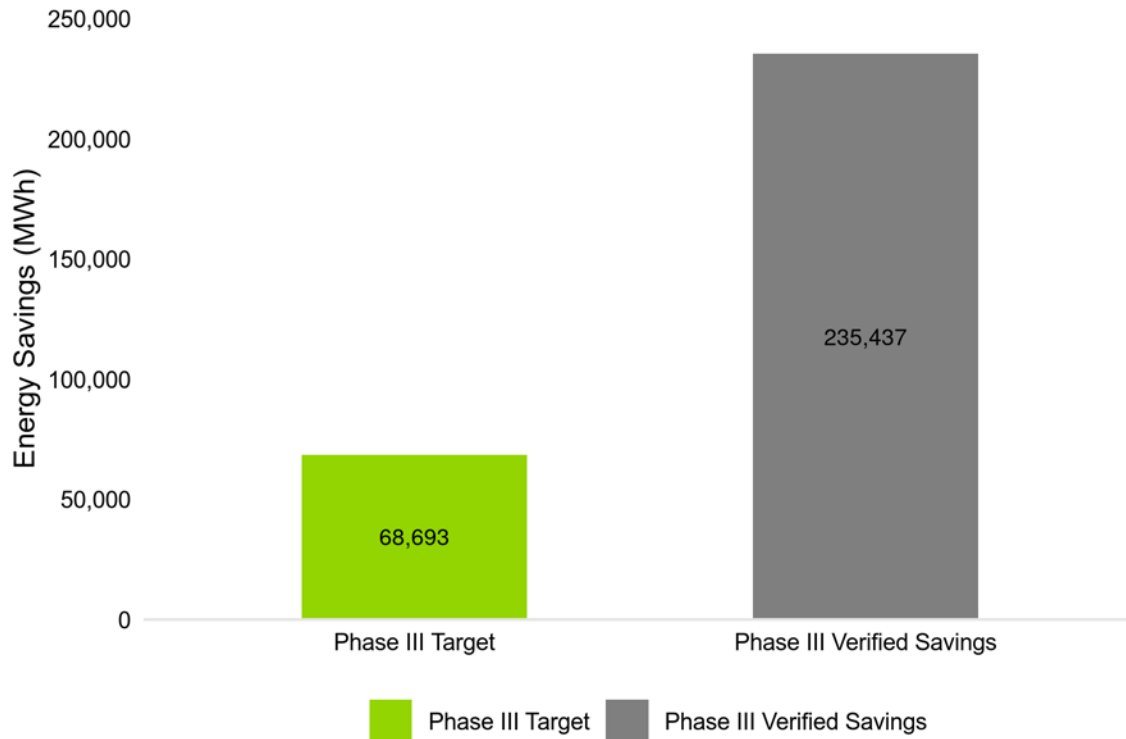
<sup>13</sup> PECO. *PECO Program Years 2016-2020 Act 129 – Phase III Energy Efficiency and Conservation Plan*. Revised March 31, 2016. <https://www.puc.pa.gov/pcdocs/1444592.pdf>.

<sup>14</sup> PA PUC. *Energy Efficiency and Conservation Program Implementation Order* at Docket No. M-2014-2424864 (*Phase III Implementation Order*). Entered June 11, 2015.



to the Phase III savings target. Based on the latest available information, PECO has achieved 342.7% 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: Guidehouse 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 (T&D) losses.

The EDCs were not required to obtain peak demand reductions in the first program year of Phase III (PY8), and DR programs were deemed voluntary by the PA PUC in PY12 due to the COVID-19 pandemic.<sup>15</sup>

<sup>15</sup> The PA PUC granted the Energy Association of Pennsylvania’s (EAP) petition to modify compliance with peak demand reduction targets because of the COVID-19 pandemic. The EAP requested that the PA PUC modify the Phase III Implementation Order to measure compliance with peak DR targets based on EDC performance during the second, third, and fourth program years of Phase III (June 1, 2017 through May 31, 2020), and permit EDCs to implement approved DR programs on a voluntary basis for the fifth and final program year (June 1, 2020 through May 31, 2021). EAP sought expedited consideration of this petition.

See *Petition to Amend the Commission’s June 19, 2015 Implementation Order* at Docket No. M-2014-2424864, (Phase III Implementation Order) Phase III Modification Order entered June 3, 2020.

<http://www.puc.pa.gov/pcdocs/1665150.docx>.

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.

In PY12, PECO called five DR events in the summer of 2020: July 20, July 27, July 29, August 25, and August 27. The average performance for all events to date is presented in Table 2-1. The full methodology is available in the standalone PY12 DR report, submitted to the SWE on March 15, 2021.<sup>16</sup> Given that the PY12 DR season was voluntary,<sup>17</sup> PECO achieved its Phase III DR requirements with the PY9 through PY11 events. Additionally, PECO voluntarily implemented PY12 DR activities.

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<sup>16</sup> PECO. *Annual Report to the Pennsylvania Public Utility Commission Demand Response Performance Report Only*. January 15, 2020. <https://www.peco.com/SiteCollectionDocuments/PhaseIIIECPsemiannualreportDRs.pdf>.

<sup>17</sup> PY12 DR is voluntary: PA PUC. *Petition to Amend the Commission's June 19, 2015 Implementation Order. M-2014-2424864*. May 21, 2020. <https://www.puc.pa.gov/pcdocs/1665150.docx>.

**Table 2-1. Phase III to Date (P3TD) DR Performance by Event**

PY	Event Date	Residential DR (MW)	Small C&I DR (MW)	Large C&I DR (MW)	Portfolio (MW)	Relative Precision at 90% Confidence
PY9	June 13, 2017	39.53	0.00	127.97	167.50	10.9%
PY9	July 20, 2017	33.48	0.00	121.89	155.37	11.0%
PY9	July 21, 2017	23.34	0.00	140.83	164.17	10.3%
PY10	July 2, 2018	38.93	0.00	149.25	188.18	10.2%
PY10	July 3, 2018	33.84	0.00	144.67	178.51	10.7%
PY10	August 6, 2018	25.07	1.15	175.12	201.34	10.6%
PY10	August 28, 2018	30.69	0.92	159.52	191.12	11.3%
PY10	September 4, 2018	29.99	0.77	137.79	168.55	11.4%
PY10	September 5, 2018	29.52	0.84	129.54	159.91	11.9%
PY11	July 17, 2019	34.36	0.86	120.04	155.26	6.1%
PY11	July 18, 2019	11.06	1.02	121.63	133.71	5.9%
PY11	July 19, 2019	34.93	1.18	120.89	157.00	5.8%
PY11	August 19, 2019	24.90	0.98	126.17	152.05	5.6%
PY12	July 20, 2020	30.24	1.08	147.31	178.63	7.5%
PY12	July 27, 2020	28.58	0.66	139.01	168.25	8.2%
PY12	July 29, 2020	27.48	0.46	150.48	178.42	6.7%
PY12	August 25, 2020	23.07	0.90	117.09	141.06	8.4%
PY12	August 27, 2020	25.82	0.33	110.17	136.32	9.2%
<b>PYVTD – Average PY12 DR Event Performance</b>		<b>27.04</b>	<b>0.69</b>	<b>132.81</b>	<b>160.54</b>	<b>7.9%</b>
<b>VTD<sup>18</sup> – Average Phase III DR Event Performance</b>		<b>29.16</b>	<b>0.62</b>	<b>135.52</b>	<b>165.30</b>	<b>9.5%</b>
<b>Compliance Value (PY9-PY11) – Average Performance</b>		<b>29.97</b>	<b>0.59</b>	<b>136.56</b>	<b>167.13</b>	<b>10.0%</b>

Note: VTD impacts are based on an average of all events and not an average of program years.

C&I = Commercial and Industrial

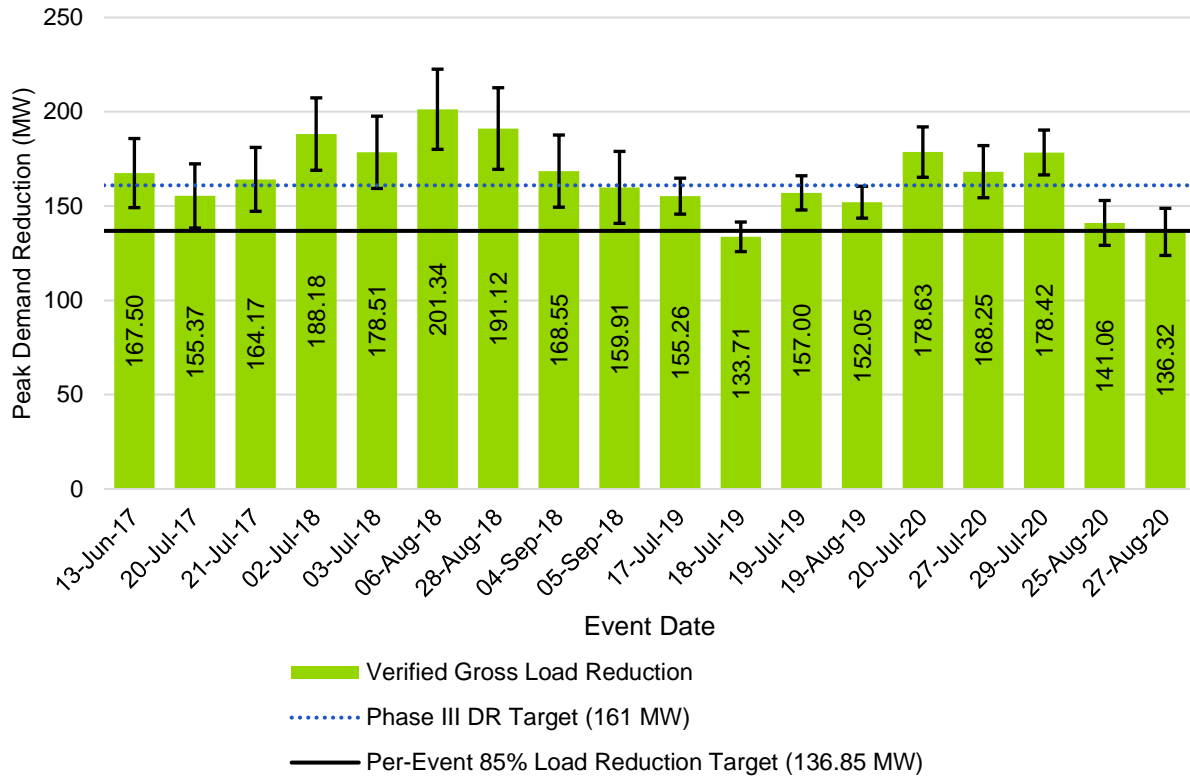
Source: Guidehouse analysis

The PA PUC's Phase III Implementation Order<sup>19</sup> also established a requirement that EDCs achieve at least 85% of the Phase III compliance reduction target in each DR event. For PECO, this translates to a 136.85 MW minimum for each DR event. Figure 2-6 compares the performance of each of the DR events in PY12 to the event-specific minimum and average targets. PY12 DR programs were voluntary, so the comparison of per-event performance to the 85% target is strictly informational.

<sup>18</sup> VTD DR impacts are the average performance across all Phase III DR event hours. This is inclusive of PY12, which was voluntary and did not count toward Phase III compliance.

<sup>19</sup> PA PUC. *Energy Efficiency and Conservation Program Implementation Order* at Docket No. M-2014-2424864 (*Phase III Implementation Order*). Entered June 11, 2015.

**Figure 2-6. Event Performance Compared to 85% Per-Event Target**



Source: Guidehouse analysis

## 2.4 Phase III Performance by Customer Segment

Table 2-2 through Table 2-5 present the participation, savings, and spending results by customer sector for PY12 and Phase III. The Residential, Small C&I, and Large C&I sectors (also referred to as customer segments or rate classes) are defined by PECO tariff. The Residential Low-Income and G/E/NP customer segments (Table 2-4 and Table 2-5) are 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 and Large C&I sectors. The G/E/NP segment is a subset of the Small and Large C&I sectors.

Table 2-2 provides the PY12 participation counts and spending totals for PECO's programs for the three sectors (Residential, Small C&I, and Large C&I) inclusive of all Low-Income and G/E/NP segments.

**Table 2-2. PY12 Summary Statistics by Customer Sector**

Parameter	Residential	Small C&I	Large C&I	Total
No. of Participants	1,270,545	5,991	2,608	<b>1,279,144</b>
PY12 Energy Realization Rate	0.93	1.01	0.87	<b>0.91</b>
PYVTD MWh/yr	191,628	88,029	279,078	<b>558,735</b>
PY12 Demand Realization Rate	1.39	1.04	1.11	<b>1.17</b>
PYVTD MW (EE)	25.03	12.76	46.66	<b>84.45</b>
PYVTD MW (DR)	26.31	1.01	122.18	<b>149.50</b>
Incentives (\$1,000)	\$11,410	\$4,233	\$7,123	<b>\$22,767</b>

Source: Guidehouse analysis

Table 2-3 provides the P3TD participation counts and spending totals for PECO's programs for the three sectors (Residential, Small C&I, and Large C&I) inclusive of all Low-Income and G/E/NP segments.

**Table 2-3. Phase III Summary Statistics by Customer Sector**

Parameter	Residential	Small C&I	Large C&I	Total
No. of Participants	5,714,910	14,888	6,556	<b>5,736,354</b>
P3TD Energy Realization Rate	0.97	1.05	0.94	<b>0.97</b>
VTD MWh/yr	1,146,283	297,000	624,389	<b>2,067,672</b>
P3TD Demand Realization Rate	1.36	1.09	1.10	<b>1.22</b>
VTD MW (EE)	145.68	45.79	98.73	<b>290.20</b>
VTD MW (DR)	29.97	0.59	136.56	<b>167.13</b>
Incentives (\$1,000)	\$42,179	\$10,525	\$18,146	<b>\$70,851</b>

Source: Guidehouse analysis

Table 2-4 summarizes the savings, spending, and participation values for the Low-Income and G/E/NP customer segment carveouts only. PECO tracks activities for two Low-Income segments that contribute to the Low-Income carveout:

- PECO customers at 50% or below the federal poverty level (FPL)
- PECO customers at 51% to 150% of the FPL

The Low-Income totals correspond to achievements shown in Figure 2-4, and the G/E/NP totals correspond to achievements shown in Figure 2-5.

**Table 2-4. PY12 Summary Statistics by Carveout**

Parameter	Low-Income (0%-50% FPL)	Low-Income (51%-150% FPL)	Low-Income Total	G/E/NP Total
No. of Participants	1,493	6,640	<b>8,133</b>	<b>4,411</b>
PY12 Energy Realization Rate	0.77	0.74	<b>0.75</b>	<b>1.04</b>
PYVTD MWh/yr	1,810	13,030	<b>14,840</b>	<b>78,208</b>
Incentives (\$1,000)	\$0	\$172	<b>\$172</b>	<b>\$3,476</b>
Program (Non-Incentive) Costs (\$1,000)	\$561	\$7,236	<b>\$7,797</b>	<b>\$210</b>

Source: Guidehouse analysis

Table 2-5 summarizes the carveout performance since the beginning of Phase III.

**Table 2-5. Phase III Summary Statistics by Carveout**

Parameter	Low-Income (0%-50% FPL)	Low-Income (51%-150% FPL)	Low-Income Total	G/E/NP Total
No. of Participants	12,644	215,614	<b>228,258</b>	<b>9,812</b>
P3TD Energy Realization Rate	0.96	0.96	<b>0.96</b>	<b>1.01</b>
VTD MWh/yr	14,288	97,110	<b>111,398</b>	<b>235,437</b>
Incentives (\$1,000)	\$1	\$1,206	<b>\$1,207</b>	<b>\$9,303</b>
Program (Non-Incentive) Costs (\$1,000)	\$3,640	\$22,874	<b>\$26,514</b>	<b>\$406</b>

Source: Guidehouse analysis

## 2.5 Summary of Participation by Program

Participation is defined differently for each program and solution depending on the program delivery channel and data tracking practices. Appendix E includes an overview of the different participation definitions for each solution, and Table 2-6 provides the current participation totals by program and solution for PY12 and for P3TD.

**Table 2-6. EE&C Portfolio Participation by Program and Solution**

Program and Solution	PY12 Participation	P3TD Participation
Lighting, Appliances & HVAC (LAH)	828,966	4,829,891
Appliance Recycling	11,113	70,377
Whole Home	3,415	22,573
New Construction	1,432	3,894
Behavioral <sup>[1]</sup>	361,748	466,381
Multifamily Targeted	5,568	34,327
<b>Residential EE Program</b>	<b>1,212,242</b>	<b>5,427,443</b>

Program and Solution	PY12 Participation	P3TD Participation
Whole Home	8,133	61,200
Lighting	0	167,058
<b>Low-Income EE Program</b>	<b>8,133</b>	<b>228,258</b>
Equipment and Systems	3,624	9,544
New Construction	64	280
Whole Building	163	1,130
Data Centers Targeted	0	2
Multifamily Targeted	93	542
<b>Small C&amp;I EE Program</b>	<b>3,944</b>	<b>11,498</b>
Equipment and Systems	1,945	5,375
New Construction	54	197
Data Centers Targeted	1	5
Multifamily Targeted	31	188
<b>Large C&amp;I EE Program</b>	<b>2,031</b>	<b>5,765</b>
<b>Combined Heat and Power (CHP) Program</b>	<b>2</b>	<b>8</b>
<b>Residential DR<sup>(1)</sup> Program</b>	<b>50,919</b>	<b>61,440</b>
<b>Small C&amp;I DR<sup>(1)</sup> Program</b>	<b>1,517</b>	<b>1,586</b>
<b>Large C&amp;I DR<sup>(1)</sup> Program</b>	<b>356</b>	<b>356</b>
<b>Portfolio Total</b>	<b>1,279,144</b>	<b>5,736,354</b>

<sup>(1)</sup> DR participation and Behavioral participation is not additive like other programs because the same participants tend to remain in the program with only small attrition. Therefore, total participation in the Behavioral and DR programs for Phase III is equal to the highest program year participation count for each of the programs.

Source: Guidehouse analysis

## 2.6 Summary of Impact Evaluation Results

During PY12, Guidehouse completed impact evaluations for all active EE programs and solutions in the PECO portfolio. Table 2-7 summarizes the realization rates and net-to-gross (NTG) ratios by program and solution.

**Table 2-7. Impact Evaluation Results Summary**

Program and Solution	Energy Realization Rate	Demand Realization Rate	NTG Ratio
LAH	0.96	0.98	0.53
Appliance Recycling	1.04	0.99	0.52
Whole Home	0.94	0.95	0.95
New Construction	0.91	0.94	0.92
Behavioral	0.92	Inf	1.00
Multifamily Targeted	0.96	0.94	0.92
<b>Residential EE Program</b>	<b>0.95</b>	<b>1.45</b>	<b>0.73</b>
Whole Home	0.75	0.76	1.00
<b>Low-Income EE Program</b>	<b>0.75</b>	<b>0.76</b>	<b>1.00</b>

Program and Solution	Energy Realization Rate	Demand Realization Rate	NTG Ratio
Equipment and Systems	1.03	1.07	0.78
New Construction	1.04	0.95	0.33
Whole Building	0.92	1.00	0.88
Data Centers Targeted	N/A	N/A	N/A
Multifamily Targeted	0.98	1.01	0.81
<b>Small C&amp;I EE Program</b>	<b>1.02</b>	<b>1.05</b>	<b>0.76</b>
Equipment and Systems	0.92	0.82	0.61
New Construction	1.36	1.45	0.48
Data Centers Targeted	0.60	0.61	0.67
Multifamily Targeted	0.99	0.95	0.81
<b>Large C&amp;I EE Program</b>	<b>0.96</b>	<b>0.85</b>	<b>0.60</b>
<b>CHP Program</b>	<b>0.82</b>	<b>1.95</b>	<b>0.87</b>
<b>Portfolio Total</b>	<b>0.91</b>	<b>1.17</b>	<b>0.76</b>

Note: For the Residential Behavioral Solution, the implementer does not report demand savings; however, the SWE requires PECO to verify demand savings. As a result, there is no demand realization rate for the Behavioral Solution. The verified demand savings do get added to the Residential EE Program savings. As a result, the demand realization rate for the Residential EE Program is greater than the demand realization rate for each individual solution in the program.

Source: Guidehouse analysis

Guidehouse did not conduct NTG research, including analysis of high impact measures (HIMs), in PY12. The evaluation team applied the PY11 NTG results to all solutions.

## 2.7 Summary of Energy Impacts by Program

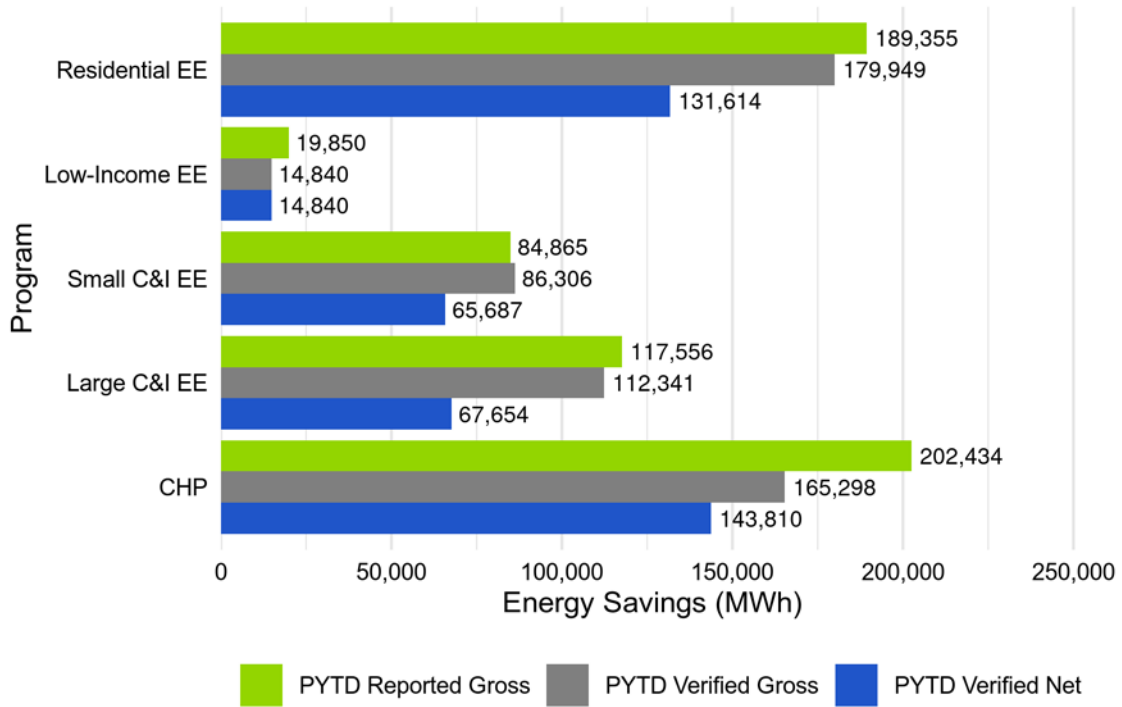
Act 129 compliance targets are based on annualized savings estimates (MWh/yr). Each program year the annual savings achieved by EE&C program activity are recorded as incremental annual—or first-year—savings and are added to EDCs' progress toward compliance. Incremental annual savings estimates are presented 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 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 2-7 summarizes the PYTD energy savings by program for PY12. The energy impacts in this report are presented at the meter level and do not reflect adjustments for T&D losses. The verified gross savings are adjusted by the energy realization rate, and the verified net savings are adjusted by both the realization rate and the NTG ratio.



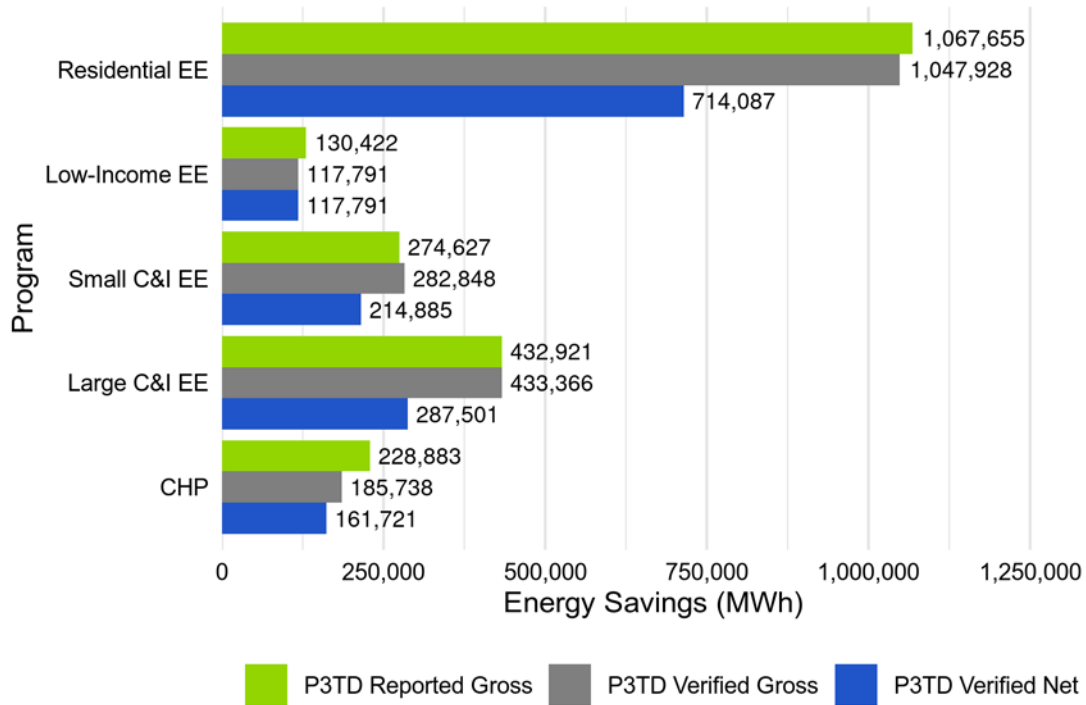
**Figure 2-7. PYTD Energy Savings by Program**



Source: Guidehouse analysis

Figure 2-8 summarizes the energy savings by program for Phase III of Act 129.

**Figure 2-8. P3TD Energy Savings by Program**



Source: Guidehouse analysis

Table 2-8 summarizes the energy impacts by program through PY12.

**Table 2-8. Incremental Annual Energy Savings by EE Program**

Program and Solution	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
LAH	94,008	90,573	48,302	576,661	580,390	291,551
Appliance Recycling	10,947	11,335	5,918	70,007	70,910	30,877
Whole Home	5,312	5,015	4,742	28,874	27,223	24,880
New Construction	1,833	1,669	1,535	7,988	7,590	6,504
Behavioral	74,135	68,367	68,367	368,250	346,330	346,330
Multifamily Targeted	3,120	2,991	2,749	15,875	15,486	13,944
<b>Residential EE Program</b>	<b>189,355</b>	<b>179,949</b>	<b>131,614</b>	<b>1,067,655</b>	<b>1,047,928</b>	<b>714,087</b>
Whole Home	19,850	14,840	14,840	121,336	108,710	108,710
Lighting	0	0	0	9,086	9,081	9,081
<b>Low-Income EE Program</b>	<b>19,850</b>	<b>14,840</b>	<b>14,840</b>	<b>130,422</b>	<b>117,791</b>	<b>117,791</b>
Equipment and Systems	66,003	68,051	52,770	205,132	215,369	165,544
New Construction	4,926	5,147	1,699	17,256	18,054	5,544
Whole Building	9,598	8,858	7,785	36,192	34,753	32,378

Program and Solution	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Data Centers Targeted	0	0	0	119	50	46
Multifamily Targeted	4,338	4,249	3,434	15,928	14,622	11,374
<b>Small C&amp;I EE Program</b>	<b>84,865</b>	<b>86,306</b>	<b>65,687</b>	<b>274,627</b>	<b>282,848</b>	<b>214,885</b>
Equipment and Systems	104,391	95,929	58,423	380,061	376,987	256,337
New Construction	9,015	12,288	5,898	35,955	39,670	18,389
Data Centers Targeted	10	6	4	556	535	422
Multifamily Targeted	4,140	4,119	3,328	16,349	16,175	12,353
<b>Large C&amp;I EE Program</b>	<b>117,556</b>	<b>112,341</b>	<b>67,654</b>	<b>432,921</b>	<b>433,366</b>	<b>287,501</b>
<b>CHP Program</b>	<b>202,434</b>	<b>165,298</b>	<b>143,810</b>	<b>228,883</b>	<b>185,738</b>	<b>161,721</b>
<b>Portfolio Total</b>	<b>614,060</b>	<b>558,735</b>	<b>423,606</b>	<b>2,134,509</b>	<b>2,067,672</b>	<b>1,495,985</b>

Source: Guidehouse analysis

The previously reported VTD savings from prior years have not changed since Guidehouse submitted the PY11 final annual report.<sup>20</sup>

## 2.7.2 Lifetime Energy Savings by Program

Table 2-9 presents the PYVTD and VTD lifetime energy savings by program. Lifetime energy savings are calculated by multiplying the annual energy savings by the EUL. Per the PA 2016 TRC Order,<sup>21</sup> 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 baseline equipment. After the RUL, savings relative to code equipment are used for the remainder of the efficient measure's EUL.

<sup>20</sup> PECO. *Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129*. November 15, 2019. <https://www.puc.pa.gov/pcdocs/1645979.pdf>.

<sup>21</sup> PA PUC. *2016 Total Resource Cost (TRC) Test Order* at Docket No. M-2015-2468992. Entered June 11, 2015. <https://www.puc.pa.gov/pcdocs/1367195.docx>.

**Table 2-9. Summary of Lifetime Energy Savings by EE Program**

Program	PYVTD Gross Lifetime Energy (MWh/yr)	PYVTD Net Lifetime Energy (MWh/yr)	VTD Gross Lifetime Energy (MWh/yr)	VTD Net Lifetime Energy (MWh/yr)
Residential EE	650,035	407,011	5,831,135	3,215,567
Low-Income EE	108,739	108,739	866,023	866,023
Small C&I EE	870,186	659,406	2,902,792	2,195,290
Large C&I EE	1,270,114	754,900	5,025,018	3,278,946
CHP	2,479,476	2,157,144	2,786,071	2,425,817
<b>Portfolio Total</b>	<b>5,378,550</b>	<b>4,087,200</b>	<b>17,411,039</b>	<b>11,981,643</b>

Source: Guidehouse analysis

## 2.8 Summary of Demand Impacts by Program

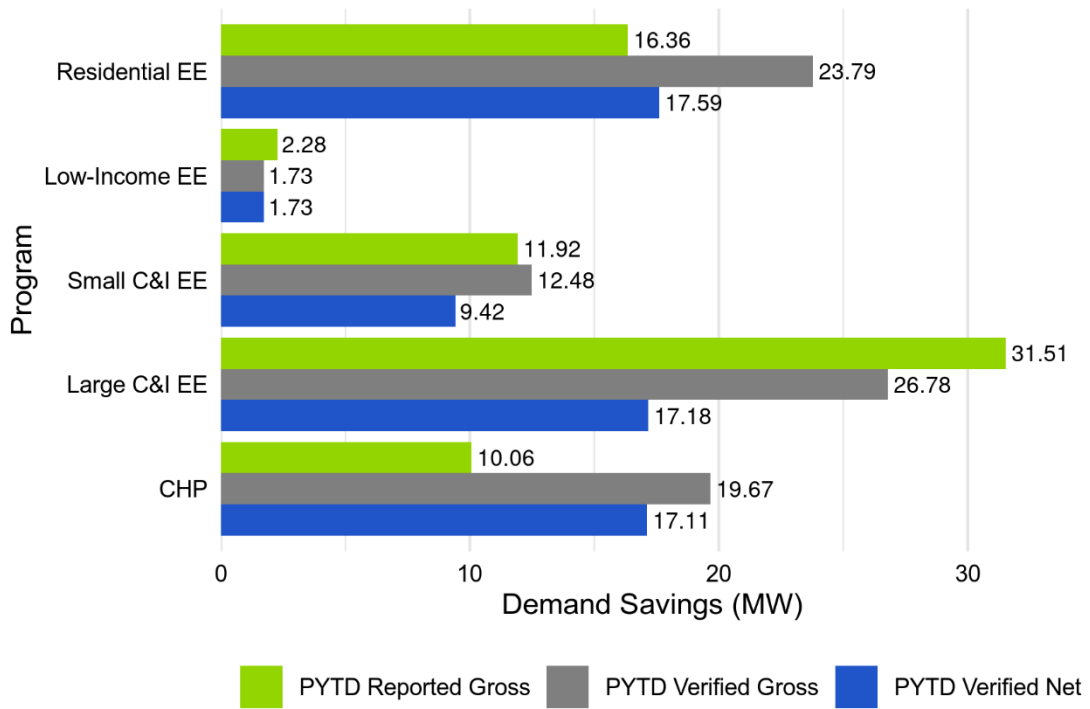
PECO’s Phase III EE&C programs achieve peak demand reductions in two primary ways. The first is through coincident reductions from EE measures, and the second is through dedicated DR offerings that exclusively target temporary demand reductions on peak days. EE reductions coincident with system peak hours are reported and used to calculate 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 program year. 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. The peak demand impacts from EE in this report are presented at the meter level and do not reflect adjustments for T&D losses. Figure 2-9 summarizes the PYTD demand savings by EE program for PY12.

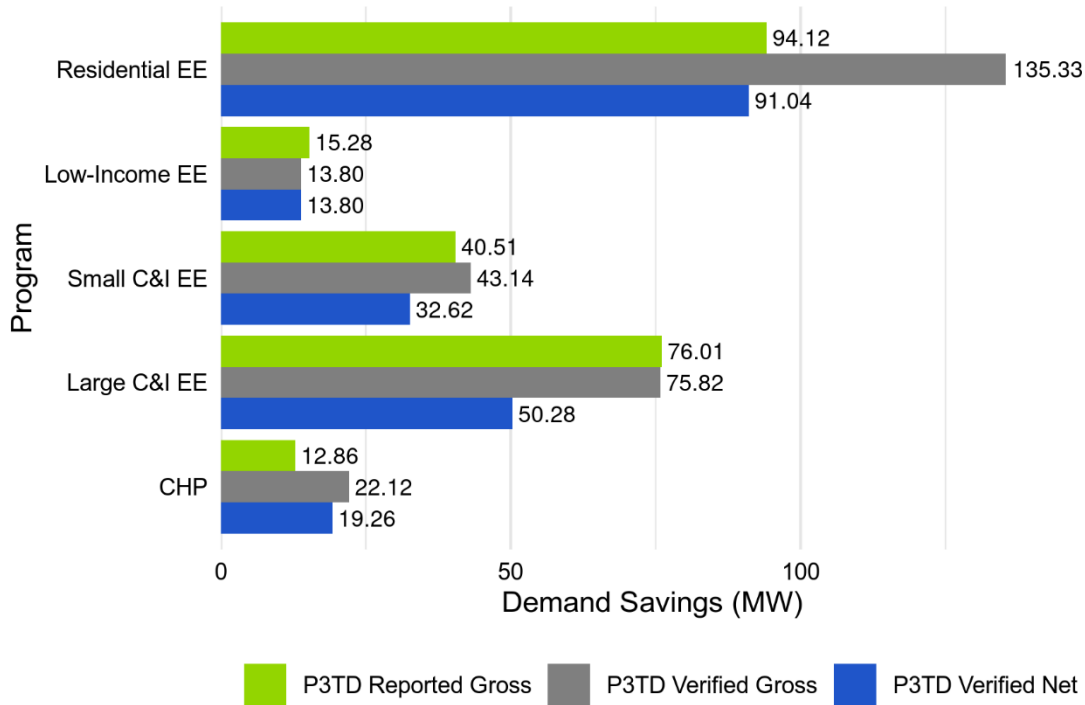
**Figure 2-9. PYTD Demand Savings by EE Program**



Source: Guidehouse analysis

Figure 2-10 summarizes the P3TD demand savings by EE program for Phase III of Act 129.

**Figure 2-10. P3TD Demand Savings by EE Program**



Source: Guidehouse analysis

A summary of the peak demand impacts by EE program through the current reporting period is presented in Table 2-10.

**Table 2-10. Summary of Demand Savings by EE Program**

Program and Solution	PYRTD (MW)	PYVTD Gross (MW)	PYVTD Net (MW)	RTD (MW)	VTD Gross (MW)	VTD Net (MW)
LAH	12.94	12.69	7.36	75.63	77.92	40.15
Appliance Recycling	1.49	1.48	0.75	10.06	9.91	4.19
Whole Home	0.71	0.67	0.64	3.56	3.36	3.09
New Construction	0.83	0.78	0.72	2.85	2.71	2.36
Behavioral	0.00	7.80	7.80	0.00	39.54	39.54
Multifamily Targeted	0.38	0.36	0.33	2.01	1.90	1.71
<b>Residential EE Program</b>	<b>16.36</b>	<b>23.79</b>	<b>17.59</b>	<b>94.12</b>	<b>135.33</b>	<b>91.04</b>
Whole Home	2.28	1.73	1.73	14.21	12.73	12.73
Lighting	0.00	0.00	0.00	1.07	1.07	1.07
<b>Low-Income EE Program</b>	<b>2.28</b>	<b>1.73</b>	<b>1.73</b>	<b>15.28</b>	<b>13.80</b>	<b>13.80</b>
Equipment and Systems	8.97	9.56	7.31	28.65	32.46	24.83
New Construction	0.83	0.79	0.26	3.06	3.01	0.93
Whole Building	1.79	1.79	1.57	7.26	6.25	5.77

Program and Solution	PYRTD (MW)	PYVTD Gross (MW)	PYVTD Net (MW)	RTD (MW)	VTD Gross (MW)	VTD Net (MW)
Data Centers Targeted	0.00	0.00	0.00	0.02	0.01	0.01
Multifamily Targeted	0.34	0.34	0.28	1.52	1.41	1.09
<b>Small C&amp;I EE Program</b>	<b>11.92</b>	<b>12.48</b>	<b>9.42</b>	<b>40.51</b>	<b>43.14</b>	<b>32.62</b>
Equipment and Systems	29.46	24.06	15.70	69.06	66.78	45.52
New Construction	1.53	2.22	1.07	4.87	7.04	3.24
Data Centers Targeted	0.00	0.00	0.00	0.04	0.04	0.03
Multifamily Targeted	0.53	0.50	0.40	2.05	1.97	1.50
<b>Large C&amp;I EE Program</b>	<b>31.51</b>	<b>26.78</b>	<b>17.18</b>	<b>76.01</b>	<b>75.82</b>	<b>50.28</b>
<b>CHP Program</b>	<b>10.06</b>	<b>19.67</b>	<b>17.11</b>	<b>12.86</b>	<b>22.12</b>	<b>19.26</b>
<b>Portfolio Total</b>	<b>72.14</b>	<b>84.45</b>	<b>63.04</b>	<b>238.78</b>	<b>290.20</b>	<b>207.00</b>

Source: Guidehouse analysis

The previously reported VTD demand savings from prior years have not changed since Guidehouse submitted the PY11 Annual Report.<sup>22</sup>

## 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:<sup>23</sup>

- 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 forecast peak hour(s) above 96% of the PJM RTO summer peak demand forecast.
- Once six curtailment events have been called in a program year, the peak demand reduction program shall be suspended for that program year.

Phase III DR programs began operating in PY9; therefore, no DR program savings were reported for PY8. Starting in PY9, the peak demand impacts from DR are presented at the

<sup>22</sup> PECO. *Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129*. February 15, 2021. <https://www.puc.pa.gov/pcdocs/1695779.pdf>.

<sup>23</sup> PA PUC. *Energy Efficiency and Conservation Program Implementation Order* at Docket No. M-2014-2424864 (*Phase III Implementation Order*). Entered June 11, 2015.

system level and reflect adjustments to account for T&D losses. PECO uses the following line loss percentages/multipliers by sector:<sup>24</sup>

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

PECO voluntarily implemented PY12 DR activities per PA PUC.<sup>25</sup> In PY12, PECO operated all DR programs as normal, except for event start time and duration for the Air Conditioning (AC) Saver program. AC saver curtailment events were shortened to 2 hours and were started 1 hour after the Large C&I events.

Table 2-11 (also shown as Table 2-1) summarizes the demand reductions for each of the DR programs in PECO's EE&C Plan<sup>26</sup> and for the DR portfolio. Verified gross demand savings are the average performance across all Phase III DR events independent of how many events occurred in a given program year. The P3TD – Average Phase III DR Event Performance row is calculated as an average of all events to date, so years with more or fewer events will not be weighted disproportionately.

**Table 2-11. Summary of Demand Savings for DR Programs by Customer Segment and Event**

PY	Event Date	Residential DR (MW)	Small C&I DR (MW)	Large C&I DR (MW)	Portfolio (MW)	Relative Precision at 90% Confidence
PY9	June 13, 2017	39.53	0.00	127.97	167.50	10.9%
PY9	July 20, 2017	33.48	0.00	121.89	155.37	11.0%
PY9	July 21, 2017	23.34	0.00	140.83	164.17	10.3%
PY10	July 2, 2018	38.93	0.00	149.25	188.18	10.2%
PY10	July 3, 2018	33.84	0.00	144.67	178.51	10.7%
PY10	August 6, 2018	25.07	1.15	175.12	201.34	10.6%
PY10	August 28, 2018	30.69	0.92	159.52	191.12	11.3%
PY10	September 4, 2018	29.99	0.77	137.79	168.55	11.4%
PY10	September 5, 2018	29.52	0.84	129.54	159.91	11.9%
PY11	July 17, 2019	34.36	0.86	120.04	155.26	6.1%
PY11	July 18, 2019	11.06	1.02	121.63	133.71	5.9%
PY11	July 19, 2019	34.93	1.18	120.89	157.00	5.8%
PY11	August 19, 2019	24.90	0.98	126.17	152.05	5.6%
PY12	July 20, 2020	30.24	1.08	147.31	178.63	7.5%
PY12	July 27, 2020	28.58	0.66	139.01	168.25	8.2%

<sup>24</sup> PA PUC. "Section 1.14 Transmission and Distribution System Losses." *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.

<sup>25</sup> Petition to Amend the Commission's June 19, 2015 Implementation Order. M-2014-2424864. May 21, 2020. <https://www.puc.pa.gov/pcdocs/1665150.docx>.

<sup>26</sup> PECO. *PECO Program Years 2016-2020 Act 129 – Phase III Energy Efficiency and Conservation Plan*. Revised March 31, 2016. <https://www.puc.pa.gov/pcdocs/1444592.pdf>.



PY	Event Date	Residential DR (MW)	Small C&I DR (MW)	Large C&I DR (MW)	Portfolio (MW)	Relative Precision at 90% Confidence
PY12	July 29, 2020	27.48	0.46	150.48	178.42	6.7%
PY12	August 25, 2020	23.07	0.90	117.09	141.06	8.4%
PY12	August 27, 2020	25.82	0.33	110.17	136.32	9.2%
<b>PYVTD – Average PY12 DR Event Performance</b>		<b>27.04</b>	<b>0.69</b>	<b>132.81</b>	<b>160.54</b>	<b>7.9%</b>
<b>VTD<sup>27</sup> – Average Phase III DR Event Performance</b>		<b>29.16</b>	<b>0.62</b>	<b>135.52</b>	<b>165.30</b>	<b>9.5%</b>
<b>Compliance Value (PY9-PY11) – Average Performance</b>		<b>29.97</b>	<b>0.59</b>	<b>136.56</b>	<b>167.13</b>	<b>10.0%</b>

Note: P3TD impacts are based on an average of all events and not an average of program years.

Source: Guidehouse analysis

## 2.9 Summary of Fuel Switching Impacts

Act 129 allows EDCs to achieve electric savings by converting electric equipment to non-electric equipment. Table 2-12 lists the fuel switching measures offered in Phase III while Table 2-13 provides the key fuel switching metrics in PY12 and to date in Phase III.

**Table 2-12. List of Fuel Switching Measures**

### Fuel Switching Measures Implemented in PY12

Electric clothes dryer to ENERGY STAR® gas clothes dryer
Electric range to gas range
Electric baseboard to ENERGY STAR® fossil fuel furnace
Electric furnace to ENERGY STAR® fossil fuel furnace
Electric water heater to ENERGY STAR® gas water heater
CHP

Source: Guidehouse analysis

**Table 2-13. Summary of Fuel Switching Measure Portfolio Impacts**

Parameter	PYVTD	VTD
Total No. of Measures Offered	9	9
Total No. of Units Implemented	411	1,285
Gross Energy Savings via Fuel Switching (MWh/yr)	165,957	188,281
Fossil Fuel Consumption Change (MMBtu/yr)	521,309	712,364
P3TD Incentive Spending (\$1,000)	\$2,128.72	\$3,523.01

Source: Guidehouse analysis

<sup>27</sup> VTD demand response impacts are the average performance across all Phase III demand response event hours. This is inclusive of PY12, which was voluntary and did not count toward Phase III compliance.

## 2.10 Summary of Cost-Effectiveness Results

A detailed breakdown of portfolio finances and cost-effectiveness is presented in Table 2-14. The TRC benefits in Table 2-14 are calculated using gross verified impacts. Net present value (NPV) PY12 costs and benefits are expressed in 2020 dollars. NPV costs and benefits for P3TD financials are expressed in 2016 dollars.

**Table 2-14. Summary of Portfolio Finances – Gross Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$31,844	\$113,893
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$167,746	\$316,090
	<b>Cost Subtotal</b>	<b>\$199,591</b>	<b>\$429,983</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$709	\$3,525
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$10,246	\$38,279
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$9,545	\$41,150
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$24,773	\$103,999
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$45,274</b>	<b>\$186,954</b>
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$25,207	\$26,425
	<b>Cost Subtotal</b>	<b>\$25,207</b>	<b>\$26,425</b>
<b>Total NPV of Costs<sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$270,072</b>	<b>\$643,362</b>
<b>Total NPV of Benefits<sup>[7]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$162,610	\$432,992
	Lifetime Electric Capacity Benefits	\$67,940	\$188,567
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, Operations and Maintenance [O&M])	\$16,081	\$80,118
	<b>Benefits Total</b>	<b>\$246,631</b>	<b>\$701,676</b>
<b>TRC Benefit-Cost Ratio<sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.91</b>	<b>1.09</b>

<sup>[1]</sup> Includes direct install equipment costs and costs for EE&C kits.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

<sup>[4]</sup> 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.

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. EDC program delivery costs include crosscutting portfolio costs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

TRC benefit-cost ratios are calculated by comparing total NPV TRC benefits and total NPV TRC costs. 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 2-15 through Table 2-18 show the gross and net TRC ratios by program and for the portfolio. Guidehouse calculated the benefits using gross and net verified impacts, where appropriate. Costs and benefits for PY12 results are expressed in 2020 dollars, while P3TD values are expressed as an NPV in 2016 dollars using a discount rate of 7.6%.

**Table 2-15. Summary PY12 Gross TRC Results by Program (\$1,000)<sup>[1]</sup>**

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Residential EE	\$44,863	\$38,176	1.18	\$6,688
Low-Income EE	\$9,096	\$3,742	2.43	\$5,354
Small C&I EE	\$35,174	\$38,156	0.92	-\$2,983
Large C&I EE	\$58,726	\$64,439	0.91	-\$5,714
CHP	\$89,948	\$108,256	0.83	-\$18,308
Residential DR	\$2,499	\$2,667	0.94	-\$169
Small C&I DR	\$63	\$94	0.67	-\$31
Large C&I DR	\$6,263	\$4,997	1.25	\$1,267
<b>Portfolio Total<sup>[2]</sup></b>	<b>\$246,631</b>	<b>\$269,527</b>	<b>0.92</b>	<b>-\$22,896</b>

<sup>[1]</sup> Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020.

<sup>[2]</sup> The portfolio total benefits include crosscutting costs.

Source: Guidehouse analysis

**Table 2-16. Summary PY12 Net TRC Results by Program (\$1,000)<sup>[1]</sup>**

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Residential EE	\$27,374	\$29,483	0.93	-\$2,110
Low-Income EE	\$9,096	\$3,742	2.43	\$5,354
Small C&I EE	\$26,669	\$30,845	0.86	-\$4,177
Large C&I EE	\$35,097	\$40,637	0.86	-\$5,542
CHP	\$78,254	\$94,183	0.83	-\$15,929
Residential DR	\$2,499	\$2,667	0.94	-\$169
Small C&I DR	\$63	\$94	0.67	-\$31
Large C&I DR	\$6,263	\$4,997	1.25	\$1,267
<b>Portfolio Total<sup>[2]</sup></b>	<b>\$185,314</b>	<b>\$215,649</b>	<b>0.86</b>	<b>-\$30,336</b>

<sup>[1]</sup> Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020.

<sup>[2]</sup> The portfolio total benefits include crosscutting costs.

Source: Guidehouse analysis

**Table 2-17. Summary P3TD Gross TRC Results by Program (\$1,000)<sup>[1]</sup>**

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Residential EE	\$275,747	\$162,553	1.70	\$113,194
Low-Income EE	\$47,717	\$32,427	1.47	\$15,289
Small C&I EE	\$98,032	\$102,867	0.95	-\$4,834
Large C&I EE	\$168,230	\$178,380	0.94	-\$10,149
CHP	\$76,472	\$96,999	0.79	-\$20,527
Residential DR	\$9,255	\$13,621	0.68	-\$4,366
Small C&I DR	\$177	\$486	0.36	-\$309
Large C&I DR	\$26,046	\$14,879	1.75	\$11,167
<b>Portfolio Total <sup>[2]</sup></b>	<b>\$701,676</b>	<b>\$643,362</b>	<b>1.09</b>	<b>\$58,315</b>

<sup>[1]</sup> Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020.

<sup>[2]</sup> The portfolio total benefits include crosscutting costs.

Source: Guidehouse analysis

**Table 2-18. Summary P3TD Net TRC Results by Program (\$1,000)<sup>[1]</sup>**

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Residential EE	\$152,234	\$121,803	1.25	\$30,430
Low-Income EE	\$47,717	\$32,427	1.47	\$15,289
Small C&I EE	\$74,005	\$81,845	0.90	-\$7,841
Large C&I EE	\$111,046	\$124,667	0.89	-\$13,623
CHP	\$66,592	\$84,577	0.79	-\$17,985
Residential DR	\$9,255	\$13,621	0.68	-\$4,366
Small C&I DR	\$177	\$486	0.36	-\$309
Large C&I DR	\$26,046	\$14,879	1.75	\$11,167
<b>Portfolio Total <sup>[2]</sup></b>	<b>\$487,071</b>	<b>\$515,456</b>	<b>0.94</b>	<b>-\$28,386</b>

<sup>[1]</sup> Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020.

<sup>[2]</sup> The portfolio total benefits include crosscutting costs.

Source: Guidehouse analysis

## 2.11 Comparison of Performance to Approved EE&C Plan

Table 2-19 compares PY12 expenditures by program to the budget estimates set forth in the EE&C Plan<sup>28</sup> for PY12. All dollar values in Table 2-19 are presented in 2020 dollars.

**Table 2-19. Comparison of PY12 Expenditures to Phase III EE&C Plan (\$1,000)**

Program	PY12 Budget from EE&C Plan	PY12 Actual Expenditures	Ratio (Actual/Plan)
Residential EE	\$20,563	\$24,986	1.22
Low-Income EE	\$7,847	\$3,845	0.49
Small C&I EE	\$8,628	\$13,688	1.59
Large C&I EE	\$11,300	\$14,604	1.29
CHP	\$2,165	\$2,037	0.94
Residential DR	\$2,990	\$3,261	1.09
Small C&I DR	\$192	\$117	0.61
Large C&I DR	\$6,715	\$4,997	0.74
<b>Portfolio Total</b>	<b>\$60,400</b>	<b>\$67,534</b>	<b>1.12</b>

Source: Guidehouse analysis

Table 2-20 compares program year and P3TD expenditures by program to the budget estimates set forth in the EE&C Plan. All values shown are the sum of nominal dollars.

**Table 2-20. Comparison of Expenditures to Phase III EE&C Plan by Program (\$1,000)**

Program	Phase III Budget from EE&C Plan through PY12	P3TD Actual Expenditures	Ratio (Actual/Plan)
Residential EE	\$100,048	\$123,783	1.24
Low-Income EE	\$36,117	\$36,539	1.01
Small C&I EE	\$44,675	\$48,110	1.08
Large C&I EE	\$54,728	\$53,726	0.98
CHP	\$24,995	\$3,273	0.13
Residential DR	\$13,717	\$18,959	1.38
Small C&I DR	\$943	\$694	0.74
Large C&I DR	\$27,137	\$18,294	0.67
<b>Portfolio Total</b>	<b>\$302,360</b>	<b>\$303,377</b>	<b>1.00</b>

Source: Guidehouse analysis

Table 2-21 compares PY12 verified gross program savings to the energy savings projections set forth in the EE&C Plan.

<sup>28</sup> PECO. PECO Program Years 2016-2020 Act 129 – Phase III Energy Efficiency and Conservation Plan. Revised March 31, 2016. <https://www.puc.pa.gov/pcdocs/1444592.pdf>.

**Table 2-21. Comparison of Actual Program Savings to EE&C Plan Projections for PY12**

Program	EE&C Plan Projections for PY12 (MWh/yr)	PY12 VTD Gross Savings (MWh/yr)	Ratio (Actual/Plan)
Residential EE	156,457	179,949	1.15
Low-Income EE	26,746	14,840	0.55
Small C&I EE	79,113	86,306	1.09
Large C&I EE	97,507	112,341	1.15
CHP	29,490	165,298	5.61
<b>Portfolio Total</b>	<b>389,314</b>	<b>558,735</b>	<b>1.44</b>

Source: Guidehouse analysis

Table 2-22 compares Phase III verified gross program savings to the energy savings projections filed in the EE&C Plan.

**Table 2-22. Comparison of Energy Savings to Phase III EE&C Plan by Program**

Program	EE&C Plan through PY12 (MWh/yr)	VTD Gross Savings (MWh/yr)	Ratio (Actual/Plan)
Residential EE	725,921	1,047,928	1.44
Low-Income EE	118,490	117,791	0.99
Small C&I EE	403,255	282,848	0.70
Large C&I EE	480,097	433,366	0.90
CHP	363,534	185,738	0.51
<b>Portfolio Total</b>	<b>2,091,302</b>	<b>2,067,672</b>	<b>0.99</b>

Source: Guidehouse analysis

The list below briefly discusses key reasons why programs exceeded or fell short of projected gross energy savings in PY12:

- For the fifth consecutive year of Phase III and in spite of the pandemic, the Residential EE Program exceeded its annual targets specified in the PECO EE&C Plan. Similar to previous years, the Lighting channel of the Lighting, Appliances & HVAC (LAH) Solution, including lighting sold through the PECO Marketplace, and the Behavioral Solution were significant contributors to the portfolio in PY12. The remaining Residential EE Program solutions represent approximately 13% of PY12 gross verified energy savings achievements. This program is discussed in Section 3.1 of this report.
- The Low-Income EE Program exceeded the Phase III target. The majority of the savings were attained in PY11. PECO discontinued the Low-Income Lighting offering prior to PY9, so the Low-Income Whole Home Solution is the sole contributing solution to the Low-Income EE Program. Since that change, PECO has adjusted implementation tactics to increase Whole Home Solution savings, including expanding partnerships with other utility and income-eligible programs to identify and comprehensively serve households. PECO also expanded the lighting giveaway component of the Low-Income Whole Home Solution. This program is discussed in Section 3.2 of this report.
- The Large and Small C&I Programs both exceeded the PY12 target (9% over target for the Small C&I Program and 15% over target for the Large C&I Program). These programs are discussed in Sections 3.3 and 3.4 of this report.

- The CHP Program reported savings for two projects in PY12, bringing the total for Phase III to eight projects. Gross savings fell short of plan due to low participation early in Phase III and one large project being delayed into Phase IV due to pandemic construction delays.
- PECO's average DR event performance for PY12 is 160.54 MW, and PECO exceeded the 85% minimum target (136.85 MW) for four out of five events (all but the final event). For the final event, the margin of error of the verified impacts (136.32 MW  $\pm$  9.2 %) includes the 85% minimum target. PECO's DR performance decreased in the final two events of the season, mainly due to a decrease in performance of the Large C&I DR program. PECO reported that many participants in the Large C&I programs chose to either not participate in later events or participate at a lower level of curtailment. Nevertheless, PECO's average DR performance to date is 167.13 MW, which exceeds the Phase III compliance reduction target of 161 MW by 3.8% (103.8% of the target achieved to date). This average reflects the fact that the PY12 DR season is voluntary,<sup>29</sup> and PECO has achieved its Phase III DR requirements as of the conclusion of PY11.

In Phase IV, Guidehouse and PECO will continue to conduct targeted evaluation activities on an ongoing basis to quantify performance and continually improve the programs and support Phase V portfolio design.<sup>30</sup>

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<sup>29</sup> PY12 DR is voluntary: PA PUC. *Petition to Amend the Commission's June 19, 2015 Implementation Order. M-2014-2424864*. May 21, 2020. <https://www.puc.pa.gov/pdocs/1665150.docx>.

<sup>30</sup> Per PECO's Phase IV EE&C Plan (PECO Energy Co. - Docket No. [M-2020-3020830](#), [PHASE IV EE& C PLAN - PECO ENERGY](#)), PECO implemented a process in Phase III to observe program and portfolio performance, record learnings, and adjust programs as needed to improve outcomes. The learnings gained from this continuous improvement process and Guidehouse's knowledge of the regulatory environment in Pennsylvania helped inform the Phase IV Plan.

## 2.12 Findings and Recommendations

The evaluation activities Guidehouse completed led to a variety of recommendations for program improvement. Table 2-23 shows the overarching recommendations that affect more than one program, the evaluation activity(s) that uncovered the finding, and Guidehouse's recommendation(s) to PECO to address the finding.

**Table 2-23. Summary of Evaluation Recommendations**

Evaluation Activity	Finding	Recommendation
<b>Program Tracking Database</b>	Guidehouse identified some data inconsistencies in the tracking system database (eTrack), pertaining to data accuracy, discrepancies, and completeness resulting in rework and follow up requests. PECO engaged CSPs, evaluators, and program managers to actively work through data inconsistencies in PY12.	Continue to actively engage CSPs, evaluators, and program managers to minimize data inconsistencies.
<b>Progress Toward Goals</b>	PECO has exceeded the Phase III portfolio target by 104,953 MWh, the Low-Income carveout target by 3,452 MWh, and the G/E/NP carveout target by 166,744 MWh.	Carry over portfolio verified gross savings of 104,953 MWh and Low-Income carveout savings of 3,452 MWh toward Phase IV.

Source: Guidehouse analysis



### 3. Evaluation Results by Program

This section documents the gross impact, net impact, and process evaluation activities conducted in PY12 along with the outcomes of those activities. Not every program receives an evaluation every program year. Table 3-1 breaks down the evaluation activity plan, with a check indicating the type of evaluation Guidehouse will conduct for each program 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	LAH	√	√	√	√		√	√	√	√	√	√	√	√		
	Appliance Recycling	√	√	√	√				√			√	√	√	√	
	Whole Home	√			√	√	√	√				√	√	√		
	New Construction				√	√	√	√				√	√	√	√	
	Behavioral	√		√	√			√				√			√	
	Multifamily Targeted	√	√	√	√			√	√	√	√					
Residential Low-Income EE	Whole Home	√		√	√			√			√			√		
	Lighting	√		√												
Small C&I EE	Equipment and Systems	√			√	√	√	√			√	√	√	√		
	New Construction	√			√	√	√	√			√	√	√			
	Whole Building				√	√	√				√	√	√			
	Behavioral															
	Data Centers Targeted	√			√	√	√	√			√					
	Multifamily Targeted	√	√	√	√			√	√	√	√					

Program	Solution	PY8			PY9			PY10			PY11			PY12		
		Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process
Large C&I EE	Equipment and Systems	√			√	√	√	√			√	√	√	√		
	New Construction	√			√	√	√	√			√	√	√			
	Data Centers Targeted	√			√	√	√	√								
	Multifamily Targeted	√	√	√	√			√	√	√	√					
CHP	CHP	√			√	√	√	√	√	√	√			√		
DR	Residential DR	√		√	√	√	√	√	√		√	√		√	√	
	Small C&I DR	√		√	√	√	√	√	√		√	√		√	√	
	Large C&I DR				√	√	√	√	√		√	√		√	√	

Source: Guidehouse 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 series of solutions designed to influence customer behavior and purchasing decisions.

The Residential EE Program represents less than half of PECO's PY12 portfolio-reported energy savings and consists of six solutions or initiatives that contribute to those savings. Savings are achieved through a range of delivery mechanisms and methods including upstream incentives (e.g., manufacturer buy-downs), downstream incentives (e.g., mail-in rebates), appliance removal and recycling, in-home audits, direct install measures, efficient building construction, and changes in household behaviors. PECO relies on five CSPs to deliver the program, listed here with their corresponding solutions:

- LAH Solution – CLEAResult
- Appliance Recycling Solution – ARCA Recycling
- Whole Home Solution – CLEAResult
- New Construction Solution – Performance Systems Development (PSD)
- Behavioral Solution – Oracle
- Multifamily Targeted Market Segment – Franklin

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

### 3.1.1 Participation and Reported Savings by Customer Segment

This section provides the total Residential EE Program results for PY12, including participation, energy and demand savings, and incentive costs. Table 3-2 presents the participation counts and incentive payments for the Residential EE Program in PY12 by customer segment.

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

Parameter	Residential	Small C&I	Large C&I
PYTD No. of Participants	1,211,524	506	212
PYRTD MWh/yr	189,020	297	38
PYRTD MW	16.31	0.04	0.01
PY12 Incentives (\$1,000)	\$7,752.65	\$31.42	\$6.43

Source: Guidehouse analysis

### 3.1.2 Gross Impact Evaluation

The Residential EE Program’s gross impact evaluation activities involved different approaches tailored to each solution’s characteristics to verify PY12 reported gross savings values. First, Guidehouse reviewed each solution’s program tracking data to verify proper application of the Pennsylvania Technical Reference Manual (TRM)<sup>31</sup> algorithms in reported savings values. The evaluation team completed these reviews for the full population of PY12’s verified Residential EE Program measures (LAH, Appliance Recycling, and New Construction). 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. A goal of the evaluation activities was to verify that a given measure was implemented. Additionally, for partially deemed measures, the evaluation verified certain measure characteristics that inform gross energy and demand impact estimations—in particular, those characteristics where the 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, billing and regression analyses, or a combination of these activities.

Per the Phase III Evaluation Plan,<sup>32</sup> Guidehouse applied the PY11 realization rate and NTG ratio to the PY12 Residential Whole Home Solution reported savings.

In consultation with the SWE, Guidehouse adjusted the Multifamily Targeted Market Segment evaluation activities in response to health concerns related to the pandemic. As phone verifications for this market segment have historically been challenging, Guidehouse once again applied the PY10 realization rate (based on in-person site visits) to the PY12 reported savings.

Guidehouse drew samples from each verified solution for gross impact evaluation activities according to the sampling plans. The evaluation team developed and sought approval for representative samples that complied with the Phase III Evaluation Framework, the TRM, and industry standards, as well as those that helped PECO meet the SWE and PA PUC requirements.

Table 3-3 summarizes the activities conducted for each solution and for specific components or sampled strata within a given solution. Appendix F contains additional detail on the gross impact evaluation approaches used for the Residential EE Program’s individual solutions.

**Table 3-3. Residential EE Impact Evaluation Activities**

Solution	Engineering File Reviews	Online Survey Verification	TRM Savings Calculation Review	Other
LAH (Lighting)			√	Invoice reviews and record-level savings calculations ENERGY STAR certification verification

<sup>31</sup> PA PUC. *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.

<sup>32</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

Solution	Engineering File Reviews	Online Survey Verification	TRM Savings Calculation Review	Other
LAH (Appliances and HVAC)	√ [1]	√	√	
LAH (Marketplace)			√	Tracking system review
Appliance Recycling		√	√	Regression analysis
Whole Home				Applied PY11 verification realization rate
New Construction	√		√	Building simulation modeling
Behavioral				Billing analysis: <ul style="list-style-type: none"> <li>For home energy report (HER) participants in the test and control groups, Guidehouse used a lagged dependent variable (LDV) model.</li> <li>For AC Saver cohort recipients included in the Behavioral Solution, Guidehouse used a regression with preprogram matching method to estimate savings related to HERs.</li> </ul> Peak demand impacts: Accounting for average peak demand impacts resulting from HERs. <sup>[2]</sup> Double counting (dual participation) analysis: Accounting for Behavioral Solution participant activities within other PECO EE solutions.
Multifamily Targeted				Applied PY10 verification realization rate

<sup>[1]</sup> HVAC only.

<sup>[2]</sup> The Behavioral Solution implementer, Oracle, does not report demand savings. Guidehouse completes this analysis as part of its annual reporting, as required by the SWE. A realization rate cannot be calculated due to the lack of reported demand savings.

Source: Guidehouse analysis

Table 3-4 provides the sampling frame for the gross impact evaluation of the Residential EE Program in PY12.

**Table 3-4. Residential EE Program Gross Impact Sample Design for PY12**

Solution	Stratum	Population Size	Targeted Sample Size	Achieved Sample Size	Verification Method
LAH	Furnace High Efficiency Fan	2,177	6	7	Tracking system review, file review and online survey verification
	Central AC	5,201	6	18	Tracking system review, file review and online survey verification
	ASHP	1,198	6	8	Tracking system review, file review and online survey verification
	Ductless Mini-Split Heat Pumps	592	6	14	Tracking system review, file review and online survey verification

Solution	Stratum	Population Size	Targeted Sample Size	Achieved Sample Size	Verification Method
	Other – HVAC	2,014	6	9	Tracking system review, file review and online survey verification
	Dehumidifier	2,295	6	12	Tracking system review, file review and online survey verification
	Clothes Dryer	1,249	6	12	Tracking system review, file review and online survey verification
	Clothes Washer	1,831	6	13	Tracking system review, file review and online survey verification
	Refrigerator	2,450	6	8	Tracking system review, file review and online survey verification
	Air Purifier	607	6	11	Tracking system review, file review and online survey verification
	Other – Appliances	908	6	15	Tracking system review, file review and online survey verification
	Specialty Lighting	155,484	N/A	N/A	Tracking system review
	Standard Lighting	29,208	N/A	N/A	Tracking system review
	<b>Solution Total</b>	<b>205,214</b>	<b>66</b>	<b>127</b>	
<b>Appliance Recycling</b>	Freezers	1,191	10 <sup>[1]</sup>	11	Tracking system review and online survey verification
	Room ACs	731	10 <sup>[1]</sup>	11	Tracking system review and online survey verification
	Refrigerators	8,978	20 <sup>[1]</sup>	21	Tracking system review and online survey verification
	<b>Solution Total</b>	<b>10,900</b>	<b>40 <sup>[1]</sup></b>	<b>43</b>	
<b>New Construction</b>	Large	182	5	5	Engineering file reviews and building simulation modeling
	Medium	301	5	5	Engineering file reviews and building simulation modeling
	Small	464	5	5	Engineering file reviews and building simulation modeling
	<b>Solution Total</b>	<b>947</b>	<b>15</b>	<b>15</b>	
<b>Behavioral</b>	<b>Solution Total</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	
<b>Total Program</b>	<b>All</b>	<b>217,061</b>	<b>121</b>	<b>185</b>	

<sup>[1]</sup> These targets only include the residential component of the appliance recycling solution not the low-income portion.

Source: Guidehouse analysis

Guidehouse shows the PY12 verified energy and demand savings in Table 3-5 and Table 3-6, respectively. These tables also include the realization rates on a stratum and solution level, which is calculated by dividing the total verified savings by the reported savings.

Table 3-5 summarizes the reported and verified energy savings results along with the coefficient of variation (CV) and relative precision for each stratum sampled for the Residential EE Program in PY12.

**Table 3-5. Residential EE Program Gross Results for Energy**

Solution	Stratum	Reported Gross Energy Savings (MWh/yr)	Verified Gross Energy Savings (MWh/yr)	Energy Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
LAH	Furnace High Efficiency Fan	896	896	1.00	0.00	0.0%
	Central AC	3,688	3,688	1.00	0.00	0.0%
	ASHP	1,575	1,455	0.92	0.00	0.0%
	Ductless Mini-Split Heat Pumps	1,279	1,279	1.00	0.00	0.0%
	Other – HVAC	490	492	1.00	0.00	0.0%
	Dehumidifier	359	441	1.23	0.00	0.0%
	Clothes Washer	218	173	0.79	0.00	0.0%
	Clothes Dryer	243	231	0.95	0.00	0.0%
	Refrigerator	208	208	1.00	0.05	3.1%
	Air Purifier	399	849	2.13	0.04	1.9%
	Other – Appliances	160	173	1.08	0.24	9.4%
	Marketplace: Thermostats	2,538	2,659	1.05	0.00	0.0%
	Marketplace: Smart Strips	212	214	1.01	0.00	0.0%
	Marketplace: Lighting	642	667	1.04	0.00	0.0%
	Standard Lighting	8,487	10,109	1.19	0.00	0.0%
	Specialty Lighting	72,613	67,039	0.92	0.00	0.0%
<b>Solution Total</b>		<b>94,008</b>	<b>90,573</b>	<b>0.96</b>	<b>0.07</b>	<b>0.02%</b>
Appliance Recycling	Freezers	1,207	953	0.79	0.35	16.6%
	Room ACs	927	913	0.98	0.09	4.4%
	Refrigerators	8,813	9,470	1.07	0.21	7.0%
	<b>Solution Total</b>	<b>10,947</b>	<b>11,335</b>	<b>1.04</b>	<b>0.26</b>	<b>5.8%</b>
Whole Home	Large	2,710	2,492	0.92	0.22	13.8%
	Medium	1,536	1,523	0.99	0.11	8.7%
	Small	1,017	953	0.94	0.08	6.1%
	Very Small	50	47	0.94	0.00	100.0%
	<b>Solution Total</b>	<b>5,312</b>	<b>5,015</b>	<b>0.94</b>	<b>0.19</b>	<b>6.8%</b>
New Construction	Large	629	564	0.90	0.13	10.2%
	Medium	617	470	0.76	0.15	12.2%
	Small	570	616	1.08	0.30	23.5%
	Very Small	17	19	1.08	0.00	23.5%
	<b>Solution Total</b>	<b>1,833</b>	<b>1,669</b>	<b>0.91</b>	<b>0.22</b>	<b>8.5%</b>

Solution	Stratum	Reported Gross Energy Savings (MWh/yr)	Verified Gross Energy Savings (MWh/yr)	Energy Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
<b>Behavioral</b>	<b>Solution Total</b>	<b>74,135</b>	<b>68,367</b>	<b>0.92</b>	<b>0.00</b>	<b>0.0%</b>
<b>Multifamily Targeted</b>	Multisector	561	556	0.99	0.06	4.9%
	Large Residential	2,233	2,094	0.94	1.18	113.8%
	Small Residential	326	340	1.04	0.13	8.8%
	<b>Solution Total</b>	<b>3,120</b>	<b>2,991</b>	<b>0.96</b>	<b>1.60</b>	<b>63.1%</b>
<b>Total Program</b>	<b>All</b>	<b>189,355</b>	<b>179,949</b>	<b>0.95</b>	<b>5.27</b>	<b>2.0% [90% CI]</b>

Note: CI = confidence interval

Source: Guidehouse analysis

Table 3-6 summarizes the reported and verified demand savings results along with the CV and relative precision for each stratum sampled for the Residential EE Program in PY12.

**Table 3-6. Residential EE Program Gross Results for Demand**

Solution	Stratum	Reported Gross Demand Savings (MW)	Verified Gross Demand Savings (MW)	Demand Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
<b>LAH</b>	Furnace High Efficiency Fan	0.14	0.14	1.00	0.00	0.0%
	Central AC	1.86	1.86	1.00	0.002	0.1%
	ASHP	0.39	0.27	0.69	0.00	0.0%
	Ductless Mini-Split Heat Pumps	0.23	0.23	1.00	0.00	0.0%
	Other – HVAC	0.35	0.35	1.00	0.00	0.0%
	Dehumidifier	0.10	0.12	1.21	0.00	0.0%
	Clothes Washer	0.03	0.03	0.86	0.00	0.0%
	Clothes Dryer	0.05	0.05	0.96	0.00	0.0%
	Refrigerator	0.04	0.04	0.98	0.03	1.7%
	Air Purifier	0.05	0.10	2.01	0.03	1.5%
	Other – Appliances	0.04	0.05	1.03	0.15	5.7%
	Marketplace: Thermostats	0.00	0.00	1.00	0.00	0.0%
	Marketplace: Smart Strips	0.02	0.02	1.00	0.00	0.0%
Marketplace: Lighting	0.08	0.08	1.04	0.00	0.0%	



Solution	Stratum	Reported Gross Demand Savings (MW)	Verified Gross Demand Savings (MW)	Demand Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
	Standard Lighting	1.00	1.20	1.20	0.00	0.0%
	Specialty Lighting	8.55	8.15	0.95	0.00	0.0%
	<b>Solution Total</b>	<b>12.94</b>	<b>12.69</b>	<b>0.98</b>	<b>0.08</b>	<b>0.03%</b>
<b>Appliance Recycling</b>	Freezers	0.14	0.11	0.78	0.35	16.6%
	Room ACs	0.34	0.32	0.94	0.18	8.5%
	Refrigerators	1.02	1.06	1.04	0.21	7.0%
	<b>Solution Total</b>	<b>1.49</b>	<b>1.48</b>	<b>0.99</b>	<b>0.24</b>	<b>5.3%</b>
<b>Whole Home</b>	Large	0.26	0.22	0.87	0.31	19.5%
	Medium	0.31	0.31	1.00	0.08	6.0%
	Small	0.14	0.13	0.95	0.07	5.6%
	Very Small	0.01	0.01	0.95	0.00	100.0%
	<b>Solution Total</b>	<b>0.71</b>	<b>0.67</b>	<b>0.95</b>	<b>0.18</b>	<b>6.6%</b>
<b>New Construction</b>	Large	0.22	0.21	0.95	0.03	2.5%
	Medium	0.35	0.31	0.87	0.02	1.2%
	Small	0.25	0.26	1.03	0.08	6.0%
	Very Small	0.00	0.00	1.03	N/A	100.0%
	<b>Solution Total</b>	<b>0.83</b>	<b>0.78</b>	<b>0.94</b>	<b>0.05</b>	<b>1.8%</b>
<b>Behavioral</b>	<b>Solution Total</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>	<b>0.0%</b>
<b>Multifamily Targeted</b>	Multisector	0.07	0.07	0.95	0.06	4.6%
	Large Residential	0.27	0.25	0.93	1.05	101.4%
	Small Residential	0.04	0.04	1.00	0.09	6.2%
	<b>Solution Total</b>	<b>0.38</b>	<b>0.36</b>	<b>0.94</b>	<b>1.45</b>	<b>57.1%</b>
<b>Total Program</b>	<b>All</b>	<b>16.36</b>	<b>23.79</b>	<b>1.45</b>	<b>4.04</b>	<b>1.5% [90% CI]</b>

<sup>[1]</sup> For the Residential Behavioral Solution, the implementer does not report demand savings; however, the SWE requires PECO to verify demand savings. As a result, there is no demand realization rate for the Behavioral Solution. However, the verified demand savings are added to the Residential EE Program savings. As a result, the demand realization rate for the Residential EE Program is greater than the demand realization rate for each individual solution in the program.

Source: Guidehouse analysis

For each solution, factors leading to variations between the reported and verified savings and the observed realization rates for the Residential EE Program are detailed in Appendix F. Overall, the LAH Solution and the Behavioral Solution are the most significant drivers of the

program-level results and realization rates—these two solutions represent almost 90% of the program's savings.

### 3.1.3 Net Impact Evaluation

In alignment with the evaluation plan<sup>33</sup>, Guidehouse did not assess NTG impacts in PY12 but rather relied on results collected in PY10 and PY11 for all solutions.<sup>34</sup> Table 3-7 summarizes the results from the evaluation including the reported and verified energy savings, the calculated NTG results, and the CV and relative precision for each stratum sampled for the Residential EE Program.

The primary objective of the net savings analysis is to determine the program's net effect on customer electricity usage. The evaluation team derived net program impacts by estimating NTG ratios that quantify the percentage of the gross program impacts that can reliably be attributed to the program.

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

Spillover is defined as 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. Guidehouse 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.

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<sup>33</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

<sup>34</sup> In PY11, Guidehouse surveyed PECO Residential EE Program participants using online surveys to gather information about free ridership and spillover. The evaluation team developed survey instruments consistent with the Phase III Evaluation Framework's guidance on net impact evaluation techniques and guidance from the Uniform Methods Project on estimating net savings. Survey instruments also captured feedback about customer experiences from participants to inform the process evaluation.

**Table 3-7. Residential EE Program Net Energy Savings Impact Evaluation Results for PY12**

Solution	Stratum	Verified Gross Energy Savings (MWh/yr)	Verified Net Energy Savings (MWh/yr)	Free Ridership Rate	Spillover Rate	NTG Ratio <sup>[1]</sup>	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
LAH <sup>[2]</sup>	Furnace High Efficiency Fan	896	896	0.47	0.47	1.00	1.15	34.1%
	Central AC	3,688	2,987	0.47	0.28	0.81	1.04	26.6%
	ASHP	1,455	1,426	0.40	0.39	0.98	0.99	40.3%
	Ductless Mini-Split Heat Pumps	1,279	780	0.42	0.03	0.61	0.90	28.6%
	Other – HVAC	492	398	0.47	0.28	0.81	0.86	29.6%
	Dehumidifier	441	419	0.47	0.42	0.95	1.23	34.5%
	Clothes Washer	173	156	0.65	0.55	0.90	2.79	76.6%
	Clothes Dryer	231	208	0.65	0.55	0.90		
	Refrigerator	208	461	0.52	1.74	2.22	1.43	32.4%
	Air Purifier	849	1,723	0.39	1.42	2.03	1.02	48.1%
	Other – Appliances	173	362	0.52	1.63	2.10	3.40	120.9%
	Marketplace: Thermostats	2,659	1,755	0.37	0.03	0.66	0.58	12.3%
	Marketplace: Smart Strips	214	175	0.24	0.06	0.82	0.74	10.4%
	Marketplace: Lighting	667	560	0.18	0.01	0.84	0.25	14.2%
	Standard Lighting	10,109	5,156	0.53	0.04	0.51	0.45	3.4%
	Specialty Lighting	67,039	30,838	0.58	0.04	0.46	0.40	2.6%
	<b>Solution Total</b>		<b>90,573</b>	<b>48,302</b>	<b>0.55</b>	<b>0.08</b>	<b>0.53</b>	<b>0.58</b>
Appliance Recycling	Freezers	953	638	0.33	0.00	0.67	0.61	13.7%
	Room ACs	913	356	0.61	0.00	0.39	1.07	34.9%
	Refrigerators	9,470	4,924	0.48	0.00	0.52	0.99	10.8%
	<b>Solution Total</b>		<b>11,335</b>	<b>5,918</b>	<b>0.48</b>	<b>0.00</b>	<b>0.52</b>	<b>0.99</b>

Solution	Stratum	Verified Gross Energy Savings (MWh/yr)	Verified Net Energy Savings (MWh/yr)	Free Ridership Rate	Spillover Rate	NTG Ratio <sup>[1]</sup>	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
<b>Whole Home</b>	Large	2,492	2,243	0.19	0.09	0.90	0.26	6.7%
	Medium	1,523	1,416	0.23	0.16	0.93	0.41	11.2%
	Small	953	1,010	0.21	0.27	1.06	0.48	11.2%
	Very Small	47	73	0.21	0.77	1.56	0.75	40.0%
	<b>Solution Total</b>		<b>5,015</b>	<b>4,742</b>	<b>0.21</b>	<b>0.15</b>	<b>0.95</b>	<b>0.40</b>
<b>New Construction</b>	Large	564	519	0.08	0.00	0.92		
	Medium	470	433	0.08	0.00	0.92		
	Small	616	566	0.08	0.00	0.92	0.35	19.8%
	Very Small	19	17	0.08	0.00	0.92		
	<b>Solution Total</b>		<b>1,669</b>	<b>1,535</b>	<b>0.08</b>	<b>0.00</b>	<b>0.92</b>	<b>0.35</b>
<b>Behavioral</b>	<b>Solution Total</b>	<b>68,367</b>	<b>68,367</b>	<b>0.00</b>	<b>0.00</b>	<b>1.00</b>	<b>N/A</b>	<b>N/A</b>
<b>Multifamily Targeted</b>	Multisector	556	485	0.13	0.00	0.87	0.20	15.7%
	Large Residential	2,094	1,950	0.07	0.00	0.93	0.18	4.6%
	Small Residential	340	314	0.08	0.00	0.92	0.23	7.2%
	<b>Solution Total</b>		<b>2,991</b>	<b>2,749</b>	<b>0.08</b>	<b>0.00</b>	<b>0.92</b>	<b>0.21</b>
<b>Total Program</b>	<b>All</b>	<b>179,949</b>	<b>131,614</b>	<b>0.32</b>	<b>0.05</b>	<b>0.73</b>	<b>0.61</b>	<b>2.4% [90% CI]</b>

<sup>[1]</sup> Guidehouse conducted NTG research for the Residential EE Program in PY11, the Residential Multifamily Targeted Market Segment in PY10, and the specialty and standard LED lighting strata in PY8; those results are presented in this table.

<sup>[2]</sup> Guidehouse applied the PY11 free ridership, spillover, and NTG ratios from the LAH Clothes Washer strata to the Clothes Dryer strata for PY12.

Source: Guidehouse analysis

### 3.1.4 Process Evaluation

As described in the Phase III Evaluation Plan<sup>35</sup> updated for PY12 and approved by the SWE, Guidehouse did not conduct in-depth process evaluation activities for the Residential EE Programs. Instead, the team interviewed the PECO program manager and CSP staff to identify significant implementation changes to inform the impact evaluation activities. No significant changes were found. The team carried out in-depth process evaluations in prior program years.

#### 3.1.4.1 Key Findings from Process Evaluation

No significant process findings were identified for the Residential EE Program in PY12.

### 3.1.5 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-8. Guidehouse calculated TRC benefits using gross verified impacts. Costs and benefits for PYTD results are expressed in 2020 dollars while P3TD values are expressed as an NPV in 2016 dollars using a discount rate of 7.6%.

**Table 3-8. Summary of Residential EE Program Finances – Gross Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$8,580	\$36,522
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$12,988	\$55,812
	<b>Cost Subtotal</b>	<b>\$21,568</b>	<b>\$92,334</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$373	\$1,760
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$6,293	\$23,900
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$9,741	\$43,918
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$16,407</b>	<b>\$69,579</b>

<sup>35</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$201	\$641
	<b>Cost Subtotal</b>	<b>\$201</b>	<b>\$641</b>
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$38,176</b>	<b>\$162,553</b>
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$22,199	\$155,281
	Lifetime Electric Capacity Benefits	\$8,619	\$53,793
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$14,045	\$66,673
	<b>Benefits Total</b>	<b>\$44,863</b>	<b>\$275,747</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>1.18</b>	<b>1.70</b>

<sup>[1]</sup> Includes direct install equipment costs and costs for EE&C kits.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

<sup>[4]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

Table 3-9 presents program financials and cost-effectiveness on a net savings basis.

**Table 3-9. Summary of Residential EE Program Finances – Net Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$8,580	\$36,522
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$4,315	\$15,137
	<b>Cost Subtotal</b>	<b>\$12,895</b>	<b>\$51,659</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$373	\$1,760
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$6,293	\$23,900
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$9,741	\$43,918
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$16,407</b>	<b>\$69,579</b>
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$182	\$566
	<b>Cost Subtotal</b>	<b>\$182</b>	<b>\$566</b>
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$29,483</b>	<b>\$121,803</b>
	Lifetime Electric Energy Benefits	\$13,989	\$86,926
	Lifetime Electric Capacity Benefits	\$5,462	\$30,119
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$7,923	\$35,189
	<b>Benefits Total</b>	<b>\$27,374</b>	<b>\$152,234</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.93</b>	<b>1.25</b>

<sup>[1]</sup> Includes direct install equipment costs and costs for EE&C kits.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

<sup>[4]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

### 3.1.6 Status of Recommendations

The evaluation activities led to several findings and recommendations from Guidehouse to PECO. Table 3-10 presents those solution-level findings and recommendations along with a summary of how PECO plans to address the recommendations in program delivery. Additional details on the solution-level analysis activities that led to these findings and recommendations can be found in Appendix F.

**Table 3-10. Summary of Findings and Recommendations for the Residential EE Program**

Solution	Finding	Recommendation	EDC Status
<b>Appliance Recycling</b>	The largest contributor to the realization rate came from applying deemed values where reported measure characteristics are available. This resulted in a change of 700 MWh or 6% savings increase. <sup>1</sup>	Update PY13 reported savings to either use actual appliance specifications or findings (average savings value) from the most recent evaluation.	In progress. PECO is working with the evaluation team and CSP to implement in Phase IV.
<b>Behavioral</b>	Verified savings differences are principally due to dual participation adjustments in randomized control trial waves and the addition of the AC Saver wave savings. Savings for the randomized control trial (RCT) waves prior to the dual participation adjustment are comparable to those reported by Oracle. Guidehouse verified RCT wave savings of 74,617 MWh, compared to reported savings of 74,135 MWh before adjusting for double counting, a difference of less than two-thirds of a percent.	Consider applying a small discount factor to the reported savings to account for dual participation to reduce realization rate differences.	In progress. PECO is working with the evaluation team to apply discount factors along with persistence to forecast accurately towards the post-verification savings.
<b>LAH</b>	Guidehouse adjusted baseline wattages for several LED products (302 out of 833), comprising a variety of lamp types. The overall effect of the adjustments was a reduction of reported savings by 7%.	Refine process for characterizing baseline wattages in alignment with TRM requirements, especially for fixtures and specialty lamps.	N/A in Phase IV as per the TRM. This was the difference between classifying GSL and specialty lamps.
<b>LAH</b>	Several lighting fixture products were listed with efficient wattage values that did not match the ENERGY STAR database value. Where these discrepancies were identified, Guidehouse applied the ENERGY STAR values to calculate verified savings.	Consider incorporating a quality control procedure that checks and confirms that new product wattage values are consistent with ENERGY STAR criteria.	Under consideration. The ENERGY STAR QPL is imported into the CLEAResult system via API Get call. If/when there are errors in the ENERGY STAR database that get imported (and possibly later corrected), there is not a cost effective way to QC check every import (especially without knowing when errors would potentially be corrected).



Solution	Finding	Recommendation	EDC Status
<b>LAH</b>	Savings calculations for six appliance measure types (air source heat pumps, air purifiers, residential clothes washers, dehumidifiers, refrigerators, smart/learning thermostats) were not consistent with the TRM algorithms or IMPs, resulting in discrepancies between reported and verified savings. Collectively, these resulted in a change of 517 MWh or 5% savings increase.	Confirm the Phase IV calculations for these measures are consistent with TRM and IMPs. Consider incorporating preliminary measure savings calculation reviews to ensure measures added to the database are consistent with the TRM and IMPs. Update measure savings calculations or methodologies consistent with new IMPs, or both.	In progress. Phase IV measures are entered into the eTRM database, which will import all IMPs with start/end date based on installation date (i.e. an item installed in June with a change in IMP in July can claim June savings, while an item installed in July after IMP change will claim post-IMP savings).
<b>Multifamily</b>	Reported lighting savings are based on the hours of use (HOU) and coincidence factors (CFs) deemed for the "Overall Household or Unknown Room" and not on the actual lighting measure installation location.	Consider recording installed room locations or bin installation locations into similar groups (e.g., interior high use, interior low use, exterior) to align reported and verified savings results.	Will be implemented. PECO will work with CSPs to take note of lighting end uses in spaces so that the evaluation process can be more streamlined and clearer.

Source: Guidehouse analysis

<sup>1</sup>This estimate includes all appliances recycled through the Appliance Recycling solution for residential and low-income sectors.

## 3.2 Residential Low-Income EE Program

The Residential Low-Income EE Program offers an array of participant solutions and activities to achieve PECO's goal of helping income-eligible 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 savings carveout requirement. Additionally, PECO targets Customer Assistance Program (CAP) customers with high usage and incomes of 0%-50% of the FPL per the February 17, 2016 Joint Petition for Settlement<sup>36</sup> agreement.

In PY12, the Low-Income EE Program consisted of the Whole Home Solution. Savings are achieved through a range of delivery mechanisms and methods including product giveaways, in-home audits, and direct install measures. The Low-Income EE Program discontinued a Lighting Solution in PY9 that offered upstream incentives (retailer buy-downs). PECO relies on two CSPs to deliver the program savings: CMC Energy and ARCA Recycling, Inc.

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 referred customers who are on the CAP rate and at or below 150% of the FPL are applied toward the low-income carveout and reported through the Whole Home Solution.

PECO's income-qualified customers are also eligible to benefit from the other solutions offered by the Residential EE Program. However, low-income participation in those solutions and the associated savings are reported through the Residential EE Program; they are not applied to the low-income carveout. Rather, only savings from the programs and solutions in this section specifically targeting income-eligible customers count toward the carveout.

### 3.2.1 Participation and Reported Savings by Customer Segment

This section provides the PY12 Low-Income EE Program results including participation, energy and demand savings, and incentive costs. Table 3-11 presents the participation counts and incentive payments for the Low-Income EE Program in PY12 by customer segment.

**Table 3-11. Low-Income EE Program Summary by Customer Segment**

Parameter	Residential	Small C&I	Large C&I
PYTD No. of Participants	8,102	24	7
PYRTD MWh/yr	16,150	1,859	1,841
PYRTD MW	1.70	0.30	0.27
PY12 Incentives (\$1,000)	\$102.54	\$0.00	\$0.00

Source: Guidehouse analysis

### 3.2.2 Gross Impact Evaluation

The Low-Income EE Program's gross impact evaluation activities started with a review of program tracking data to verify proper application of TRM algorithms in reported savings values.

<sup>36</sup> Petition of PECO Energy Company for approval of its Act 129 Phase III Energy Efficiency and Conservation Plan, Docket No. M-2015-2515691.

The evaluation team completed these reviews for the full population of implemented PY12 Low-Income EE Program measures. Next, the team identified appropriate evaluation activities based on the nature of the participants, implementation strategies, and the level of information accompanying the reported savings. The primary goal of the evaluation activities was to verify that implementation of a given measure occurred.

In consultation with the SWE, Guidehouse adjusted some evaluation activities in response to health concerns related to the pandemic. Phone survey verifications (which were also conducted in PY11) replaced planned onsite verifications for the Low-Income Whole Home Solution.

Guidehouse then drew samples for these gross impact evaluation activities. The team developed and sought approval for representative samples that complied with the Phase III Evaluation Framework, the TRM, and industry standards, as well as those that helped PECO meet the SWE and PA PUC requirements.

The Whole Home Solution was verified through engineering file reviews of program applications, invoices, and phone verifications for projects with direct installation measures only. In PY12, energy kits were distributed to some customers when pandemic restrictions prevented in-home visits. Guidehouse conducted a verification survey with energy kit customers. Income-eligible Appliance Recycling Solution participant projects are evaluated through the Appliance Recycling Solution, with savings reported through the Low-Income Whole Home Solution.

Table 3-12 provides the sampling frame for the gross impact evaluation of the Low-Income EE Program in PY12.

**Table 3-12. Low-Income EE Program Gross Impact PY12 Sample Design**

<b>Solution</b>	<b>Stratum</b>	<b>Population Size</b>	<b>Targeted Sample Size</b>	<b>Achieved Sample Size</b>	<b>Verification Method</b>
<b>Whole Home</b>	Large Single-Family (SF)	398	8	8	Engineering file reviews and phone verification
	Medium SF	712	8	8	Engineering file reviews and phone verification
	Small SF	1,434	8	9	Engineering file reviews and phone verification
	Very Small SF	438	0	0	N/A
	Multifamily	54	6	3	Engineering file reviews and phone verification
	Refrigerator Retirement	1,052	10	12	Tracking system review and online survey verification
	Freezer Retirement	120	10	14	Tracking system review and online survey verification
	Room AC Retirement	99	10	10	Tracking system review and online survey verification
	Mailed Kits	10,963	Census (154)	154	Online verification via postcards and email
<b>Total Program</b>	<b>All</b>	<b>15,270</b>	<b>214</b>	<b>218</b>	

Source: Guidehouse analysis

Table 3-13 summarizes the reported and verified energy (MWh/yr) savings results, along with the CV and relative precision for each stratum sampled for the Low-Income EE Program in PY12.

**Table 3-13. Low-Income EE Program PY12 Gross Results for Energy**

<b>Solution</b>	<b>Stratum</b>	<b>Reported Gross Energy Savings (MWh/yr)</b>	<b>Verified Gross Energy Savings (MWh/yr)</b>	<b>Energy Realization Rate</b>	<b>Achieved Sample CV or Error Ratio</b>	<b>Relative Precision at 85% Confidence Interval</b>
<b>Whole Home</b>	Large SF	2,502	1,862	0.74	0.41	23.1%
	Medium SF	2,418	2,001	0.83	0.35	19.9%
	Small SF	3,138	2,546	0.81	0.35	18.8%
	Very Small SF	328	266	0.81	N/A	100.0%
	Multifamily	3,972	3,019	0.76	0.08	10.4%
	Giveaways	747	741	0.99	0.00	0.0%
	Mailed Kits	5,462	3,097	0.57	0.71	8.3%
	Freezer Retirement	124	89	0.71	0.33	13.7%
	Room AC Retirement	130	118	0.91	0.27	13.3%
	Refrigerator Retirement	1,028	1,102	1.07	0.02	0.7%
	<b>Solution Total</b>		<b>19,850</b>	<b>14,840</b>	<b>0.75</b>	<b>1.00</b>
<b>Total Program</b>	<b>All</b>	<b>19,850</b>	<b>14,840</b>	<b>0.75</b>	<b>1.00</b>	<b>4.9% [90% CI]</b>

Source: Guidehouse analysis

Table 3-14 summarizes the reported and verified demand (MW) savings results, along with the CV and relative precision for each stratum sampled for the Low-Income EE Program in PY12.

**Table 3-14. Low-Income EE Program PY12 Gross Results for Demand**

<b>Solution</b>	<b>Stratum</b>	<b>Reported Gross Demand Savings (MW)</b>	<b>Verified Gross Demand Savings (MW)</b>	<b>Demand Realization Rate</b>	<b>Achieved Sample CV or Error Ratio</b>	<b>Relative Precision at 85% Confidence Interval</b>
<b>Whole Home</b>	Large SF	0.27	0.21	0.78	0.39	22.4%
	Medium SF	0.26	0.22	0.86	0.33	19.1%
	Small SF	0.34	0.29	0.85	0.34	17.9%
	Very Small SF	0.04	0.03	0.85	0.00	100.0%
	Multifamily	0.61	0.46	0.76	0.06	7.5%
	Giveaways	0.08	0.08	0.99	0.00	0.0%
	Mailed Kits	0.52	0.27	0.51	0.79	9.2%
	Freezer Retirement	0.01	0.01	0.70	0.33	13.7%
	Room AC Retirement	0.05	0.05	0.96	0.08	3.9%
	Refrigerator Retirement	0.12	0.12	1.04	0.02	0.7%
	<b>Solution Total</b>		<b>2.28</b>	<b>1.73</b>	<b>0.76</b>	<b>0.91</b>
<b>Total Program</b>	<b>All</b>	<b>2.28</b>	<b>1.73</b>	<b>0.76</b>	<b>0.91</b>	<b>4.5% [90% CI]</b>

Source: Guidehouse analysis

The overall evaluation resulted in a reduction to reported savings. 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 G.

### 3.2.3 Net Impact Evaluation

Net impacts were not assessed for the Low-Income EE Program in PY12.

#### 3.2.3.1 High Impact Measure Research

HIMs were not assessed for the Low-Income EE Program in PY12.

### 3.2.4 Process Evaluation

As described in the Phase III Evaluation Plan<sup>37</sup> updated for PY12 and approved by the SWE, Guidehouse did not complete any in-depth process evaluation activities for the Low-Income EE Program Whole Home Solution. Instead, the team interviewed the PECO program manager and CSP staff to identify significant implementation changes to inform the impact evaluation activities. No significant changes were found. The team conducted in-depth process evaluations in PY8 and PY9.

#### 3.2.4.1 Key Findings from Process Evaluation

No significant process findings were identified for the Low-Income EE Program in PY12.

### 3.2.5 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-15. Guidehouse calculated TRC benefits using gross verified impacts. Costs and benefits for PYTD results are expressed in 2020 dollars while P3TD values are expressed as an NPV in 2016 dollars using a discount rate of 7.6%.

**Table 3-15. Summary of Low-Income EE Program Finances – Gross Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$2,934	\$20,857
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	-\$103	-\$366
	<b>Cost Subtotal</b>	<b>\$2,831</b>	<b>\$20,490</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$80	\$311
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$0	\$1,392
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0

<sup>37</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$832	\$10,234
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$911</b>	<b>\$11,937</b>
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$3,742</b>	<b>\$32,427</b>
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$3,525	\$23,267
	Lifetime Electric Capacity Benefits	\$979	\$6,815
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$4,592	\$17,634
	<b>Benefits Total</b>	<b>\$9,096</b>	<b>\$47,717</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>2.43</b>	<b>1.47</b>

<sup>[1]</sup> Includes direct install equipment costs and costs for EE&C kits.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

<sup>[4]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

Table 3-16 presents program financials and cost-effectiveness on a net savings basis.

**Table 3-16. Summary of Low-Income EE Program Finances – Net Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$2,934	\$20,857
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	-\$103	-\$366
	<b>Cost Subtotal</b>	<b>\$2,831</b>	<b>\$20,490</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$80	\$311

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$0	\$1,392
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$832	\$10,234
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$911</b>	<b>\$11,937</b>
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$3,742</b>	<b>\$32,427</b>
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$3,525	\$23,267
	Lifetime Electric Capacity Benefits	\$979	\$6,815
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$4,592	\$17,634
	<b>Benefits Total</b>	<b>\$9,096</b>	<b>\$47,717</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>2.43</b>	<b>1.47</b>

<sup>[1]</sup> Includes direct install equipment costs and costs for EE&C kits.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

<sup>[4]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

### 3.2.6 Status of Recommendations

The evaluation activities in PY12 led to findings and recommendations from Guidehouse to PECO. Table 3-17 presents the solution-level findings and recommendations for the Low-Income EE Program, along with a summary of how PECO plans to address the recommendation in program delivery. Additional details on the solution-level analysis activities that led to these findings and recommendations can be found in Appendix G.



**Table 3-17. Summary of Findings and Recommendations for the Residential Low-Income EE Program**

Solution	Finding	Recommendation	EDC Status
Whole Home	Savings calculations for three measures were not consistent with TRM algorithms, resulting in discrepancies reducing reported savings by 1,417,835 kWh or 9.6%. Measures include low flow kitchen aerators, low flow bathroom aerators, and low flow showerheads.	Adjust savings calculation methodologies to align with TRM algorithms as described in Table G-1.	Will be implemented. PECO has reviewed results with Guidehouse and understands. This will be reviewed with the Phase IV CSP.
Whole Home	Energy Kits were mailed to Whole Home participants due to pandemic home-visit restrictions. Savings were reduced because water conservation devices in many cases were not installed by homeowners. When they were installed, a high portion were installed in homes with gas hot water systems.	Incorporate screening questions and only send water conservation devices to households with electric hot water or remove water conservation devices from future Energy Kit distribution.	Will be implemented. The Phase IV CSP is aware of Energy Kit realization rates and reason for savings reduction. Adjustments will be made to ISR calcs.

Source: Guidehouse analysis

### 3.3 Small C&I EE Program

The Small C&I EE Program offers a crosscutting 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, listed with the implementers below:

- Equipment and Systems Solution – ICF
- New Construction Solution – ICF
- Whole Building Solution – SmartWatt
- Behavioral Solution – Not implemented in PY12
- Data Centers Targeted Market Segment – ICF
- Multifamily Targeted Market Segment – Franklin

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 (i.e., Small C&I EE and Large C&I EE), and participation rules vary according to program rules.

The Behavioral Solution was not implemented in PY12 and had no corresponding evaluation activities. Guidehouse also did not conduct any evaluation activities for the Data Centers because the solution did not have any participation in PY12.

#### 3.3.1 Participation and Reported Savings by Customer Segment

This section provides the Small C&I EE Program results for PY12, including participation, energy and demand savings, and incentive costs. Table 3-18 presents the participation counts and incentive payments for the Small C&I EE Program in PY12 by customer segment.

**Table 3-18. Small C&I EE Program Summary by Customer Segment**

Parameter	Residential	Small C&I	Large C&I
PYTD No. of Participants	0	3,944	0
PYRTD MWh/yr	0	84,865	0
PYRTD MW	0.00	11.92	0.00
PY12 Incentives (\$1,000)	\$0.00	\$5,875.26	\$0.00

Source: Guidehouse analysis

#### 3.3.2 Gross Impact Evaluation

Guidehouse conducted the gross impact evaluation for the Small C&I EE Program following the general approach outlined in its Evaluation Plan for PY12.

In PY12, the Small C&I EE Program gross impact evaluation consisted of desk reviews, phone verifications, virtual verifications,<sup>38</sup> 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 Solution:** The evaluation team conducted ex post verification activities for a sample of 44 projects in the Small C&I Equipment and Systems Solution in PY12, which meets the target set in Guidehouse’s sampling design memo.<sup>39</sup>
- **New Construction Solution:** The evaluation team applied PY11 realization rates to the PY12 reported savings.
- **Whole Building Solution:** The evaluation team applied PY11 realization rates to the PY12 reported savings.
- **Data Centers Targeted Market Segment:** There was no participation for this solution in PY12.
- **Multifamily Targeted Market Segment:** The evaluation team applied PY10 realization rates to the PY12 reported savings.

Table 3-19 provides the sampling frame for the gross impact evaluation of the Small C&I EE Program in PY12.

**Table 3-19. Small C&I EE Program Gross Impact Sample Design for PY12**

Solution	Stratum	Population Size	Targeted Sample Size	Achieved Sample Size	Verification Method
<b>Equipment and Systems</b>	Very Large	3	Census (3)	2	PY12 engineering file reviews; PY12 onsite verification with metering
	Large	35	6	6	PY12 engineering file reviews; PY12 onsite verification with metering or onsite, virtual, or phone verification
	Medium	152	6	6	PY12 engineering file reviews; PY12 onsite, virtual, or phone verification
	Small	521	8	8	PY12 engineering file reviews; PY12 phone verification
	Extra Small	366	0	0	N/A
	Midstream Large	72	6	6	PY12 engineering file reviews; PY12 onsite verification with metering or onsite, virtual, or phone verification
	Midstream Medium	394	8	8	PY12 engineering file reviews; PY12 phone verification
	Midstream Small	1,194	8	8	PY12 engineering file reviews; PY12 phone verification

<sup>38</sup> Virtual verification included virtual tours and interviews using videoconferencing.

<sup>39</sup> PECO. *PY12 Large Small CI EE Impact Sample Design Memo 03-23-21*. Dated March 23, 2021.

Solution	Stratum	Population Size	Targeted Sample Size	Achieved Sample Size	Verification Method
	Midstream Very Small	887	0	0	N/A
	<b>Solution Total</b>	<b>3,624</b>	<b>45</b>	<b>44</b>	
<b>Total Program</b>	<b>All</b>	<b>3,624</b>	<b>45</b>	<b>44</b>	

Source: Guidehouse analysis

Table 3-20 summarizes the reported and verified energy savings results, along with the CV and relative precision for each stratum sampled for the Small C&I EE Program in PY12.

**Table 3-20. Small C&I EE Program Gross Results for Energy**

Solution	Stratum	Reported Gross Energy Savings (MWh/yr)	Verified Gross Energy Savings (MWh/yr)	Energy Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
<b>Equipment and Systems</b>	Very Large	4,018	4,018	1.00	0.00	0.0%
	Large	13,636	10,932	0.80	0.46	31.6%
	Medium	15,630	14,360	0.92	0.31	21.8%
	Small	13,524	13,553	1.00	0.03	1.6%
	Extra Small	867	869	1.00	N/A	100.0%
	Midstream Large	6,100	6,673	1.09	0.25	17.6%
	Midstream Medium	7,701	10,874	1.41	0.69	39.2%
	Midstream Small	4,216	6,304	1.50	0.39	22.1%
	Midstream Very Small	313	468	1.50	N/A	100.0%
		<b>Solution Total</b>	<b>66,003</b>	<b>68,051</b>	<b>1.03</b>	<b>0.39</b>
<b>New Construction</b>	Very Large	2,184	2,224	1.02	0.00	0.0%
	Large	1,584	1,765	1.11	0.47	37.2%
	Small	1,101	1,101	1.00	0.00	0.0%
	Very Small	57	57	1.00	0.00	100.0%
		<b>Solution Total</b>	<b>4,926</b>	<b>5,147</b>	<b>1.04</b>	<b>0.26</b>
<b>Whole Building</b>	Medium	6,518	5,909	0.91	0.11	8.7%
	Small	3,015	2,887	0.96	0.08	4.2%
	Very Small	65	62	0.96	0.00	100.0%
		<b>Solution Total</b>	<b>9,598</b>	<b>8,858</b>	<b>0.92</b>	<b>0.13</b>
<b>Multifamily Targeted</b>	Small	3,551	3,499	0.99	0.10	5.6%
	Multisector	787	750	0.95	0.15	11.9%
		<b>Solution Total</b>	<b>4,338</b>	<b>4,249</b>	<b>0.98</b>	<b>0.11</b>
<b>Total Program</b>	<b>All</b>	<b>84,865</b>	<b>86,306</b>	<b>1.02</b>	<b>0.43</b>	<b>7.8% [90% CI]</b>

Source: Guidehouse analysis

Table 3-21 summarizes the reported and verified demand savings results, along with the CV and relative precision for each stratum sampled for the Small C&I EE Program in PY12.

**Table 3-21. Small C&I EE Program Gross Results for Demand**

Solution	Stratum	Reported Gross Demand Savings (MW)	Verified Gross Demand Savings (MW)	Demand Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
<b>Equipment and Systems</b>	Very Large	0.00	0.00	1.00	0.00	0.0%
	Large	1.51	0.85	0.56	0.97	67.3%
	Medium	2.42	2.09	0.86	0.76	52.7%
	Small	2.53	2.43	0.96	0.11	6.0%
	Extra Small	0.18	0.17	0.96	N/A	100.0%
	Midstream Large	0.68	0.97	1.43	0.83	57.6%
	Midstream Medium	1.04	1.62	1.55	0.70	40.0%
	Midstream Small	0.54	1.29	2.40	1.02	58.2%
	Midstream Very Small	0.06	0.15	2.40	N/A	100.0%
	<b>Solution Total</b>	<b>8.97</b>	<b>9.56</b>	<b>1.07</b>	<b>0.71</b>	<b>15.7%</b>
<b>New Construction</b>	Very Large	0.32	0.30	0.94	0.00	0.0%
	Large	0.26	0.24	0.92	0.19	14.8%
	Small	0.24	0.24	1.00	0.00	0.0%
	Very Small	0.01	0.01	1.00	0.00	100.0%
	<b>Solution Total</b>	<b>0.83</b>	<b>0.79</b>	<b>0.95</b>	<b>0.10</b>	<b>4.1%</b>
<b>Whole Building</b>	Medium	1.20	1.17	0.98	0.05	3.8%
	Small	0.57	0.60	1.05	0.09	4.8%
	Very Small	0.01	0.01	1.05	0.00	100.0%
	<b>Solution Total</b>	<b>1.79</b>	<b>1.79</b>	<b>1.00</b>	<b>0.07</b>	<b>2.7%</b>
<b>Multifamily Targeted</b>	Small	0.28	0.27	0.99	0.08	4.8%
	Multisector	0.06	0.07	1.12	0.16	13.1%
	<b>Solution Total</b>	<b>0.34</b>	<b>0.34</b>	<b>1.01</b>	<b>0.10</b>	<b>4.3%</b>
<b>Total Program</b>	<b>All</b>	<b>11.92</b>	<b>12.48</b>	<b>1.05</b>	<b>0.75</b>	<b>13.7% [90% CI]</b>

Source: Guidehouse analysis

### 3.3.3 Net Impact Evaluation

As described in the Phase III Evaluation Plan,<sup>40</sup> Guidehouse applied the PY10 NTG values to the Multifamily Targeted Market Segment and the PY11 NTG values to the Equipment and Systems, New Construction, and Whole Building Solutions. The team did not conduct NTG research in the PY12 evaluation.

<sup>40</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

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

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

Spillover is defined as 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. Guidehouse 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.

Table 3-22 summarizes the evaluation results including the reported and verified energy savings, calculated NTG results, and the CV and relative precision for each stratum sampled for the Small C&I EE Program.

**Table 3-22. Small C&I EE Programs Net Energy Savings Impact Evaluation Results for PY12**

Solution	Stratum	Verified Gross Energy Savings (MWh/yr)	Verified Net Energy Savings (MWh/yr)	Free Ridership Rate	Spillover Rate	NTG Ratio <sup>[1]</sup>	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
<b>Equipment and Systems</b> <sup>[2]</sup>	Very Large	4,018	3,415	0.62	0.47	0.85	0.72	69.0%
	Large	10,932	9,292	0.62	0.47	0.85		
	Medium	14,360	9,765	0.32	0.00	0.68	0.52	24.6%
	Small	13,553	10,436	0.26	0.03	0.77	0.39	13.5%
	Extra Small	869	669	0.26	0.03	0.77	0.39	13.5%
	Midstream Large	6,673	5,605	0.16	0.00	0.84	N/A	N/A
	Midstream Medium	10,874	8,373	0.23	0.00	0.77	N/A	N/A
	Midstream Small	6,304	4,854	0.23	0.00	0.77	N/A	N/A
	Midstream Very Small	468	361	0.23	0.00	0.77	N/A	N/A
<b>Solution Total</b>		<b>68,051</b>	<b>52,770</b>	<b>0.33</b>	<b>0.11</b>	<b>0.78</b>	<b>0.68</b>	<b>17.3%</b>
<b>New Construction</b>	Very Large	2,224	734	0.67	0.00	0.33	0.66	32.7%
	Large	1,765	582	0.67	0.00	0.33		
	Small	1,101	363	0.67	0.00	0.33		
	Very Small	57	19	0.67	0.00	0.33		
	<b>Solution Total</b>		<b>5,147</b>	<b>1,699</b>	<b>0.67</b>	<b>0.00</b>	<b>0.33</b>	<b>0.66</b>
<b>Whole Building</b>	Medium	5,909	5,023	0.20	0.05	0.85	0.17	10.5%
	Small	2,887	2,685	0.08	0.00	0.93	0.15	4.4%
	Very Small	62	77	0.04	0.28	1.24	0.38	26.2%
	<b>Solution Total</b>		<b>8,858</b>	<b>7,785</b>	<b>0.16</b>	<b>0.04</b>	<b>0.88</b>	<b>0.21</b>
<b>Multifamily Targeted</b>	Small	3,499	2,828	0.19	0.00	0.81	0.30	17.2%
	Multisector	750	606	0.19	0.00	0.81		
	<b>Solution Total</b>		<b>4,249</b>	<b>3,434</b>	<b>0.19</b>	<b>0.00</b>	<b>0.81</b>	<b>0.30</b>
<b>Total Program</b>	<b>All</b>	<b>86,306</b>	<b>65,687</b>	<b>0.33</b>	<b>0.09</b>	<b>0.76</b>	<b>0.85</b>	<b>14.7% [90% CI]</b>

<sup>[1]</sup> Guidehouse applied stratum-level NTG results from PY11 to the Small C&I Equipment and Systems, New Construction, and Whole Building Solutions. For the Small C&I Multifamily Targeted Market Segment, Guidehouse applied stratum-level NTG results from PY10.

Source: Guidehouse analysis

### 3.3.4 Process Evaluation

As described in the Phase III Evaluation Plan<sup>41</sup> updated for PY12 and approved by the SWE, Guidehouse did not conduct in-depth process evaluation activities for the Small C&I EE Program. Instead, the team interviewed the PECO program manager and CSP staff to identify significant implementation changes to inform the impact evaluation activities. No significant changes were found. The team carried out in-depth process evaluations in prior program years.

Based on the program manager and CSP staff interviews, the evaluation team found that communication remained a strength of the program throughout the pandemic as the pandemic-related installation delays continued.

### 3.3.5 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-23. Guidehouse calculated TRC benefits using gross verified impacts. Costs and benefits for PYTD results are expressed in 2020 dollars while P3TD values are expressed as an NPV in 2016 dollars using a discount rate of 7.6%.

**Table 3-23. Summary of Small C&I EE Program Finances – Gross Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$7,409	\$18,444
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$24,622	\$63,672
	<b>Cost Subtotal</b>	<b>\$32,032</b>	<b>\$82,116</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$170	\$836
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$2,753	\$8,133
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$3,202	\$11,782
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
<b>Cost Subtotal</b>	<b>\$6,125</b>	<b>\$20,751</b>	
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>

<sup>41</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.



Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$38,156</b>	<b>\$102,867</b>
	Lifetime Electric Energy Benefits	\$26,630	\$71,493
	Lifetime Electric Capacity Benefits	\$9,533	\$27,430
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	-\$990	-\$891
	<b>Benefits Total</b>	<b>\$35,174</b>	<b>\$98,032</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.92</b>	<b>0.95</b>

<sup>[1]</sup> Includes direct install equipment costs.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

<sup>[4]</sup> 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.

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

Table 3-24 presents program financials and cost-effectiveness on a net savings basis.

**Table 3-24. Summary of Small C&I EE Program Finances – Net Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$7,409	\$18,444
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$17,311	\$42,651
	<b>Cost Subtotal</b>	<b>\$24,720</b>	<b>\$61,095</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$170	\$836
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$2,753	\$8,133
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$3,202	\$11,782
	EDC Evaluation Costs	\$0	\$0

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
	SWE Audit Costs	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$6,125</b>	<b>\$20,751</b>
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$30,845</b>	<b>\$81,845</b>
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$20,233	\$54,137
	Lifetime Electric Capacity Benefits	\$7,247	\$20,739
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	-\$811	-\$872
	<b>Benefits Total</b>	<b>\$26,669</b>	<b>\$74,005</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.86</b>	<b>0.90</b>

<sup>[1]</sup> Includes direct install equipment costs.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

<sup>[4]</sup> 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.

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

### 3.3.6 Status of Recommendations

The evaluation activities in PY12 led to several findings and recommendations from Guidehouse to PECO. Table 3-25 presents those solution-level findings and recommendations along with a summary of how PECO plans to address the recommendations in program delivery. Additional details on the solution-level analysis activities that led to these findings and recommendations can be found in Appendix H.

**Table 3-25. Summary of Findings and Recommendations for the Small C&I EE Program**

Solution	Finding	Recommendation	EDC Status
<b>Equipment and Systems</b>	Of the three total prescriptive HVAC projects sampled, Guidehouse identified one prescriptive chiller project that claimed twice the full load hours as deemed in the TRM, but did not provide any documentation to support the updated full load hours. Similarly, another prescriptive cooling project claimed a custom baseline and did not provide documentation to support the efficiency or system performance assumptions.	Require customers to provide documentation or justification when using custom assumptions for open variables instead of using the deemed parameters in the TRM.	Recommendation implemented for Phase IV.
<b>Equipment and Systems</b>	Guidehouse identified four sampled projects where the verified lighting fixture wattage were different than the reported values.	For direct load control (DLC) lamps, use the DLC tested wattage from the DLC Qualified Products List (QPL) whenever possible. When the tested wattage from the DLC is not available, use the wattage tracked in the DLC QPL or the ENERGY STAR QPL. Wattages from manufacturer's specifications should be used as a last resort.	Recommendation implemented for Phase IV.

Source: Guidehouse analysis

### 3.4 Large C&I EE Program

The Large C&I EE Program offers a crosscutting 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, listed with the implementers below:

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

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. These solutions cut across multiple programs (i.e., Small C&I EE and Large C&I EE), and participation rules vary according to program rules.

Guidehouse did not conduct any evaluation activities for the Data Centers Targeted Market Segment in PY12 because there was no participation in the Large sector.

#### 3.4.1 Participation and Reported Savings by Customer Segment

This section provides the Large C&I EE Program results for PY12, including participation, energy and demand savings, and incentive costs. Table 3-26 presents the participation counts and incentive payments for the Large C&I EE Program in PY12 by customer segment.

**Table 3-26. Large C&I EE Program Summary by Customer Segment**

Parameter	Residential	Small C&I	Large C&I
PYTD No. of Participants	0	0	2,031
PYRTD MWh/yr	0	0	117,556
PYRTD MW	0.00	0.00	31.51
PY12 Incentives (\$1,000)	\$0.00	\$0.00	\$8,133.69

Source: Guidehouse analysis

#### 3.4.2 Gross Impact Evaluation

Guidehouse conducted the gross impact evaluation for the Large C&I EE Program following the general approach outlined in its Evaluation Plan for PY12.<sup>42</sup>

In PY12, the Large C&I EE Program gross impact evaluation consisted of desk reviews, phone verifications, virtual verifications,<sup>43</sup> onsite verifications, and onsite metering for a sample of projects. Summaries of verification activities for each solution and targeted market segment follow:

<sup>42</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

<sup>43</sup> Virtual verification included virtual tours and interviews using videoconferencing software

- **Equipment and Systems Solution:** The evaluation team conducted ex post verification activities for a sample of 52 projects in the Large C&I Equipment and Systems Solution in PY12, which exceeds the target set in the sample design memo.<sup>44</sup>
- **New Construction Solution:** The evaluation team applied PY11 realization rates to the PY12 reported savings.
- **Data Centers Targeted Market Segment:** The evaluation team applied PY10 realization rates to the PY12 reported savings.
- **Multifamily Targeted Market Segment:** The evaluation team applied PY10 realization rates to the PY12 reported savings.

Table 3-27 provides the sampling frame for the gross impact evaluation of the Large C&I EE Program in PY12.

**Table 3-27. Large C&I EE Program Gross Impact Sample Design for PY12**

Solution	Stratum	Population Size	Targeted Sample Size	Achieved Sample Size	Verification Method
<b>Equipment and Systems</b>	Very Large	3	Census (3)	3	PY12 engineering file reviews; PY12 onsite verification with metering
	Large	27	4	5	PY12 engineering file reviews; PY12 onsite verification with metering or onsite, virtual, or phone verification
	Medium	68	6	6	PY12 engineering file reviews; PY12 onsite verification with metering or onsite, virtual, or phone verification
	Small	285	6	8	PY12 engineering file reviews; PY12 phone verification
	RCx	8	6	5	PY12 engineering file reviews; PY12 onsite verification with metering or onsite, virtual, or phone verification
	Extra Small	139	0	0	N/A
	Midstream Large	35	6	8	PY12 engineering file reviews; PY12 onsite verification with metering or onsite, virtual, or phone verification
	Midstream Medium	147	8	7	PY12 engineering file reviews; PY12 phone verification
	Midstream Small	684	10	10	PY12 engineering file reviews; PY12 phone verification
	Midstream Very Small	549	0	0	N/A
<b>Solution Total</b>		<b>1,945</b>	<b>49</b>	<b>52</b>	
<b>Total Program</b>	<b>All</b>	<b>1,945</b>	<b>49</b>	<b>52</b>	

Source: Guidehouse analysis

<sup>44</sup> PECO. PY12 Large Small CI EE Impact Sample Design Memo 03-23-21. Dated March 23, 2021.

Table 3-28 summarizes the reported and verified energy savings results, along with the CV and relative precision for each stratum sampled for the Large C&I EE Program in PY12.

**Table 3-28. Large C&I EE Program Gross Results for Energy**

Solution	Stratum	Reported Gross Energy Savings (MWh/yr)	Verified Gross Energy Savings (MWh/yr)	Energy Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
<b>Equipment and Systems</b>	Very Large	8,444	8,683	1.03	0.00	0.0%
	Large	25,714	21,381	0.83	0.19	14.7%
	Medium	27,281	27,407	1.00	0.14	9.4%
	Small	29,201	24,465	0.84	0.94	54.0%
	Extra Small	1,389	1,164	0.84	N/A	100.0%
	RCx	2,736	2,922	1.07	0.45	35.5%
	Midstream Large	3,772	3,645	0.97	0.72	41.0%
	Midstream Medium	3,322	3,642	1.10	0.14	8.5%
	Midstream Small	2,341	2,425	1.04	0.16	8.2%
	Midstream Very Small	190	197	1.04	N/A	100.0%
	<b>Solution Total</b>		<b>104,391</b>	<b>95,929</b>	<b>0.92</b>	<b>0.65</b>
<b>New Construction</b>	Small	8,715	11,879	1.36	0.58	25.8%
	Very Small	300	409	1.36	0.00	100.0%
	<b>Solution Total</b>	<b>9,015</b>	<b>12,288</b>	<b>1.36</b>	<b>0.56</b>	<b>25.2%</b>
<b>Data Centers</b>	Large	10	6	0.60	0.00	0.0%
	<b>Solution Total</b>	<b>10</b>	<b>6</b>	<b>0.60</b>	<b>0.00</b>	<b>0.0%</b>
<b>Multifamily Targeted</b>	Large	4,140	4,119	0.99	0.08	5.5%
	<b>Solution Total</b>	<b>4,140</b>	<b>4,119</b>	<b>0.99</b>	<b>0.08</b>	<b>5.5%</b>
<b>Total Program</b>	<b>All</b>	<b>117,556</b>	<b>112,341</b>	<b>0.96</b>	<b>0.66</b>	<b>13.1% [90% CI]</b>

Source: Guidehouse analysis

Table 3-29 summarizes the reported and verified demand savings results, along with the CV and relative precision for each stratum sampled for the Large C&I EE Program in PY12.

**Table 3-29. Large C&I EE Program Gross Results for Demand**

Solution	Stratum	Reported Gross Demand Savings (MW)	Verified Gross Demand Savings (MW)	Demand Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
<b>Equipment and Systems</b>	Very Large	1.13	1.36	1.20	0.00	0.0%
	Large	4.14	3.37	0.81	0.24	19.4%
	Medium	4.50	5.52	1.23	0.44	30.6%
	Small	17.68	11.77	0.67	0.29	16.6%
	Extra Small	0.31	0.21	0.67	N/A	100.0%
	RCx	0.37	0.12	0.34	0.63	50.5%
	Midstream Large	0.50	0.65	1.30	0.80	45.9%
	Midstream Medium	0.46	0.63	1.35	0.44	27.3%
	Midstream Small	0.34	0.39	1.14	0.45	22.4%
	Midstream Very Small	0.03	0.04	1.14	N/A	100.0%
	<b>Solution Total</b>	<b>29.46</b>	<b>24.06</b>	<b>0.82</b>	<b>0.49</b>	<b>9.9%</b>
<b>New Construction</b>	Small	1.47	2.14	1.45	0.54	24.2%
	Very Small	0.06	0.08	1.45	0.00	100.0%
	<b>Solution Total</b>	<b>1.53</b>	<b>2.22</b>	<b>1.45</b>	<b>0.53</b>	<b>23.6%</b>
<b>Data Centers</b>	Large	0.00	0.00	0.61	0.00	0.0%
	<b>Solution Total</b>	<b>0.00</b>	<b>0.00</b>	<b>0.61</b>	<b>0.00</b>	<b>0.0%</b>
<b>Multifamily Targeted</b>	Large	0.53	0.50	0.95	0.08	5.7%
	<b>Solution Total</b>	<b>0.53</b>	<b>0.50</b>	<b>0.95</b>	<b>0.08</b>	<b>5.7%</b>
<b>Total Program</b>	<b>All</b>	<b>31.51</b>	<b>26.78</b>	<b>0.85</b>	<b>0.52</b>	<b>10.4% [90% CI]</b>

Source: Guidehouse analysis

### 3.4.3 Net Impact Evaluation

Net impacts were not assessed for the Large C&I EE Program in PY12. Instead Guidehouse relied on NTG values from PY10 to the Multifamily Targeted Market Segment and PY11 for the Equipment and Systems, New Construction, and Whole Building Solutions.

Table 3-30 summarizes the evaluation results including the reported and verified energy savings, calculated NTG results, and the CV and relative precision for each stratum sampled for the Large C&I EE Program.

**Table 3-30. Large C&I EE Program Net Energy Savings Impact Evaluation Results for PY12**

Solution	Stratum	Verified Gross Energy Savings (MWh/yr)	Verified Net Energy Savings (MWh/yr)	Free Ridership Rate	Spillover Rate	NTG Ratio <sup>[1]</sup>	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
<b>Equipment and Systems</b> <sup>[2]</sup>	Very Large	8,683	4,168	0.52	0.00	0.48	0.14	11.5%
	Large	21,381	10,263	0.52	0.00	0.48		
	Medium	27,407	16,170	0.41	0.00	0.59	0.59	37.0%
	Small	24,465	18,104	0.37	0.11	0.74	0.38	14.8%
	Extra Small	1,164	861	0.37	0.11	0.74		
	RCx	2,922	1,636	0.44	0.00	0.56	N/A	N/A
	Midstream Large	3,645	2,734	0.26	0.01	0.75	N/A	N/A
	Midstream Medium	3,642	2,732	0.26	0.01	0.75	N/A	N/A
	Midstream Small	2,425	1,625	0.34	0.01	0.67	N/A	N/A
	Midstream Very Small	197	132	0.34	0.01	0.67	N/A	N/A
<b>Solution Total</b>		<b>95,929</b>	<b>58,423</b>	<b>0.42</b>	<b>0.03</b>	<b>0.61</b>	<b>0.33</b>	<b>9.4%</b>
<b>New Construction</b>	Small	11,879	5,702	0.58	0.06	0.48	0.46	24.2%
	Very Small	409	196	0.58	0.06	0.48		
	<b>Solution Total</b>	<b>12,288</b>	<b>5,898</b>	<b>0.58</b>	<b>0.06</b>	<b>0.48</b>	<b>0.46</b>	<b>24.2%</b>
<b>Data Centers</b>	Large	6	4	0.34	0.01	0.67	0.00	0.0%
	<b>Solution Total</b>	<b>6</b>	<b>4</b>	<b>0.34</b>	<b>0.01</b>	<b>0.67</b>	<b>0.00</b>	<b>0.0%</b>
<b>Multifamily Targeted</b>	Large	4,119	3,328	0.19	0.00	0.81	0.30	17.2%
	<b>Solution Total</b>	<b>4,119</b>	<b>3,328</b>	<b>0.19</b>	<b>0.00</b>	<b>0.81</b>	<b>0.30</b>	<b>17.2%</b>
<b>Total Program</b>	<b>All</b>	<b>112,341</b>	<b>67,654</b>	<b>0.43</b>	<b>0.03</b>	<b>0.60</b>	<b>0.38</b>	<b>9.6% [90% CI]</b>

<sup>[1]</sup> Guidehouse conducted NTG research in PY11 for the Large C&I Equipment and Systems and New Construction Solutions.

<sup>[2]</sup> For the Midstream Large, Small, and Very Small strata of the Equipment and Systems Solution, Guidehouse applied the NTG values listed in the PY10 Annual Report.

Source: Guidehouse analysis



### 3.4.4 Process Evaluation

As described in the Phase III Evaluation Plan<sup>45</sup> updated for PY12 and approved by the SWE, Guidehouse did not conduct in-depth process evaluation activities for the Large C&I EE Program. Instead, the team interviewed the PECO program manager and CSP staff to identify significant implementation changes to inform the impact evaluation activities. No significant changes were found. The team carried out in-depth process evaluations in prior program years.

As with the Small C&I Program, based on the program manager and CSP staff interviews, the evaluation team found that communication remained a strength of the program throughout the pandemic as the pandemic continued to cause some installation delays.

### 3.4.5 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-31. Guidehouse calculated TRC benefits using gross verified impacts. Costs and benefits for PYTD results are expressed in 2020 dollars, while P3TD values are expressed as an NPV in 2016 dollars using a discount rate of 7.6%.

**Table 3-31. Summary of Large C&I EE Program Finances – Gross Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$8,428	\$21,653
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$49,643	\$131,835
	<b>Cost Subtotal</b>	<b>\$58,071</b>	<b>\$153,488</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$76	\$509
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$1,200	\$4,855
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$5,092	\$19,527
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
<b>Cost Subtotal</b>	<b>\$6,368</b>	<b>\$24,891</b>	

<sup>45</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$64,439</b>	<b>\$178,380</b>
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$38,680	\$122,190
	Lifetime Electric Capacity Benefits	\$21,612	\$49,338
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	-\$1,566	-\$3,297
	<b>Benefits Total</b>	<b>\$58,726</b>	<b>\$168,256230</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.91</b>	<b>0.94</b>

<sup>[1]</sup> Includes direct install equipment costs.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

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

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

Table 3-32 presents program financials and cost-effectiveness on a net savings basis.

**Table 3-32. Summary of Large C&I EE Program Finances – Net Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$8,428	\$21,653
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$25,840	\$78,123
	<b>Cost Subtotal</b>	<b>\$34,269</b>	<b>\$99,776</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$76	\$509
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$1,200	\$4,855
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$5,092	\$19,527
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$6,368</b>	<b>\$24,891</b>
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$40,637</b>	<b>\$124,667</b>
	Lifetime Electric Energy Benefits	\$23,026	\$81,079
	Lifetime Electric Capacity Benefits	\$12,943	\$32,155
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	-\$872	-\$2,188
	<b>Benefits Total</b>	<b>\$35,097</b>	<b>\$111,046</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.86</b>	<b>0.89</b>

<sup>[1]</sup> Includes direct install equipment costs.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

<sup>[4]</sup> 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.

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

### 3.4.6 Status of Recommendations

The evaluation activities in PY12 led to several findings and recommendations from Guidehouse to PECO. Table 3-33 presents those solution-level findings and recommendations along with a summary of how PECO plans to address the recommendations in program delivery. Additional details on the solution-level analysis activities that led to these findings and recommendations can be found in Appendix H.

**Table 3-33. Summary of Findings and Recommendations for the Large C&I EE Program**

Solution	Finding	Recommendation	EDC Status
<b>Midstream Lighting</b>	<p>Guidehouse identified two midstream lighting projects (out of 25 sampled midstream lighting projects in the Large C&amp;I sector) that double-counted the same lighting fixtures through two different pathways (midstream LED aggregation and prescriptive). The team therefore verified zero energy and demand savings for the projects within the midstream LED aggregation pathway. Through the evaluation, the team found that these lighting fixtures were sold to a contractor or customer and incented through the midstream LED aggregation pathway, and then were later installed and included within a large aggregated prescriptive project and incentivized again through the standard Equipment and Systems prescriptive pathway.</p>	<p>Incorporate additional QA/QC processes to identify fixtures or lamps already incented through another pathway and disqualify them from receiving incentive twice. As an example, this could include a flag based on business name, customer or contractor name, or account or premise ID to identify projects that require additional review to ensure no double-counting is present.</p> <p>Clearly distinguish projects incented through the various midstream pathways in program tracking data. This could be through an additional field, or through a flag in an existing field.</p>	<p>In progress. PECO reviewed this finding and recommendation with the Phase IV CSP and an additional QA/QC process has been established to prevent double counting of savings and incentives.</p>
<b>Equipment and Systems</b>	<p>Of the three total prescriptive HVAC projects sampled, Guidehouse identified one prescriptive chiller project that claimed twice the full load hours as deemed in the TRM, but did not provide any documentation to support the updated full load hours. Similarly, another prescriptive cooling project claimed a custom baseline and did not provide documentation to support the efficiency or system performance assumptions.</p>	<p>Require customers to provide documentation or justification when using custom assumptions for open variables instead of using the deemed parameters in the TRM.</p>	<p>Recommendation implemented for Phase IV.</p>
<b>Equipment and Systems</b>	<p>Guidehouse identified four sampled projects where the verified lighting fixture wattage were different than the reported values.</p>	<p>For DLC lamps, use the DLC tested wattage from the DLC Qualified Products List (QPL) whenever possible. When the tested wattage from the DLC is not available, use the wattage tracked in the DLC QPL or the ENERGY STAR QPL. Wattages from manufacturer's specifications should be used as a last resort.</p>	<p>Recommendation implemented for Phase IV.</p>

Source: Guidehouse analysis

## 3.5 CHP Program

The PECO 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 accomplish 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 confirm that participating customers install CHP projects that maximize operational savings and minimize operations and maintenance (O&M) costs.

The CHP Program has two types of incentives distributed once the project is deemed commercially operable:

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

PECO delivers the program directly through a rolling enrollment process. Projects deemed to have a high probability of starting normal operation prior to the close of Phase III are enrolled in the program and are provided a reservation letter for the anticipated incentive amount.

### 3.5.1 Participation and Reported Savings by Customer Segment

This section provides the total CHP Program results for PY12, including participation, energy and demand savings, and incentive costs. Table 3-34 presents the participation counts and incentive payments for the CHP Program in PY12 by customer segment.

**Table 3-34. CHP Program Summary by Customer Segment**

Parameter	Residential	Small C&I	Large C&I
PYTD No. of Participants	0	0	2
PYRTD MWh/yr	0	0	202,434
PYRTD MW	0	0	10.06
PY12 Incentives (\$1,000)	\$0.00	\$0.00	\$2,027.99

Source: Guidehouse analysis

### 3.5.2 Gross Impact Evaluation

The CHP Program reported two participants in PY12. Participants in the CHP Program are required to log the parameters necessary to calculate electricity generation net of parasitic loads (such as pumps necessary to operate the heat recovery systems) and thermal energy recovery.

The evaluation team relies on this data to estimate the system capacity and annual generation on which PECO bases its capacity and performance incentives.

The gross impact evaluation involved a desktop review of interval data and system as-built project documentation. Guidehouse calculated gross impacts according to the CHP chapter of the Uniform Methods Project.<sup>46</sup> In consultation with the SWE, the evaluation team decided against onsite verification because of the pandemic and the quality of the customer's interval data. Instead, the team conducted virtual site visits with the program participant to verify installation and interviews with the PECO program manager.

Table 3-35 summarizes the reported and verified energy savings results, along with the CV and relative precision for the CHP Program in PY12.

**Table 3-35. CHP Program Gross Results for Energy**

Solution	Stratum	Reported Gross Energy Savings (MWh/yr)	Verified Gross Energy Savings (MWh/yr)	Energy Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
CHP	Census	202,434	165,298	0.82	0.00	0.0%
<b>Total Program</b>	<b>All</b>	<b>202,434</b>	<b>165,298</b>	<b>0.82</b>	<b>0.00</b>	<b>0.0%</b>

Source: Guidehouse analysis

Table 3-36 summarizes the reported and verified demand savings results, along with the CV and relative precision for the CHP Program in PY12.

**Table 3-36. CHP Program Gross Results for Demand**

Solution	Stratum	Reported Gross Demand Savings (MW)	Verified Gross Demand Savings (MW)	Demand Realization Rate	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
CHP	Census	10.06	19.67	1.95	0.00	0.0%
<b>Total Program</b>	<b>All</b>	<b>10.06</b>	<b>19.67</b>	<b>1.95</b>	<b>0.00</b>	<b>0.0%</b>

Source: Guidehouse analysis

The variations between the reported and verified savings for the CHP Program are reasonable given the complexity of these systems and uncertainty in their early operational periods. The main driver for the low energy realization rate is abnormally high energy production during the interval used in the reported savings analysis. The demand realization rate is high because the implementer claimed the incentive-eligible portion of the available demand savings. Verified savings were based on the total calculated demand value.

<sup>46</sup> Simons, G.; Barsun, S. "Chapter 23: Combined Heat and Power Evaluation Protocol," *The Uniform Methods Project: Methods for Determining Energy-Efficiency Savings for Specific Measures*. 2017. National Renewable Energy Laboratory. <http://www.nrel.gov/docs/fy17osti/68579.pdf>.

### 3.5.3 Net Impact Evaluation

Guidehouse used the PY10 results for free ridership and spillover. These values were determined using survey instruments consistent with the Phase III Evaluation Framework's guidance on net impact evaluation techniques<sup>47</sup> and guidance from the Energy Trust of Oregon's NTG methodology.<sup>48</sup>

Table 3-37 summarizes the reported and verified energy savings results, the calculated NTG results, and the CV and relative precision for the CHP Program in PY12.

**Table 3-37. CHP Program Net Energy Savings Impact Evaluation Results for PY12**

Solution	Stratum	Verified Gross Energy Savings (MWh/yr)	Verified Net Energy Savings (MWh/yr)	Free Ridership Rate	Spillover Rate	NTG Ratio	Achieved Sample CV or Error Ratio	Relative Precision at 85% Confidence Interval
CHP	Census	165,298	143,810	0.13	0.0	0.87	0.00	0.0%
<b>Total Program</b>	<b>All</b>	<b>165,298</b>	<b>143,810</b>	<b>0.13</b>	<b>0.0</b>	<b>0.87</b>	<b>0.00</b>	<b>0.0%</b>

Source: Guidehouse analysis

### 3.5.4 Process Evaluation

As described in the Phase III Evaluation Plan<sup>49</sup> updated for PY12 and approved by the SWE, Guidehouse did not conduct in-depth process evaluation activities for the CHP Program. Instead, the team interviewed the PECO program manager and CSP staff to identify significant implementation changes to inform the impact evaluation activities. No significant changes were found. The team carried out in-depth process evaluations in prior program years.

### 3.5.5 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-38. Guidehouse calculated TRC benefits using gross verified impacts. Costs and benefits for PYTD results are expressed in 2020 dollars, while P3TD values are expressed as an NPV in 2016 dollars using a discount rate of 7.6%.

<sup>47</sup> PA PUC. "Section 3.4." *Phase III Evaluation Framework*. October 21, 2016.

[http://www.puc.pa.gov/Electric/pdf/Act129/SWE\\_PhaseIII-Evaluation\\_Framework102616.pdf](http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf).

<sup>48</sup> Phil Degens and Sarah Castor. *Energy Trust Free Ridership Methodology*. Energy Trust of Oregon. August 7, 2013.

<sup>49</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

**Table 3-38. Summary of CHP Program Finances – Gross Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$2,028	\$2,511
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$81,212	\$68,613
	<b>Cost Subtotal</b>	<b>\$83,240</b>	<b>\$71,125</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$0	\$0
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$9	\$90
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
<b>Cost Subtotal</b>	<b>\$9</b>	<b>\$90</b>	
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$25,007	\$25,785
	<b>Cost Subtotal</b>	<b>\$25,007</b>	<b>\$25,785</b>
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$108,256</b>	<b>\$96,999</b>
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$71,576	\$60,760
	Lifetime Electric Capacity Benefits	\$18,372	\$15,712
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$0	\$0
	<b>Benefits Total</b>	<b>\$89,948</b>	<b>\$76,472</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.83</b>	<b>0.79</b>

<sup>[1]</sup> Includes direct install equipment costs.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

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

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis



Table 3-39 presents program financials and cost-effectiveness on a net savings basis.

**Table 3-39. Summary of CHP Program Finances – Net Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants <sup>[1]</sup>	\$2,028	\$2,511
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$70,391	\$59,510
	<b>Cost Subtotal</b>	<b>\$72,419</b>	<b>\$62,021</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Design and Development (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[3]</sup>	\$0	\$0
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[3]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[4]</sup>	\$0	\$0
	Marketing (CSP Costs) <sup>[4]</sup>	\$0	\$0
	Program Delivery (EDC Costs) <sup>[5]</sup>	\$0	\$0
	Program Delivery (CSP Costs) <sup>[5]</sup>	\$9	\$90
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
<b>Cost Subtotal</b>	<b>\$9</b>	<b>\$90</b>	
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$21,756	\$22,466
	<b>Cost Subtotal</b>	<b>\$21,756</b>	<b>\$22,466</b>
<b>Total NPV of Costs <sup>[6]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$94,183</b>	<b>\$84,577</b>
<b>Total NPV of Benefits <sup>[7]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$62,271	\$52,909
	Lifetime Electric Capacity Benefits	\$15,984	\$13,683
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$0	\$0
	<b>Benefits Total</b>	<b>\$78,254</b>	<b>\$66,592</b>
<b>TRC Benefit-Cost Ratio <sup>[8]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.83</b>	<b>0.79</b>

<sup>[1]</sup> Includes direct install equipment cost.

<sup>[2]</sup> Includes direct costs attributable to planning and advancing the programs.

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

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

<sup>[5]</sup> Direct program implementation costs and labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

<sup>[6]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[7]</sup> Total TRC Benefits equal 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 a 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.

<sup>[8]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

### **3.5.6 Status of Recommendations**

Guidehouse does not have recommendations specific to the CHP Program at this time.

## 3.6 DR Programs

PECO's DR Programs include Residential DR, Small C&I DR, and Large C&I DR. These three programs encompass opportunities designed to engage customers across all sectors to reduce demand.

The Residential DR Program's eligible population and target markets are all PECO residential electric customers. The program encompasses three solutions:

- Residential Direct Load Control (DLC)
- Smart Thermostat for DR Savings
- Behavioral DR Savings

Only the Residential DLC Solution is active. The Residential DLC Solution is implemented by Itron (formerly Comverge). It was designed to shift participant loads from peak to off-peak hours by cycling their central AC during DR events by 50%. The PY12 summer DR events had over 53,000 residential participants. In PY12, as in PY11, participants received an incentive of \$40 per DLC unit per year.

PECO designed its Small C&I DR Program to engage customers to reduce demand 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; this includes customers in the G/E/NP segment.

The Small C&I DLC Solution is implemented by Itron (formerly Comverge). The program shifts load to off-peak hours by cycling participant AC units by 50% during DR event days. The PY12 summer DR events had over 1,300 Small C&I participants. In PY12 as in PY11, participants received an incentive of \$40 per DLC unit per year.

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, and is implemented by two CSPs: Enel X (formerly EnerNOC) and CPower.

For Phase III, event days for all programs are called when the PJM day-ahead peak load forecast reaches 96%. Based on the day-ahead forecasts, PECO called five events during the summer of 2020: July 20, July 27, July 29, August 25, and August 27.

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 T&D losses. The peak demand impacts presented in this section have been adjusted for line losses.

PECO voluntarily implemented PY12 DR activities per PA PUC.<sup>50</sup> In PY12, PECO operated all DR programs as normal, except for event start time and duration for the AC Saver program. AC

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<sup>50</sup> Petition to Amend the Commission's June 19, 2015 Implementation Order. M-2014-2424864. May 21, 2020. <https://www.puc.pa.gov/pcdocs/1665150.docx>.

Saver curtailment events were shortened to 2 hours and were started 1 hour after the Large C&I program events. No changes to planned evaluation activities occurred due to the pandemic.

### 3.6.1 Participation and Reported Savings by Customer Segment

Table 3-40 presents the participation counts, reported peak demand savings, and EDC expenditures for the three DR programs in PY12 by customer segment.

**Table 3-40. PY12 DR Program Summary by Customer Segment**

Parameter	Residential (Residential DR Program)	Small C&I (Small C&I DR Program)	Large C&I (Large C&I DR Program)
PYTD No. of Participants	50,919	1,517	356
PYRTD MWh/yr	0	0	0
PYRTD MW	27.04	0.69	132.81
PY12 Incentives (\$1,000)	\$2,373.33	\$91.75	\$0.09

Source: Guidehouse analysis

### 3.6.2 Gross Impact Evaluation

The standalone DR report,<sup>51</sup> submitted to the PA PUC on March 15, 2021, details the impact evaluation methodology and results. Table 3-41 lists the days that DR events were called along with the verified gross demand reductions achieved by each event. It also lists the average DR performance for PY12 and for P3TD. PECO's average compliance DR performance (PY9-PY11) is 167.13 MW, which exceeds the Phase III compliance reduction target of 161 MW by 3.8% (103.8% of target achieved to date).

**Table 3-41. PY12 DR PYVTD Performance by Event**

PY	Event Date	Residential DR (MW)	Small C&I DR (MW)	Large C&I DR (MW)	Portfolio (MW)	Relative Precision at 90% Confidence Interval
PY9	June 13, 2017	39.53	0.00	127.97	167.50	10.9%
PY9	July 20, 2017	33.48	0.00	121.89	155.37	11.0%
PY9	July 21, 2017	23.34	0.00	140.83	164.17	10.3%
PY10	July 2, 2018	38.93	0.00	149.25	188.18	10.2%
PY10	July 3, 2018	33.84	0.00	144.67	178.51	10.7%
PY10	August 6, 2018	25.07	1.15	175.12	201.34	10.6%
PY10	August 28, 2018	30.69	0.92	159.52	191.12	11.3%
PY10	September 4, 2018	29.99	0.77	137.79	168.55	11.4%
PY10	September 5, 2018	29.52	0.84	129.54	159.91	11.9%
PY11	July 17, 2019	34.36	0.86	120.04	155.26	6.1%
PY11	July 18, 2019	11.06	1.02	121.63	133.71	5.9%

<sup>51</sup> PECO. *Annual Report to the Pennsylvania Public Utility Commission Demand Response Performance Report Only*. March 15, 2021. <https://www.peco.com/SiteCollectionDocuments/PhaseIIIAct29PY12.pdf>.

PY	Event Date	Residential DR (MW)	Small C&I DR (MW)	Large C&I DR (MW)	Portfolio (MW)	Relative Precision at 90% Confidence Interval
PY11	July 19, 2019	34.93	1.18	120.89	157.00	5.8%
PY11	August 19, 2019	24.90	0.98	126.17	152.05	5.6%
PY12	July 20, 2020	30.24	1.08	147.31	178.63	7.5%
PY12	July 27, 2020	28.58	0.66	139.01	168.25	8.2%
PY12	July 29, 2020	27.48	0.46	150.48	178.42	6.7%
PY12	August 25, 2020	23.07	0.90	117.09	141.06	8.4%
PY12	August 27, 2020	25.82	0.33	110.17	136.32	9.2%
<b>PYVTD – Average PY12 DR Event Performance</b>		<b>27.04</b>	<b>0.69</b>	<b>132.81</b>	<b>160.54</b>	<b>7.9%</b>
<b>VTD – Average Phase III DR Event Performance<sup>52</sup></b>		<b>29.16</b>	<b>0.62</b>	<b>135.52</b>	<b>165.30</b>	<b>9.5%</b>
<b>Compliance Value (PY9-PY11) – Average Performance</b>		<b>29.97</b>	<b>0.59</b>	<b>136.56</b>	<b>167.13</b>	<b>10.0%</b>

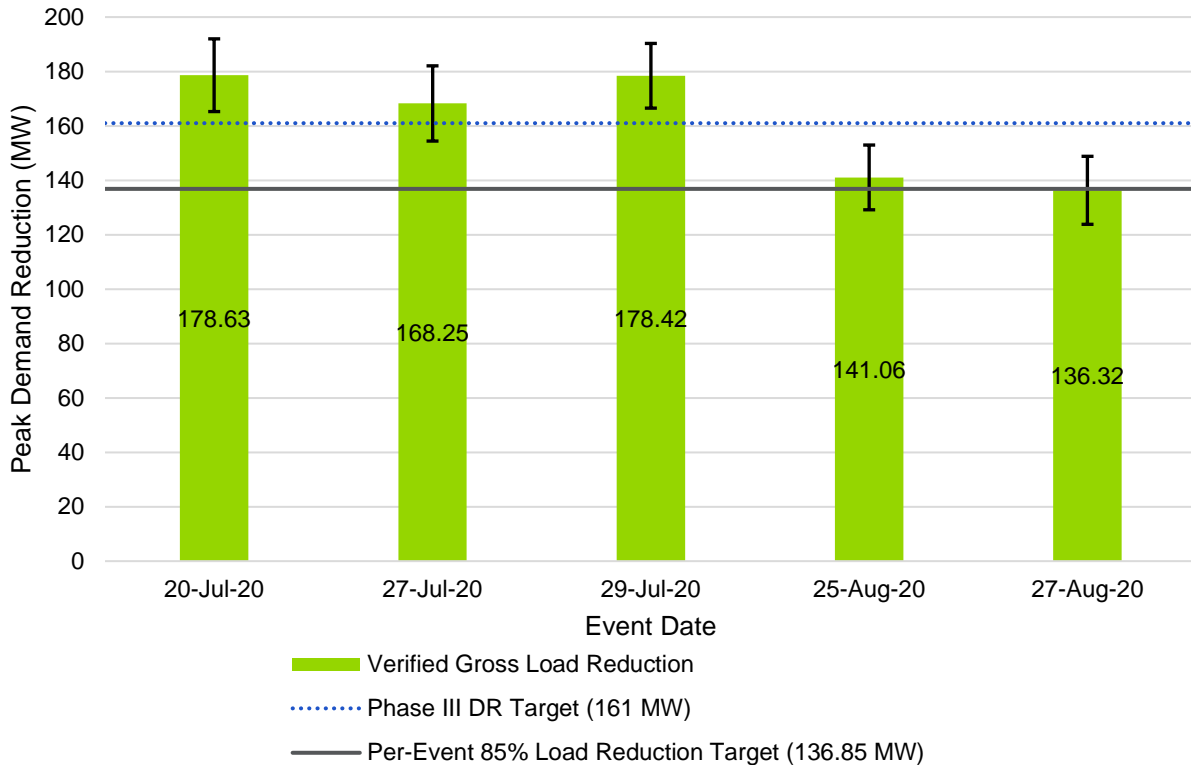
Source: Guidehouse analysis

The PA PUC’s Phase III Implementation Order<sup>53</sup> also established a requirement that EDCs achieve at least 85% of the Phase III compliance reduction target in each DR event. For PECO, this translates to a 137 MW minimum for each DR event. Figure 3-1 shows PY12 event performance relative to the compliance target.

<sup>52</sup> VTD DR impacts are the average performance across all Phase III DR event hours. This is inclusive of PY12, which was voluntary and did not count toward Phase III compliance.

<sup>53</sup> PA PUC. *Energy Efficiency and Conservation Program Implementation Order* at Docket No. M-2014-2424864 (Phase III Implementation Order). Entered June 11, 2015.

**Figure 3-1. Event Performance Compared to 85% Per-Event Target**



Source: Guidehouse analysis

### 3.6.3 Process Evaluation

Guidehouse conducted a full process evaluation in PY9. No process evaluation activities were conducted in PY12.

### 3.6.4 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-42 for Residential DR. Guidehouse calculated TRC benefits using gross verified impacts. Costs and benefits for PYTD results are expressed in 2020 dollars while P3TD values are expressed as an NPV in 2016 dollars using a discount rate of 7.6%.

**Table 3-42. Summary of Residential DR Finances – Gross Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants	\$2,373	\$11,732
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	-\$593	-\$2,933
	<b>Cost Subtotal</b>	<b>\$1,780</b>	<b>\$8,799</b>

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs)	\$0	\$0
	Design and Development (CSP Costs)	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[1]</sup>	\$3	\$36
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[1]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Marketing (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Program Delivery (EDC Costs)	\$0	\$0
	Program Delivery (CSP Costs)	\$884	\$4,787
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$887</b>	<b>\$4,822</b>
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs <sup>[3]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$2,667</b>	<b>\$13,621</b>
<b>Total NPV of Benefits <sup>[4]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$0	\$0
	Lifetime Electric Capacity Benefits	\$2,499	\$9,255
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$0	\$0
	<b>Benefits Total</b>	<b>\$2,499</b>	<b>\$9,255</b>
<b>TRC Benefit-Cost Ratio <sup>[5]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.94</b>	<b>0.68</b>

<sup>[1]</sup> Tracking system, general administration, program management, general management, legal, and technical assistance.

<sup>[2]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[3]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[4]</sup> Total TRC Benefits equal 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 a 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.

<sup>[5]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

Table 3-43 presents program financials and cost-effectiveness on a net savings basis for Residential DR.

**Table 3-43. Summary of Residential DR Finances – Net Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants	\$2,373	\$11,732
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	-\$593	-\$2,933
	<b>Cost Subtotal</b>	<b>\$1,780</b>	<b>\$8,799</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs)	\$0	\$0
	Design and Development (CSP Costs)	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[1]</sup>	\$3	\$36
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[1]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Marketing (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Program Delivery (EDC Costs)	\$0	\$0
	Program Delivery (CSP Costs)	\$884	\$4,787
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
<b>Cost Subtotal</b>	<b>\$887</b>	<b>\$4,822</b>	
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs <sup>[3]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$2,667</b>	<b>\$13,621</b>
<b>Total NPV of Benefits <sup>[4]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$0	\$0
	Lifetime Electric Capacity Benefits	\$2,499	\$9,255
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$0	\$0
	<b>Benefits Total</b>	<b>\$2,499</b>	<b>\$9,255</b>
<b>TRC Benefit-Cost Ratio <sup>[5]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.94</b>	<b>0.68</b>

<sup>[1]</sup> Tracking system, general administration, program management, general management, legal, and technical assistance.

<sup>[2]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[3]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[4]</sup> Total TRC Benefits equal 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 a 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.

<sup>[5]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-44 for Small C&I DR. Guidehouse calculated TRC benefits using gross verified impacts. Costs and



benefits for PYTD results are expressed in 2020 dollars while P3TD values are expressed as an NPV in 2016 dollars using a discount rate of 7.6%.

**Table 3-44. Summary of Small C&I DR Finances – Gross Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants	\$92	\$468
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	-\$23	-\$117
	<b>Cost Subtotal</b>	<b>\$69</b>	<b>\$351</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs)	\$0	\$0
	Design and Development (CSP Costs)	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[1]</sup>	\$0	\$2
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[1]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Marketing (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Program Delivery (EDC Costs)	\$0	\$0
	Program Delivery (CSP Costs)	\$25	\$132
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
<b>Cost Subtotal</b>	<b>\$25</b>	<b>\$135</b>	
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs <sup>[3]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$94</b>	<b>\$486</b>
<b>Total NPV of Benefits <sup>[4]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$0	\$0
	Lifetime Electric Capacity Benefits	\$63	\$177
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$0	\$0
	<b>Benefits Total</b>	<b>\$63</b>	<b>\$177</b>
<b>TRC Benefit-Cost Ratio <sup>[5]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.67</b>	<b>0.36</b>

<sup>[1]</sup> Tracking system, general administration, program management, general management, legal, and technical assistance.

<sup>[2]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[3]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[4]</sup> Total TRC Benefits equal 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 a 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.

<sup>[5]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

Table 3-45 presents program financials and cost-effectiveness on a net savings basis for Small C&I DR.

**Table 3-45. Summary of Small C&I DR Finances – Net Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants	\$92	\$468
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	-\$23	-\$117
	<b>Cost Subtotal</b>	<b>\$69</b>	<b>\$351</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs)	\$0	\$0
	Design and Development (CSP Costs)	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[1]</sup>	\$0	\$2
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[1]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Marketing (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Program Delivery (EDC Costs)	\$0	\$0
	Program Delivery (CSP Costs)	\$25	\$132
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
<b>Cost Subtotal</b>	<b>\$25</b>	<b>\$135</b>	
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs<sup>[3]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$94</b>	<b>\$486</b>
<b>Total NPV of Benefits<sup>[4]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$0	\$0
	Lifetime Electric Capacity Benefits	\$63	\$177
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$0	\$0
	<b>Benefits Total</b>	<b>\$63</b>	<b>\$177</b>
<b>TRC Benefit-Cost Ratio<sup>[5]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>0.67</b>	<b>0.36</b>

<sup>[1]</sup> Tracking system, general administration, program management, general management, legal, and technical assistance.

<sup>[2]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[3]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[4]</sup> Total TRC Benefits equal 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 a 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.

<sup>[5]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-46 for Large C&I DR. Guidehouse calculated TRC benefits using gross verified impacts. Costs and benefits for PYTD results are expressed in 2020 dollars while P3TD values are expressed as an NPV in 2016 dollars using a discount rate of 7.6%.

**Table 3-46. Summary of Large C&I DR Finances – Gross Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants	\$0	\$1,707
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$0	-\$427
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$1,280</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs)	\$0	\$0
	Design and Development (CSP Costs)	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[1]</sup>	\$7	\$71
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[1]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Marketing (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Program Delivery (EDC Costs)	\$0	\$0
	Program Delivery (CSP Costs)	\$4,990	\$13,528
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
<b>Cost Subtotal</b>	<b>\$4,997</b>	<b>\$13,599</b>	
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs<sup>[3]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$4,997</b>	<b>\$14,879</b>
<b>Total NPV of Benefits<sup>[4]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$0	\$0
	Lifetime Electric Capacity Benefits	\$6,263	\$26,046
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$0	\$0
	<b>Benefits Total</b>	<b>\$6,263</b>	<b>\$26,046</b>
<b>TRC Benefit-Cost Ratio<sup>[5]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>1.25</b>	<b>1.75</b>

<sup>[1]</sup> Tracking system, general administration, program management, general management, legal, and technical assistance.

<sup>[2]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[3]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[4]</sup> Total TRC Benefits equal 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 a 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.

<sup>[5]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

Table 3-47 presents program financials and cost-effectiveness on a net savings basis for Large C&I DR.

**Table 3-47. Summary of Large C&I DR Finances – Net Verified**

Category	Parameter	PYTD (\$1,000)	P3TD (\$1,000)
<b>NPV of Incremental Measure Costs (\$1,000)</b>	EDC Incentives to Participants	\$0	\$1,707
	EDC Incentives to Trade Allies	\$0	\$0
	Participant Costs (Net of Incentives/Rebates Paid by Utilities)	\$0	-\$427
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$1,280</b>
<b>NPV of Program Overhead Costs (\$1,000)</b>	Design and Development (EDC Costs)	\$0	\$0
	Design and Development (CSP Costs)	\$0	\$0
	Administration, Management, and Technical Assistance (EDC Costs) <sup>[1]</sup>	\$7	\$71
	Administration, Management, and Technical Assistance (CSP Costs) <sup>[1]</sup>	\$0	\$0
	Marketing (EDC Costs) <sup>[2]</sup>	\$0	\$0
	Marketing (CSP Costs) <sup>[2]</sup>	\$0	\$0
	Program Delivery (EDC Costs)	\$0	\$0
	Program Delivery (CSP Costs)	\$4,990	\$13,528
	EDC Evaluation Costs	\$0	\$0
	SWE Audit Costs	\$0	\$0
<b>Cost Subtotal</b>	<b>\$4,997</b>	<b>\$13,599</b>	
<b>NPV of Fossil Fuel Impacts from Fuel Switching (\$1,000)</b>	Increased Fossil Fuel Consumption	\$0	\$0
	<b>Cost Subtotal</b>	<b>\$0</b>	<b>\$0</b>
<b>Total NPV of Costs <sup>[3]</sup> (\$1,000)</b>	<b>Cost Total</b>	<b>\$4,997</b>	<b>\$14,879</b>
<b>Total NPV of Benefits <sup>[4]</sup> (\$1,000)</b>	Lifetime Electric Energy Benefits	\$0	\$0
	Lifetime Electric Capacity Benefits	\$6,263	\$26,046
	Lifetime Non-Electric Benefits (Fossil Fuel, Water, O&M)	\$0	\$0
	<b>Benefits Total</b>	<b>\$6,263</b>	<b>\$26,046</b>
<b>TRC Benefit-Cost Ratio <sup>[5]</sup></b>	<b>Benefits Total/Costs Total</b>	<b>1.25</b>	<b>1.75</b>

<sup>[1]</sup> Tracking system, general administration, program management, general management, legal, and technical assistance.

<sup>[2]</sup> Includes the marketing CSP and marketing costs by program CSPs.

<sup>[3]</sup> Total TRC Costs include Total EDC Costs and Participant Costs.

<sup>[4]</sup> Total TRC Benefits equal 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 a 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.

<sup>[5]</sup> TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Guidehouse analysis

### **3.6.5 Status of Recommendations**

PECO's PY12 season was the last for the DR programs because Phase IV does not include DR. Therefore, Guidehouse does not make recommendations for future seasons at this time.

## 4. Summary of Finances

This section provides an overview of the expenditures associated with PECO's portfolio and the recovery of those costs from ratepayers.

### 4.1 Program Financials

Program-specific and portfolio total finances for PY12 are shown in Table 4-1. The columns in Table 4-1 and Table 4-2 are adapted from the Direct Program Cost categories in the PA PUC's EE&C Plan template<sup>54</sup> for Phase III. EDC Materials, Labor, and Administration includes costs associated with an EDC's own employees. Implementation Conservation Service Provider (ICSP) Materials, Labor, and Administration includes the program implementation contractor, and the costs of any other outside vendors that EDCs employ to support program delivery.

**Table 4-1. PYTD Financials**

<b>Program</b>	<b>Incentives to Participants and Trade Allies (\$1,000)</b>	<b>EDC Materials, Labor, and Administration (\$1,000)</b>	<b>ICSP Materials, Labor, and Administration (\$1,000)</b>	<b>Total Cost (\$1,000)</b>
Residential EE	\$7,790	\$6,666	\$10,529	\$24,986
Low-Income EE	\$103	\$80	\$3,663	\$3,845
Small C&I EE	\$5,875	\$2,923	\$4,890	\$13,688
Large C&I EE	\$8,134	\$1,276	\$5,194	\$14,604
CHP	\$2,028	\$0	\$9	\$2,037
Residential DR	\$2,373	\$3	\$884	\$3,261
Small C&I DR	\$92	\$0	\$25	\$117
Large C&I DR	\$0	\$7	\$4,990	\$4,997
Common Portfolio Costs <sup>[1]</sup>				\$9,000
<b>Portfolio Total</b>	<b>\$26,395</b>	<b>\$10,956</b>	<b>\$30,184</b>	<b>\$76,534</b>
<b>SWE Costs <sup>[2]</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>\$300</b>
<b>Total</b>	<b>\$26,395</b>	<b>\$10,956</b>	<b>\$30,184</b>	<b>\$76,834</b>

<sup>[1]</sup> Includes the administrative CSP, tracking system, general administration, and clerical costs; EDC program management; CSP program management; general management; oversight of major accounts; and technical assistance.

<sup>[2]</sup> SWE costs are outside of the 2% spending cap.

Sources: PECO's eTrack database, CSP tracking data

<sup>54</sup> PA PUC. "Section 10." EE&C Plan Template. July 21, 2015. <http://www.puc.pa.gov/pdocs/1372426.doc>.

Table 4-2 shows program-specific and portfolio total finances since the inception of Phase III.

**Table 4-2. P3TD Financials**

<b>Program</b>	<b>Incentives to Participants and Trade Allies (\$1,000)</b>	<b>EDC Materials, Labor, and Administration (\$1,000)</b>	<b>ICSP Materials, Labor, and Administration (\$1,000)</b>	<b>Total Cost (\$1,000)</b>
Residential EE	\$37,884	\$30,537	\$55,362	\$123,783
Low-Income EE	\$1,307	\$1,166	\$34,066	\$36,539
Small C&I EE	\$15,845	\$11,858	\$20,407	\$48,110
Large C&I EE	\$25,111	\$4,959	\$23,655	\$53,726
CHP	\$3,171	\$0	\$101	\$3,273
Residential DR	\$13,393	\$37	\$5,529	\$18,959
Small C&I DR	\$534	\$3	\$157	\$694
Large C&I DR	\$1	\$73	\$18,220	\$18,294
Common Portfolio Costs <sup>[1]</sup>				\$47,353
<b>Portfolio Total</b>	<b>\$97,247</b>	<b>\$48,633</b>	<b>\$157,498</b>	<b>\$350,730</b>
<b>SWE Costs <sup>[2]</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>\$2,200</b>
<b>Total</b>	<b>\$97,247</b>	<b>\$48,633</b>	<b>\$157,498</b>	<b>\$352,930</b>

<sup>[1]</sup> Includes the administrative CSP, tracking system, general administration, and clerical costs; EDC program management; CSP program management; general management; oversight of major accounts; and technical assistance.

<sup>[2]</sup> SWE costs are outside of the 2% spending cap.

Sources: PECO's eTrack database, CSP tracking data

## 4.2 Cost Recovery

Act 129 allows Pennsylvania EDCs to recover EE&C Plan<sup>55</sup> costs through a cost recovery mechanism. PECO's cost recovery charges are organized separately by four customer sectors to confirm 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 a 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 4-3 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 4-3.

<sup>55</sup> PECO. *PECO Program Years 2016-2020 Act 129 – Phase III Energy Efficiency and Conservation Plan*. Revised March 31, 2016. <https://www.puc.pa.gov/pcdocs/1444592.pdf>.

**Table 4-3. EE&C Plan Expenditures by Cost Recovery Category**

Parameter	Cost Recovery Sector	Rate Classes Included <sup>[2]</sup>	Program Year					P3TD <sup>[1]</sup>
			PY8	PY9	PY10	PY11	PY12	
<b>EE&amp;C Plan Expenditures (\$1,000 Nominal)</b>	Residential	R, RH, and CAP	\$35,450	\$43,217	\$41,675	\$40,865	\$35,233	\$196,440
	Small C&I	GS	\$7,035 <sup>[2]</sup>	\$11,105	\$12,024	\$14,209	\$13,628	\$58,001
	Large C&I	PD, HT, and EP	\$9,713	\$15,250	\$20,056	\$23,481	\$25,279	\$93,779
	Municipal	SLE, AL, and TLCL	\$28	\$31	\$30	\$28	\$2,394	\$2,511
<b>Portfolio Total</b>		<b>All</b>	<b>\$52,225</b>	<b>\$69,602</b>	<b>\$73,785</b>	<b>\$78,583</b>	<b>76,534</b>	<b>\$350,730</b>

Note: SWE costs are not included.

<sup>[1]</sup> P3TD values are expressed as the sum of nominal dollars.

<sup>[2]</sup> See current rate class definitions at <https://www.peco.com/MyAccount/MyBillUsage/Pages/CurrentElectric.aspx>

Source: PECO



## **Appendix A. Upstream Lighting Cross-Sector Sales**

Guidehouse completed its analysis of the upstream lighting cross-sector sales estimation as part of the PY8 evaluation for the LAH Solution. Guidehouse applied the PY8 cross-sector sales values to PY12. Details about the evaluation, including the cross-sector sales assumptions for the solution, can be found in Appendix F.1.

## Appendix B. Site Inspection Summary

Table B-1 summarizes the site inspections and common discrepancies found during the evaluation.

**Table B-1. PY12 Site Inspection Summary**

Program and Solution	Inspection Firm	Number of In-Person Inspections Conducted	Number of Virtual Inspections Conducted	Number of Sites with Discrepancies from Reported Values	Summary of Common Discrepancies
Small C&I, Equipment and Systems <sup>[1]</sup>	Guidehouse/INCA	4	0	2	One lighting project found 30% fewer lights installed onsite than claimed. One custom HVAC project did not provide any documentation regarding assumptions and contained multiple calculation errors.
Large C&I, Equipment and Systems <sup>[1]</sup>	Guidehouse/INCA	5	5	1	One large discrepancy was caused by over 10 months of trend data, including summer peak months, available for evaluation but only 6 weeks of autumn data available for original savings estimates.
CHP	Guidehouse	0	2	0	N/A
<b>Total</b>		<b>9</b>	<b>7</b>	<b>3</b>	

<sup>[1]</sup> Many C&I projects had small discrepancies from the reported values, with few projects showing 1.00 realization rates for both energy and demand savings. The numbers listed in this table include projects with energy or demand savings that were more than 20% different from the ex ante results.

Source: Guidehouse analysis

## **Appendix C. HER Impact Evaluation Detail**

Guidehouse analyzed 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 F.5.

## Appendix D. PY12 and P3TD Summary by Customer Segment and Carveout

**Table D-1. PY12 Reported Energy Savings by Customer Segment and Carveout**

Program and Solution	Residential (MWh)	Small C&I (MWh)	Large C&I (MWh)	Low-Income Carveout (MWh)	G/E/NP Carveout (MWh)
LAH	93,915	71	22	0	0
Appliance Recycling	10,707	223	16	0	0
Whole Home	5,309	3	0	0	0
New Construction	1,833	0	0	0	0
Behavioral	74,135	0	0	0	0
Multifamily Targeted	3,120	0	0	0	0
<b>Residential EE Program</b>	<b>189,020</b>	<b>297</b>	<b>38</b>	<b>0</b>	<b>0</b>
Whole Home	16,150	1,859	1,841	19,850	0
Lighting	N/A	N/A	N/A	N/A	N/A
<b>Low-Income EE Program</b>	<b>16,150</b>	<b>1,859</b>	<b>1,841</b>	<b>19,850</b>	<b>0</b>
Equipment and Systems	0	66,003	0	0	35,408
New Construction	0	4,926	0	0	839
Whole Building	0	9,598	0	0	2,180
Data Centers Targeted	N/A	N/A	N/A	N/A	N/A
Multifamily Targeted	0	4,338	0	0	0
<b>Small C&amp;I EE Program</b>	<b>0</b>	<b>84,865</b>	<b>0</b>	<b>0</b>	<b>38,427</b>
Equipment and Systems	0	0	104,391	0	35,258
New Construction	0	0	9,015	0	1,547
Data Centers Targeted	0	0	10	0	0
Multifamily Targeted	0	0	4,140	0	0
<b>Large C&amp;I EE Program</b>	<b>0</b>	<b>0</b>	<b>117,556</b>	<b>0</b>	<b>36,806</b>
<b>CHP Program</b>	<b>0</b>	<b>0</b>	<b>202,434</b>	<b>0</b>	<b>0</b>
<b>Portfolio Total</b>	<b>205,170</b>	<b>87,021</b>	<b>321,869</b>	<b>19,850</b>	<b>75,233</b>

Source: Guidehouse analysis

**Table D-2. PY12 Reported Demand Savings by Customer Segment and Carveout**

Program and Solution	Residential (MW)	Small C&I (MW)	Large C&I (MW)	Low-Income Carveout (MW)	G/E/NP Carveout (MW)
LAH	12.92	0.01	0.00	0.00	0.00
Appliance Recycling	1.46	0.03	0.00	0.00	0.00
Whole Home	0.71	0.00	0.00	0.00	0.00
New Construction	0.83	0.00	0.00	0.00	0.00
Behavioral	0.00	0.00	0.00	0.00	0.00

Program and Solution	Residential (MW)	Small C&I (MW)	Large C&I (MW)	Low-Income Carveout (MW)	G/E/NP Carveout (MW)
Multifamily Targeted	0.38	0.00	0.00	0.00	0.00
<b>Residential EE Program</b>	<b>16.31</b>	<b>0.04</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>
Whole Home	1.70	0.30	0.27	2.28	0.00
Lighting	N/A	N/A	N/A	N/A	N/A
<b>Low-Income EE Program</b>	<b>1.70</b>	<b>0.30</b>	<b>0.27</b>	<b>2.28</b>	<b>0.00</b>
Equipment and Systems	0.00	8.97	0.00	0.00	4.12
New Construction	0.00	0.83	0.00	0.00	0.12
Whole Building	0.00	1.79	0.00	0.00	0.55
Data Centers Targeted	N/A	N/A	N/A	N/A	N/A
Multifamily Targeted	0.00	0.34	0.00	0.00	0.00
<b>Small C&amp;I EE Program</b>	<b>0.00</b>	<b>11.92</b>	<b>0.00</b>	<b>0.00</b>	<b>4.78</b>
Equipment and Systems	0.00	0.00	29.46	0.00	18.43
New Construction	0.00	0.00	1.53	0.00	0.24
Data Centers Targeted	0.00	0.00	0.00	0.00	0.00
Multifamily Targeted	0.00	0.00	0.53	0.00	0.00
<b>Large C&amp;I EE Program</b>	<b>0.00</b>	<b>0.00</b>	<b>31.51</b>	<b>0.00</b>	<b>18.67</b>
<b>CHP Program</b>	<b>0.00</b>	<b>0.00</b>	<b>10.06</b>	<b>0.00</b>	<b>0.00</b>
<b>Portfolio Total</b>	<b>18.01</b>	<b>12.27</b>	<b>41.85</b>	<b>2.28</b>	<b>23.45</b>

Source: Guidehouse analysis

**Table D-3. P3TD Reported Energy Savings by Customer Segment and Carveout**

Program and Solution	Residential (MWh)	Small C&I (MWh)	Large C&I (MWh)	Low-Income Carveout (MWh)	G/E/NP Carveout (MWh)
LAH	576,477	157	27	0	1
Appliance Recycling	68,273	1,360	374	0	0
Whole Home	28,868	6	0	0	0
New Construction	7,988	0	0	0	0
Behavioral	368,250	0	0	0	0
Multifamily Targeted	15,875	0	0	0	0
<b>Residential EE Program</b>	<b>1,065,731</b>	<b>1,523</b>	<b>401</b>	<b>0</b>	<b>1</b>
Whole Home	108,449	7,333	5,554	121,336	0
Lighting	9,086	0	0	9,086	0
<b>Low-Income EE Program</b>	<b>117,535</b>	<b>7,333</b>	<b>5,554</b>	<b>130,422</b>	<b>0</b>
Equipment and Systems	0	205,132	0	0	80,613
New Construction	0	17,256	0	0	2,465
Whole Building	0	36,192	0	0	4,561
Data Centers Targeted	0	119	0	0	0
Multifamily Targeted	0	15,928	0	0	0
<b>Small C&amp;I EE Program</b>	<b>0</b>	<b>274,627</b>	<b>0</b>	<b>0</b>	<b>87,639</b>

Program and Solution	Residential (MWh)	Small C&I (MWh)	Large C&I (MWh)	Low-Income Carveout (MWh)	G/E/NP Carveout (MWh)
Equipment and Systems	0	0	380,061	0	122,127
New Construction	0	0	35,955	0	9,701
Data Centers Targeted	0	0	556	0	36
Multifamily Targeted	0	0	16,349	0	0
<b>Large C&amp;I EE Program</b>	<b>0</b>	<b>0</b>	<b>432,921</b>	<b>0</b>	<b>131,864</b>
<b>CHP Program</b>	<b>0</b>	<b>0</b>	<b>228,883</b>	<b>0</b>	<b>0</b>
<b>Portfolio Total</b>	<b>1,183,266</b>	<b>283,483</b>	<b>667,760</b>	<b>130,422</b>	<b>219,503</b>

Source: Guidehouse analysis

**Table D-4. P3TD Reported Demand Savings by Customer Segment and Carveout**

Program and Solution	Residential (MW)	Small C&I (MW)	Large C&I (MW)	Low-Income Carveout (MW)	G/E/NP Carveout (MW)
LAH	75.58	0.05	0.01	0.00	0.00
Appliance Recycling	9.83	0.19	0.04	0.00	0.00
Whole Home	3.56	0.00	0.00	0.00	0.00
New Construction	2.85	0.00	0.00	0.00	0.00
Behavioral	0.00	0.00	0.00	0.00	0.00
Multifamily Targeted	2.01	0.00	0.00	0.00	0.00
<b>Residential EE Program</b>	<b>93.83</b>	<b>0.23</b>	<b>0.05</b>	<b>0.00</b>	<b>0.00</b>
Whole Home	12.14	1.23	0.84	14.21	0.00
Lighting	1.07	0.00	0.00	1.07	0.00
<b>Low-Income EE Program</b>	<b>13.21</b>	<b>1.23</b>	<b>0.84</b>	<b>15.28</b>	<b>0.00</b>
Equipment and Systems	0.00	28.65	0.00	0.00	9.14
New Construction	0.00	3.06	0.00	0.00	0.30
Whole Building	0.00	7.26	0.00	0.00	1.11
Data Centers Targeted	0.00	0.02	0.00	0.00	0.00
Multifamily Targeted	0.00	1.52	0.00	0.00	0.00
<b>Small C&amp;I EE Program</b>	<b>0.00</b>	<b>40.51</b>	<b>0.00</b>	<b>0.00</b>	<b>10.56</b>
Equipment and Systems	0.00	0.00	69.06	0.00	31.04
New Construction	0.00	0.00	4.87	0.00	1.17
Data Centers Targeted	0.00	0.00	0.04	0.00	0.00
Multifamily Targeted	0.00	0.00	2.05	0.00	0.00
<b>Large C&amp;I EE Program</b>	<b>0.00</b>	<b>0.00</b>	<b>76.01</b>	<b>0.00</b>	<b>32.22</b>
<b>CHP Program</b>	<b>0.00</b>	<b>0.00</b>	<b>12.86</b>	<b>0.00</b>	<b>0.00</b>
<b>Portfolio Total</b>	<b>107.05</b>	<b>41.97</b>	<b>89.76</b>	<b>15.28</b>	<b>42.78</b>

Source: Guidehouse analysis

**Table D-5. PY12 Verified Energy Savings by Customer Segment and Carveout**

Program and Solution	Residential (MWh)	Small C&I (MWh)	Large C&I (MWh)	Low-Income Carveout (MWh)	G/E/NP Carveout (MWh)
LAH	90,479	72	22	0	0
Appliance Recycling	11,082	236	17	0	0
Whole Home	5,012	3	0	0	0
New Construction	1,669	0	0	0	0
Behavioral	68,367	0	0	0	0
Multifamily Targeted	2,991	0	0	0	0
<b>Residential EE Program</b>	<b>179,599</b>	<b>311</b>	<b>39</b>	<b>0</b>	<b>0</b>
Whole Home	12,029	1,412	1,399	14,840	0
Lighting	0	0	0	0	0
<b>Low-Income EE Program</b>	<b>12,029</b>	<b>1,412</b>	<b>1,399</b>	<b>14,840</b>	<b>0</b>
Equipment and Systems	0	68,051	0	0	39,533
New Construction	0	5,147	0	0	881
Whole Building	0	8,858	0	0	2,004
Data Centers Targeted	0	0	0	0	0
Multifamily Targeted	0	4,249	0	0	0
<b>Small C&amp;I EE Program</b>	<b>0</b>	<b>86,306</b>	<b>0</b>	<b>0</b>	<b>42,418</b>
Equipment and Systems	0	0	95,929	0	33,681
New Construction	0	0	12,288	0	2,109
Data Centers Targeted	0	0	6	0	0
Multifamily Targeted	0	0	4,119	0	0
<b>Large C&amp;I EE Program</b>	<b>0</b>	<b>0</b>	<b>112,341</b>	<b>0</b>	<b>35,790</b>
<b>CHP Program</b>	<b>0</b>	<b>0</b>	<b>165,298</b>	<b>0</b>	<b>0</b>
<b>Portfolio Total</b>	<b>191,628</b>	<b>88,029</b>	<b>279,078</b>	<b>14,840</b>	<b>78,208</b>

Source: Guidehouse analysis

**Table D-6. PY12 Verified Demand Savings by Customer Segment and Carveout**

Program and Solution	Residential (MW)	Small C&I (MW)	Large C&I (MW)	Low-Income Carveout (MW)	G/E/NP Carveout (MW)
LAH	12.67	0.01	0.00	0.00	0.00
Appliance Recycling	1.45	0.03	0.00	0.00	0.00
Whole Home	0.67	0.00	0.00	0.00	0.00
New Construction	0.78	0.00	0.00	0.00	0.00
Behavioral	7.80	0.00	0.00	0.00	0.00
Multifamily Targeted	0.36	0.00	0.00	0.00	0.00
<b>Residential EE Program</b>	<b>23.74</b>	<b>0.04</b>	<b>0.01</b>	<b>0.00</b>	<b>0.00</b>
Whole Home	1.29	0.23	0.21	1.73	0.00
Lighting	0.00	0.00	0.00	0.00	0.00
<b>Low-Income EE Program</b>	<b>1.29</b>	<b>0.23</b>	<b>0.21</b>	<b>1.73</b>	<b>0.00</b>

Program and Solution	Residential (MW)	Small C&I (MW)	Large C&I (MW)	Low-Income Carveout (MW)	G/E/NP Carveout (MW)
Equipment and Systems	0.00	9.56	0.00	0.00	5.42
New Construction	0.00	0.79	0.00	0.00	0.11
Whole Building	0.00	1.79	0.00	0.00	0.54
Data Centers Targeted	0.00	0.00	0.00	0.00	0.00
Multifamily Targeted	0.00	0.34	0.00	0.00	0.00
<b>Small C&amp;I EE Program</b>	<b>0.00</b>	<b>12.48</b>	<b>0.00</b>	<b>0.00</b>	<b>6.07</b>
Equipment and Systems	0.00	0.00	24.06	0.00	14.01
New Construction	0.00	0.00	2.22	0.00	0.35
Data Centers Targeted	0.00	0.00	0.00	0.00	0.00
Multifamily Targeted	0.00	0.00	0.50	0.00	0.00
<b>Large C&amp;I EE Program</b>	<b>0.00</b>	<b>0.00</b>	<b>26.78</b>	<b>0.00</b>	<b>14.36</b>
<b>CHP Program</b>	<b>0.00</b>	<b>0.00</b>	<b>19.67</b>	<b>0.00</b>	<b>0.00</b>
<b>Portfolio Total</b>	<b>25.03</b>	<b>12.76</b>	<b>46.66</b>	<b>1.73</b>	<b>20.44</b>

Source: Guidehouse analysis

**Table D-7. P3TD Verified Energy Savings by Customer Segment and Carveout**

Program and Solution	Residential (MWh)	Small C&I (MWh)	Large C&I (MWh)	Low-Income Carveout (MWh)	G/E/NP Carveout (MWh)
LAH	572,961	7,402	26	0	1
Appliance Recycling	69,100	1,428	382	0	0
Whole Home	27,217	6	0	0	0
New Construction	7,590	0	0	0	0
Behavioral	346,330	0	0	0	0
Multifamily Targeted	15,486	0	0	0	0
<b>Residential EE Program</b>	<b>1,038,685</b>	<b>8,836</b>	<b>408</b>	<b>0</b>	<b>1</b>
Whole Home	98,518	5,316	4,876	108,710	0
Lighting	9,081	0	0	2,689	0
<b>Low-Income EE Program</b>	<b>107,598</b>	<b>5,316</b>	<b>4,876</b>	<b>111,398</b>	<b>0</b>
Equipment and Systems	0	215,369	0	0	91,920
New Construction	0	18,055	0	0	2,584
Whole Building	0	34,753	0	0	4,283
Data Centers Targeted	0	50	0	0	0
Multifamily Targeted	0	14,622	0	0	0
<b>Small C&amp;I EE Program</b>	<b>0</b>	<b>282,848</b>	<b>0</b>	<b>0</b>	<b>98,786</b>



Program and Solution	Residential (MWh)	Small C&I (MWh)	Large C&I (MWh)	Low-Income Carveout (MWh)	G/E/NP Carveout (MWh)
Equipment and Systems	0	0	376,987	0	126,280
New Construction	0	0	39,671	0	10,348
Data Centers Targeted	0	0	535	0	22
Multifamily Targeted	0	0	16,175	0	0
<b>Large C&amp;I EE Program</b>	<b>0</b>	<b>0</b>	<b>433,366</b>	<b>0</b>	<b>136,650</b>
<b>CHP Program</b>	<b>0</b>	<b>0</b>	<b>185,738</b>	<b>0</b>	<b>0</b>
<b>Portfolio Total</b>	<b>1,146,283</b>	<b>297,000</b>	<b>624,389</b>	<b>111,398</b>	<b>235,437</b>

Source: Guidehouse analysis

**Table D-8. P3TD Verified Demand Savings by Customer Segment and Carveout**

Program and Solution	Residential (MW)	Small C&I (MW)	Large C&I (MW)	Low-Income Carveout (MW)	G/E/NP Carveout (MW)
LAH	76.36	1.55	0.01	0.00	0.00
Appliance Recycling	9.68	0.19	0.04	0.00	0.00
Whole Home	3.36	0.00	0.00	0.00	0.00
New Construction	2.71	0.00	0.00	0.00	0.00
Behavioral	39.54	0.00	0.00	0.00	0.00
Multifamily Targeted	1.90	0.00	0.00	0.00	0.00
<b>Residential EE Program</b>	<b>133.54</b>	<b>1.74</b>	<b>0.05</b>	<b>0.00</b>	<b>0.00</b>
Whole Home	11.07	0.91	0.75	12.73	0.00
Lighting	1.07	0.00	0.00	0.32	0.00
<b>Low-Income EE Program</b>	<b>12.14</b>	<b>0.91</b>	<b>0.75</b>	<b>13.04</b>	<b>0.00</b>
Equipment and Systems	0.00	32.46	0.00	0.00	12.25
New Construction	0.00	3.01	0.00	0.00	0.30
Whole Building	0.00	6.25	0.00	0.00	1.03
Data Centers Targeted	0.00	0.01	0.00	0.00	0.00
Multifamily Targeted	0.00	1.41	0.00	0.00	0.00
<b>Small C&amp;I EE Program</b>	<b>0.00</b>	<b>43.14</b>	<b>0.00</b>	<b>0.00</b>	<b>13.58</b>
Equipment and Systems	0.00	0.00	66.78	0.00	27.92
New Construction	0.00	0.00	7.04	0.00	1.99
Data Centers Targeted	0.00	0.00	0.04	0.00	0.00
Multifamily Targeted	0.00	0.00	1.97	0.00	0.00
<b>Large C&amp;I EE Program</b>	<b>0.00</b>	<b>0.00</b>	<b>75.82</b>	<b>0.00</b>	<b>29.91</b>
<b>CHP Program</b>	<b>0.00</b>	<b>0.00</b>	<b>22.12</b>	<b>0.00</b>	<b>0.00</b>
<b>Portfolio Total</b>	<b>145.68</b>	<b>45.79</b>	<b>98.73</b>	<b>13.04</b>	<b>43.49</b>

Source: Guidehouse analysis

## Appendix E. Participation Counts

Across PECO's portfolio, participation is calculated in significantly different ways across solutions and CSPs. Table E-1 provides an overview of the different participation definitions by program and solution.

**Table E-1. Overview of Participation Definitions**

Program	Solution	Conservation Service Provider	Participation Definition
<b>Residential</b>	LAH (Lighting)	CLEAResult	Sum number of total lamp packs sold
	LAH (Appliances and HVAC)	CLEAResult	Count of rebates issued
	Whole Home	CLEAResult	Count of unique premise ID
	Appliance Recycling	ARCA Recycling	Count of all orders on distinct days
	New Construction	PSD	Sum No. of participants
	Behavioral	Oracle	Sum No. of participants
	Multifamily Targeted	Franklin	Distinct count of utility account ID by program, solution, and invoice number
<b>Low-Income</b>	Whole Home	CMC	Count of unique premise numbers for component 1 and 2
	Whole Home	ARCA Recycling	Count of all orders on distinct days
<b>Small C&amp;I</b>	Equipment and Systems	ICF	Count of unique project numbers
	New Construction	ICF	Count of unique project numbers
	Whole Building	SmartWatt	Count of unadjusted projects
	Data Centers Targeted	ICF	Count of unique project numbers
	Multifamily Targeted	Franklin	Distinct count of utility account ID by program, solution, and invoice number
<b>Large C&amp;I</b>	Equipment and Systems	ICF	Count of unique project numbers
	New Construction	ICF	Count of unique project numbers
	Data Centers Targeted	ICF	Count of unique project numbers
	Multifamily	Franklin	Distinct count of utility account ID by program, solution, sector, and invoice number
<b>CHP</b>		DNV Energy Services	Count of unique project numbers
<b>Residential DR</b>		Itron	Count of unique account number with device status as installed or swapped and the measure code is CACS (central air conditioner switch)
<b>Small C&amp;I DR</b>		Itron	Count of unique account number with device status as installed or swapped and the measure code is CACS
<b>Large C&amp;I DR</b>		CPower and Enel X	Large C&I customer (defined by account number) enrolled for at least 1 hour of at least one event

Source: Guidehouse analysis

[guidehouse.com](https://www.guidehouse.com)



# Final Annual Report to the Pennsylvania Public Utility Commission Phase III of Act 129

Appendix F: Residential EE Program

Appendix G: Residential Low-Income EE Program

Appendix H: Small and Large C&I EE Programs

Appendix I: Multifamily Targeted Market Segment

**Program Year 12  
(June 1, 2020 – May 31, 2021)**

**For Pennsylvania Act 129 of 2008  
Energy Efficiency and Conservation Plan**

**Prepared for:**



An Exelon Company

**Submitted by:**

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November 15, 2021

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## Appendix F. Residential Energy Efficiency Program Detail

This appendix details the evaluation methods and activities Guidehouse Inc. (Guidehouse or the evaluation team) deployed in program year 12 (PY12) for select Residential Energy Efficiency (EE) Program solutions (listed below). Refer to Section 3.1 in the main body report for key evaluation findings, results, and conclusions for these solutions.

- Lighting, Appliances & HVAC (LAH)
- Appliance Recycling
- Whole Home
- New Construction
- Behavioral

The Multifamily Targeted Market Segment also contributes to the Residential EE Program; however, given its cross-program nature, evaluation details for that market segment are presented independently in Appendix I.

### F.1 Lighting, Appliances, and HVAC Solution

The LAH Solution offers customers energy savings opportunities by assisting them in purchasing the most efficient technology when shopping for new products. The solution provides both upstream and downstream incentives:

- **Upstream:** Point of purchase discounts to increase the market share of ENERGY STAR<sup>®</sup>-qualified light-emitting diode (LED) bulbs
- **Downstream:** Rebates for equipment sold through retail and heating, ventilation, and air conditioning (HVAC) installer sales channels (known to customers as the Home Rebates Program) and instant rebates for equipment sold through the PECO Marketplace.

Appliances and HVAC equipment rebated by the program include ENERGY STAR-certified appliances and equipment, such as central air conditioners (ACs), air source heat pumps, ductless mini-split heat pumps, furnace fans, refrigerators, freezers, clothes washers and dryers, air purifiers, and other measures. The solution also distributes educational materials that increase customer awareness and acceptance.

In PY9, PECO launched the PECO Marketplace as a way for customers to shop for energy efficient technologies online. The conservation service provider (CSP) Uplight operates the PECO Marketplace and offers instant discounts on ENERGY STAR-qualified LED bulbs, advanced power strips, and smart/learning thermostats.

Participation in the LAH upstream Lighting channel is defined as the sum of stock keeping unit (SKU) sales. An SKU describes a sold lighting product, which can be a single bulb or a multipack of bulbs.<sup>1</sup> For Appliances and HVAC participants, participation is defined as the total number of non-adjusted records in PECO's tracking data (participation includes power strips and thermostats sold through the PECO Marketplace). A record may represent one or more

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<sup>1</sup> This definition is consistent with LED bulbs sold through the PECO Marketplace.



rebated items (e.g., a single participant purchasing multiple thermostats during the same purchase event).

The COVID-19 pandemic reduced LAH Solution savings during March and April 2020, although the solution continued to offer customers ways to save energy during this period. Participation increased steadily after April as customers resumed upgrading their HVAC systems and purchasing efficient appliances and LED bulbs. In PY12, participation and savings generated by the solution rebounded to the levels prior to the start of the pandemic.

### **F.1.1 Lighting**

The following subsections present the evaluation details and findings for the Lighting channel of the LAH Solution. Guidehouse conducted the following activities to verify the gross impacts and confirm CSP reporting accuracy:

- Record-level Technical Reference Manual (TRM) review
- ENERGY STAR certification verification
- Invoice review
- Incentive analysis

These analysis activities verified the solution's reported savings through a bulb-level, bottom-up recalculation of energy and demand impacts for all program bulbs incentivized by PECO during PY12.

#### ***F.1.1.1 Record-Level TRM Review***

Guidehouse applied energy and demand savings algorithms to verified input parameters as outlined in the Pennsylvania TRM<sup>2</sup> to calculate impacts. The evaluation team used commercial and industrial (C&I) facility lighting usage assumptions described in the TRM to calculate savings for the portion of bulbs purchased by nonresidential customers as estimated by PY8 in-store intercept efforts. The team adjusted baseline wattages for some bulbs based on bulb characteristics and the TRM methodology for assigning baseline wattages. In addition, because some bulbs were sold in PY11 but not invoiced until PY12, Guidehouse applied the PY11 baseline values in the TRM for these A-line lamps rather than the PY12 baseline. The evaluation team also deferred to lumen values based on the ENERGY STAR database rather than the tracking data when determining the appropriate lumen bin. Guidehouse used the following methodology to verify and update baseline wattages:

- 1. Guidehouse generated a list of unique bulb model/description/lumens/watts/type** from the tracking data, resulting in 833 unique models.
- 2. Guidehouse applied baseline wattages** using the bulb type, lumens, and sales date (i.e., PY11 versus PY12) based on the TRM assumptions. The process to review and confirm whether PY11 or PY12 baseline assumptions were appropriate is listed below:

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<sup>2</sup> PA PUC. *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.

- a. Guidehouse reviewed "transaction\_date" and flagged all A-line lamp measure records with dates before the start of PY12 (i.e., all dates prior to 6/1/2020). These are acceptable, and no further review is required for baseline verification.
  - b. For "transaction\_date" dates after 6/1/2021, Guidehouse manually reviewed detailed point-of-sale (POS) invoices provided by the CSP to confirm that the sales did in fact occur during the PY11 period. Guidehouse was able to confirm that all measure records with PY11 baseline assumptions in the PY12 data were sold prior to the start of PY12.
- 3. Guidehouse reviewed the bulb classification and reclassified products as necessary** to determine an appropriate baseline wattage. When the lumen values fell out of the ranges specified in the TRM, the evaluation team applied a baseline wattage equal to the advertised replacement wattage on the product. Adjustments were made for the following products:
- a. 3-Way Lamps (10 models): Guidehouse found models classified as standard A-line that should be classified as 3-Way.
  - b. A-line (72 models): Guidehouse found disagreements between the tracking data and the ENERGY STAR database lumen values, resulting in shifting these lamps to different lumen bins with different baseline wattage values.
  - c. A-line versus reflector (2 models): Guidehouse found one model classified as reflector that should be an A-line, and one model classified as A-line that should be a reflector (BR30).
  - d. Downlight retrofit kits (1 model): Guidehouse found one 4-inch downlight kit bulb classified as exempt; the team reclassified this as a non-exempt R20 and applied the appropriate TRM baseline wattages.
  - e. Fixtures (6 models): Guidehouse found fixtures classified as reflector retrofit kits that should be T8 replacements.
  - f. Fixtures (3 models): Guidehouse found fixtures that are suitable replacements for PAR lamps and applied PAR baseline equivalencies.
  - g. Fixtures (4 models): Guidehouse updated baseline wattage to reflect suitable general service lamp replacements rather than using the advertised replacement wattage.
  - h. Fixtures (11 models): Guidehouse found fixture models that would reasonably be replaced with A-line bulbs rather than products that were assumed to be exempted and applied A-line lamp baseline wattages.
  - i. Reflectors (134 models): Guidehouse found reflector models, primarily retrofit kits, classified as exempt when they should be classified as non-exempt.
  - j. Specialty (54 models): Guidehouse found (30) models above 40 W classified as exempt; the team reclassified these as non-exempt following the TRM. Guidehouse also found (24) models 40 W or below that should be classified as exempt.
  - k. Specialty (4 models): Guidehouse found disagreements between the tracking data and the ENERGY STAR database lumen values, resulting in shifting these lamps to different lumen bins with different baseline wattage values.

In addition to verifying baseline wattages, Guidehouse compared the efficient wattages in the ENERGY STAR database against the wattage values in the PECO tracking database to confirm consistency and accuracy. The evaluation team found several records with inconsistencies and deferred to the values in the ENERGY STAR database for verified savings. Specifically, the team found 99 models where the ENERGY STAR listed wattage did not match the PECO database.

Finally, Guidehouse incorporated cross-sector sales. Per the Phase III Evaluation Plan,<sup>3</sup> the evaluation team applied values from the PY8 evaluation. The team applied the cross-sector sales values on a per-retailer and per-bulb type basis, as Table F-1 details. For lighting sales through the PECO Marketplace, Guidehouse assumed zero cross-sector sales.

**Table F-1. Cross-Sector Sales of Standard and Specialty LEDs**

Stratum	Retailers	Cross-Sector Sales Ratio – Standard LED	Cross-Sector Sales Ratio – Specialty LED
Ba	Ace Hardware, BJ's Wholesale Club, Costco Wholesale, Dublin IGA, Eagle True Value Hardware, Holod's True Value Hardware, The Home Depot, Lowe's Home Improvement, Sam's Club, Trappe True Value, True Value Hardware	0.007	0.02
Bb	Batteries Plus Bulbs, Dollar General, Dollar Tree, Ollie's Bargain Outlet, One Dollar Zone, Target, Walgreens, Walmart	0.002	0.011
Bc	Bob's Hardware, Fairmont General Store, Fern Rock Hardware, George's Market, Goodwill, H Mart, Habitat, Independent Hardware, Mid Hardware, Mike and Matt's Italian Market, Penn Hardware, Phoenix Hardware, The Salvation Army, Uplight (PECO Marketplace), Village Hardware Hobbies	0	0

Source: Guidehouse analysis

For the C&I savings contributions, Guidehouse applied the same hours of use (HOU) and coincidence factor (CF) values used in PY12: 2,607 for HOU and 0.45 for CF.

### **F.1.1.2 ENERGY STAR® Certification Verification**

The Phase III TRM stipulates that only ENERGY STAR-certified products be incentivized through the Lighting Solution; therefore, Guidehouse reviewed the unique SKUs for all PY12 program bulbs to confirm that they met this requirement. In PY12, all bulbs in the PECO tracking database were provided with ENERGY STAR unique IDs, simplifying the verification process compared with previous years in Phase III. To verify ENERGY STAR certification, Guidehouse matched the provided ENERGY STAR IDs to the ENERGY STAR database and ensured that product characteristics showed as expected.

Guidehouse confirmed that all PY12 program bulbs are ENERGY STAR-certified models. The majority (830 out of 833 unique SKUs) mapped directly based on ENERGY STAR ID to the ENERGY STAR bulb and fixture lists. There were three lamps with incorrect ENERGY STAR

<sup>3</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

values; in each of these cases Guidehouse was able to manually identify the correct ENERGY STAR ID.

### ***F.1.1.3 Invoice Review***

Guidehouse verified program database-reported incentive spend against PECO-provided retailer invoices. The evaluation team did not find any discrepancies based on incentives paid. Because only incentives were provided in the invoice documentation, the team could not directly verify quantities; thus, incentives are deemed as an appropriate surrogate for quantity.

### ***F.1.1.4 Incentive Analysis***

Guidehouse analyzed the minimum, maximum, and average incentive for each retailer and bulb type combination to confirm that incentives align with PECO's Phase III Energy Efficiency and Conservation (EE&C) Plan.<sup>4</sup> The evaluation team found no cases where the incentives fell outside of the plan's guidelines.

The team also conducted a pricing and incentive review to compare the per-bulb incentives with the manufacturer suggested retail price (MSRP) and the expected retail price.<sup>5</sup> Guidehouse generally expects that the MSRP less the per-package incentive would equal the expected retail price. However, this equation does not hold true for 19,768 (10.7% of total) records. Furthermore, 1,510 cases had a higher than expected retail price than the MSRP (0.8% of records). The evaluation team found similar issues from PY8 through PY11 and learned that there could be a manufacturer rebate to bring down the expected retail price more than the PECO incentive. Through discussions with the PECO program manager, the team identified opportunities for PECO to continue working with the CSP and manufacturers to encourage maintenance of accurate inputs, communication of other manufacturer rebates, and updates to prices as often as possible to confirm that these differences are not erroneous. Guidehouse also discussed opportunities for the CSP to institute a quality control check during data processing that would indicate an error when the MSRP is lower than the expected retail price. This finding does not materially impact the verified savings.

### ***F.1.1.5 Results Summary***

Table F-2 summarizes the results of these activities.

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<sup>4</sup> PECO. *PECO Program Years 2016-2020 Act 129 – Phase III Energy Efficiency and Conservation Plan*. November 30, 2015. <https://www.puc.pa.gov/pdocs/1398320.pdf>.

<sup>5</sup> The expected retail price is the actual price a customer pays after incentives (including the PECO incentive and any other incentive, such as a manufacturer rebate).

**Table F-2. Activities and Findings for Residential Lighting**

Activity	Finding	Description
<b>Record-Level TRM Review</b>	Guidehouse adjusted baseline wattages for several LED products (302 out of 833).	Guidehouse adjusted baseline wattages for a variety of lamp types. The effects of this adjustment were small but impactful (<5%) and demonstrate that the program should refine its process for characterizing baseline wattages, especially for fixtures.
	Guidehouse adjusted efficient wattage for several LED products (99 out of 833).	Several fixture products were listed with efficient wattage values that did not match the ENERGY STAR database values. Guidehouse applied the ENERGY STAR values for verification where discrepancies were found.
<b>ENERGY STAR Certification Verification</b>	No issues.	Guidehouse confirmed all program bulbs in PY12 were ENERGY STAR-certified models. The majority (830 out of 833 unique SKUs) mapped directly to ENERGY STAR bulb and fixture lists, with manual searches confirming the remaining three.
<b>Invoice Review</b>	No issues—all invoices match tracking database values.	Guidehouse reviewed the incentives to confirm that the invoiced amount from manufacturers equals the invoiced amount in the CSP data. The evaluation team found no discrepancies.
<b>Incentive Analysis</b>	No issues—all incentives are consistent with plan guidelines.	Guidehouse compiled the minimum, maximum, and average incentive for each retailer/bulb category/bulb type combination to confirm the incentives align with PECO's Phase III EE&C Plan. The team found no cases where the incentives fell outside the plan's guidelines.

Source: Guidehouse analysis

## F.1.2 Appliances and HVAC

The following subsections present the evaluation details and findings for the non-Lighting, downstream rebate channel of the LAH Solution (i.e., the Appliances and HVAC channel).<sup>6</sup>

### F.1.2.1 Gross Impact Evaluation

Guidehouse conducted the following activities to verify the gross impacts and to review the CSP database for accuracy in the reporting process:

- Engineering desk reviews for all measures
  - Record-level savings review: Review of energy savings calculations and assumptions per the TRM and Statewide Evaluator (SWE)-approved interim measure protocols (IMPs), using CSP-collected project data where appropriate
  - Invoice review
- Engineering file reviews and online survey verification for HVAC projects
  - HVAC participant project file review
  - HVAC participant online verification

<sup>6</sup> Known to customers as the Home Rebates Program.

- Online survey verification for Appliances projects

The Phase III Evaluation Plan<sup>7</sup> specified phone verifications for HVAC and Appliance projects, requiring the evaluation team to call customers to discuss their participation in the Home Rebates Program. Guidehouse piloted online verification surveys in PY11 and continued with online verification surveys in PY12. The SWE approved the online verification survey methodology in April 2021 through a memo detailing updates to the Evaluation Plan.

#### *F.1.2.1.1 Engineering Desk Reviews*

Guidehouse verified program-reported savings for all projects reported in the program tracking database, eTrack, quarterly. The evaluation team used the measure-specific variables provided in the eTrack database to populate the energy and demand savings algorithms as detailed in the TRM and SWE-approved IMPs to verify the reported energy and demand savings estimates. The team completed engineering desk reviews for a census of Appliances and HVAC projects reported in PY11.

Table F-3 summarizes the results of the desk review activities that had the biggest impact on the realization rate of energy savings.

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<sup>7</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

**Table F-3. Desk Review Activities for Residential Non-Lighting**

Impact Activity	Finding	Description
<b>Record-Level Savings Review</b>	<p>Air source heat pumps (ASHPs): Ex ante savings used the baseline seasonal energy efficiency ratio (SEER) value (SEERb) of 13.</p>	<p>The 2016 TRM defines the SEERb for ASHPs as 14. Guidehouse used the SEERb of 14 for the ex post calculations, resulting in an ASHP realization rate of 0.89 for energy savings and 0.59 for demand savings.</p>
	<p>ENERGY STAR air purifiers: Ex ante savings used default savings values defined in PECO's EE&amp;C Plan instead of the savings algorithms defined in the SWE-approved IMP documentation in some cases.</p>	<p>Guidehouse calculated ex post savings for ENERGY STAR air purifiers using the SWE-approved IMP for the units that were still using the EE&amp;C Plan default savings values, resulting in a realization rate of 2.34 for both energy and demand savings.</p>
	<p>ENERGY STAR residential clothes washers: Ex ante savings used deemed integrated modified energy factor (IMEF) values defined in the TRM for PY8 and PY9.</p>	<p>The TRM shifted deemed minimum IMEF values for PY10 and beyond for federal standards for top- and front-loading washers (TRM, Table 2-81) and for ENERGY STAR residential clothes washers (TRM, Table 2-81, updated by ENERGY STAR Program Requirements Product Specification for Clothes Washers, version 8, effective February 5, 2018). Guidehouse used the new minimum IMEF values in the ex post calculations, resulting in a realization rate of 0.78 for both energy savings and demand savings.</p>
	<p>ENERGY STAR dehumidifiers: Ex ante savings used calculations with liters of water per kilowatt-hour consumed (L per kWh) instead of the default values provided in the TRM. Guidehouse found units with missing capacity values in eTrack.</p>	<p>Ex ante savings were based on a default L per kWh value instead of the energy and demand savings values detailed in the TRM, Table 2-92. Guidehouse used the values provided in Table 2-92 based on provided capacity values. Guidehouse found 38 project rows with no capacity values and used an average capacity of other dehumidifiers to estimate energy and demand savings for these units. These factors resulted in a realization rate of 1.28 for energy savings and 1.29 for demand savings.</p>
	<p>ENERGY STAR Refrigerators and Most Efficient Refrigerators: A portion of ex ante savings incorrectly used equations for ENERGY STAR refrigerators rather than the TRM table for most efficient refrigerators or EE&amp;C energy savings. Guidehouse found units with missing volumes in eTrack.</p>	<p>For ENERGY STAR most efficient refrigerators, equations for ENERGY STAR refrigerators were used instead of equations from TRM Table 2-73. For both types of refrigerators, Guidehouse found 46 units with missing adjusted volume estimates. Guidehouse used an average adjusted volume among this type of units to estimate energy and demand savings. Guidehouse also was not able to replicate some of the reported energy savings. These factors resulted in a realization rate of 1.17 for both energy and demand savings for ENERGY STAR refrigerators and 1.18 for ENERGY STAR's most efficient refrigerators.</p>
<b>Invoice Review</b>	<p>No issues.</p>	<p>Guidehouse reviewed the incentives to confirm that the invoice amounts in the PECO tracking database matched those from the CSP data. The team found no discrepancies.</p>

Source: Guidehouse analysis

### F.1.2.1.2 Engineering File Reviews and Online Survey Verification

This activity included a detailed engineering review of project files for HVAC participants and an online survey of participants who installed HVAC and appliances to verify equipment installation. Guidehouse received 55 completed HVAC verification surveys and requested all project files associated with these customers from the CSP to review to achieve at least 15% relative precision at the 85% confidence level for the HVAC component, which is well above the minimum sample quotas detailed in the PY12 sample design memo.<sup>8</sup> The evaluation team used the project files to verify the measure-specific variables listed in the eTrack database, such as capacity (tons), SEER, and heating seasonal performance factor. The team applied the verified variables to the TRM and IMP algorithms to calculate verified energy and demand savings for the sample.

Guidehouse received 72 completed verification surveys for Appliance projects, well above the targeted 36 completes required to achieve at least 15% relative precision at the 85% confidence level in the results. The evaluation team compared the project files to the results of the online verification survey for HVAC and Appliance projects. Table F-4 summarizes the results of these project file reviews and the online survey verification.

**Table F-4. Engineering File Reviews and Survey Verification for Residential Non-Lighting**

Impact Activity	Finding	Description
Engineering File Reviews	ENERGY STAR refrigerators: Guidehouse identified discrepancies regarding the top- versus bottom-mounted freezers for refrigerator-freezer units.	Two customers reported that their refrigerator had a top-mounted freezer, supported by provided project files, but the tracking database showed energy and demand savings associated with a refrigerator with a bottom-mounted freezer. Guidehouse used the energy and demand savings associated with the refrigerators with top-mounted freezers for these two customers. This resulted in realization rates of 0.9 for energy and 0.8 for demand savings for these two customers compared to the TRM calculated values.
	ENERGY STAR Air purifiers: Guidehouse identified discrepancies in clean air delivery rate (CADR) values provided in the tracking database.	Guidehouse found that three air purifier units did not have correct CADR values reported in the eTrack database. Guidehouse adjusted the CADR values and updated the energy and demand savings associated with these units. This resulted in updated savings for two of the three air purifier units, with realization rates of 0.9 and 0.8 for energy and demand savings for these customers compared to the TRM calculated values, with no changes made for the third unit because it already had maximum energy and demand savings per the 2016 TRM.

Source: Guidehouse analysis

### F.1.2.2 Net Impact Evaluation

Guidehouse did not conduct net-to-gross (NTG) research for this solution in PY12.

### F.1.2.3 Process Evaluation

Guidehouse performed PECO and CSP staff interviews in PY12 for the Lighting, Appliances and HVAC Solution. The evaluation team used in-depth interviews to collect data regarding PY12 implementation. The interviews focused on implementation strategies, data tracking,

<sup>8</sup> Guidehouse. *PECO PY12 Residential Impact Sample Design (LAH & Appliance Recycling)*. Revised April 14, 2021.



program management, and areas for improvement. Interviews found that this solution is operating as intended for PY12. No other process evaluation activities took place for this solution in PY12.<sup>9</sup>

### F.1.3 PECO Marketplace

The following subsections present the evaluation details and findings for the PECO Marketplace channel of the LAH Solution.

#### F.1.3.1 Gross Impact Evaluation

Guidehouse conducted engineering desk reviews and a record-level TRM review for all strata in the PECO Marketplace to verify the gross impacts and to check the CSP database for reporting accuracy.

##### F.1.3.1.1 Engineering Desk Reviews

Guidehouse applied the same desk review process for the PECO Marketplace channel as the downstream Appliances and HVAC channel, including verification of program-reported savings in the program tracking database, eTrack. The evaluation team used the measure-specific variables listed in the eTrack database to populate the energy and demand savings algorithms as detailed in the TRM and SWE-approved IMPs to verify the reported savings estimates. The team completed desk reviews for a census of PECO Marketplace non-Lighting measures.

Table F-5 summarizes the results of these desk review activities.

**Table F-5. Desk Review Activities for PECO Marketplace**

Impact Activity	Finding	Description
<b>Record-Level Savings Review</b>	Smart/learning thermostats: Guidehouse could not source the heating energy savings factor in the ex ante calculations.	Guidehouse reviewed all applicable data sources for the heating energy savings factor values used in the ex ante calculations but was unable to replicate the savings estimates. The team used the SWE-approved IMP in the ex post calculations, resulting in a realization rate of 1.05 for energy savings.

Source: Guidehouse analysis

#### F.1.3.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this solution in PY12.

#### F.1.3.3 Process Evaluation

Guidehouse performed PECO and CSP staff interviews in PY12 for the PECO Marketplace. The evaluation team used in-depth interviews with PECO and CSP staff to collect data regarding PY12 program implementation. The interviews focused on implementation strategies, data

<sup>9</sup> Guidehouse last surveyed LAH Solution participants for process evaluation purposes for the PY11 evaluation year. Guidehouse did not survey participants in the Lighting channel of LAH in PY11.

tracking, program management, and areas for program improvement. The interviews found that the PECO Marketplace is operating as intended for PY12. No other process evaluation activities took place for this solution in PY12.

## **F.2 Appliance Recycling Solution**

The Appliance Recycling Solution helps customers recycle energy-wasting appliances by removing and recycling operating inefficient refrigerators, freezers, and room ACs from residential customer sites at no cost to participants. ARCA is the CSP for this solution.

A participant is a customer who schedules a pickup for one or more units. During PY11, the CSP shifted to a contactless pickup method due to the pandemic. This change was temporary to practice social distancing health and safety recommendations. In PY12, the CSP shifted back to conducting in-home pickups.

Customers may be referred to the Appliance Recycling Solution through other solution activities. For example, Low-Income EE Program Whole Home Solution auditors may identify a qualifying appliance and recommend the Appliance Recycling Solution to the customer. A customer who implements Whole Home measures and recycles an appliance would be considered a participant in both solutions. Findings in this section can be attributed to both the Residential and Low-Income Programs. Savings attributable to income-eligible customers are reported through the Low-Income EE Program Whole Home Solution.

### **F.2.1 Gross Impact Evaluation**

Guidehouse verified participation counts and conducted three primary evaluation tasks to verify gross impacts for the Appliance Recycling Solution in PY12:

- The team conducted an algorithm review using the default coefficients and independent variable values specified in Table 2-78 of the TRM.
- The team used a regression analysis to refine the deemed gross verified savings to account for the program's specific appliance stock characteristics—average age, size (cubic feet), and configuration, among others.
- The team conducted an online survey to verify the appliance characteristics recorded in the tracking data and to gather additional data as inputs to the part-use factor (PUF) of the TRM's algorithm.

The analysis outputs, coupled with the PUF, formed the basis for the gross verified savings related to compliance. This calculation yields a gross savings per unit that, when summed, yields the solution's verified savings. This section summarizes the findings of these activities.

#### **F.2.1.1 Participant Counts**

Guidehouse analyzed participation counts as part of the evaluation and did not find any difference from reported participation counts of customers. However, one customer in the sample did report having recycled only one of the units that was shown in eTrack.

### F.2.1.2 Gross Verification Findings

Guidehouse conducted an algorithm review using the default coefficients and independent variable values specified in Table 2-78 of the TRM. The evaluation team performed this review on a census of recycled units in the program tracking data to determine whether the deemed values were properly applied when calculating program savings. The team calculated a lower annual unit energy consumption (UEC) value for freezers and a higher UEC for refrigerators (Table F-6) than reported in the tracking data. This discrepancy is the result of using default values rather than calculating UEC based on electric distribution company (EDC)-gathered data inputs, such as the pre-1990 independent variable, which the TRM specifies should be calculated using EDC-gathered data and not a prescribed deemed value. The room AC annual UEC, 159 kWh/yr, is specified in the TRM and was correctly applied in the tracking data.

During the algorithm review, the evaluation team discovered that 11 refrigerator and freezer units in total had ages estimated to be outside of a normal range. A few of these appliances had ages greater than 60 years and up to 90 years of age. To alleviate the chance of over- or underestimating energy savings, the implementor should use the appliances' actual year of manufacture.

The evaluation team refined the gross verified savings to account for the program's specific appliance stock characteristics—average age, size (cubic feet), and configuration, among others—as recorded in the program tracking data. In this case, the regression analysis used the coefficients detailed in the TRM and the measure stock characteristics for the algorithm's independent variables. The team conducted this analysis on a census of recycled units. The regression analysis of the recycled stock calculated a higher UEC for refrigerators than the deemed values and a lower UEC for freezers (Table F-6). As specified by the TRM, Guidehouse used the deemed room AC UEC value.

The evaluation team also conducted an online survey to verify the appliance characteristics recorded in the tracking data and to gather additional data as input to the PUF. Survey respondents reported a lower PUF than the default values for Residential EE measures. Low-Income EE Program survey respondents reported a higher PUF for refrigerators and lower PUF for freezers (Table F-6). The PUF for refrigerators and freezers is the primary driving factor for the solution's realization rate differing from 1.00. Additionally, one customer reported not having recycled a room AC unit along with the refrigerator. Guidehouse does not calculate room AC PUF because it is not required in the TRM.

**Table F-6. Appliance Recycling Impact Evaluation Values**

Sector	Measure	Reported UEC (kWh/yr)	TRM UEC (kWh/yr)	PUF
Residential	Refrigerators	945	1,025	94.9%
Residential	Freezers	844	731	86.6%
Low-Income	Refrigerators	945	986	98.8%
Low-Income	Freezers	844	638	82.4%
Residential/Low-Income	Room AC	159	159	-

Source: Guidehouse analysis

Refer to Table 3-5 and Table 3-6 in the main body report for all energy, demand, and realization rate values. This includes refrigerator, freezer, and room AC verified savings values.

## F.2.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this solution in PY12.

## F.2.3 Process Evaluation

Guidehouse conducted PECO and CSP staff interviews in PY12 for the Appliance Recycling solution. The evaluation team used in-depth interviews to collect data regarding PY12 implementation. The interviews focused on implementation strategies, data tracking, program management, and areas for program improvement. Interviews found that this solution is operating as intended for PY12. No other process evaluation activities took place for this solution in PY12.<sup>10</sup>

## F.3 Whole Home Solution

PECO's Whole Home Solution is for customers who want to improve the energy performance of their entire home. This solution offers a general walkthrough assessment available to all PECO residential customers and a more comprehensive audit, including blower door and combustion safety tests, to PECO residential electric heat customers or customers with central AC. Participating customers are sorted into one of these two categories based on the outcome of an initial screening call with CSP staff. During the assessment or audit site visits, customers receive direct installation of efficient products (such as lighting, power strips, and pipe insulation for electric domestic hot water tanks). Customers with electric heat may be eligible for additional thermal envelope improvements (such as insulation and air sealing).

Customers may also participate through a retail pathway available for larger HVAC measures:

- Fuel switching – gas, propane, or oil heat to electric heat
- Fuel switching – fossil fuel water heater to electric hot water heater
- Heat pump water heater
- Variable speed pool pump

Customers may be directed to the retail pathway through the walkthrough assessment, audit, or direct referral from customer service or a contractor. Customers may participate in one, the other, or both pathways.

Due to the pandemic, the Residential Whole Home Solution offered participants the option of a standard in-home assessment or a virtual assessment. The virtual assessment involved sending a custom kit of direct install measures to participants based on the needs of the customer's home. A virtual walkthrough was then conducted by the CSP to verify that these measures had been properly installed by the customer. During this time, and similar to the in-home assessment, the CSP auditor would also advise the customer on how they could save additional energy through either behavior changes or by directing them to the retail pathway for larger measures.

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<sup>10</sup> Guidehouse last surveyed Appliance Recycling Solution participants for process evaluation purposes for the PY11 evaluation year.

### **F.3.1 Gross Impact Evaluation**

Guidehouse did not conduct impact research for this solution in PY12. The PY11 realization rate was applied to the PY12 reported savings.

### **F.3.2 Net Impact Evaluation**

Guidehouse did not conduct NTG research for this solution in PY12. The PY11 NTG ratio was applied.

### **F.3.3 Process Evaluation**

Guidehouse conducted PECO and CSP staff interviews in PY12 for the Whole Home solution. The evaluation team used in-depth interviews to collect data regarding PY12 implementation. The interviews focused on implementation strategies, data tracking, program management, and areas for program improvement. Interviews found that although this solution is operating as intended for PY12, it saw a decrease in customer participation for both the in-home and virtual assessments likely due to the continued presence of the pandemic. No other process evaluation activities took place for this solution in PY12.<sup>11</sup>

## **F.4 New Construction Solution**

PECO's Residential New Home Rebates Program intends to accelerate the adoption of EE in the design, construction, and operation of new single-family (SF) and multifamily homes by using the U.S. Environmental Protection Agency's (EPA's) ENERGY STAR home certification. Builders building new SF or multifamily homes can take advantage of PECO's New Home Rebates Program to receive rebates for building high-performance and ENERGY STAR homes. The program has two rebate tiers: Tier 1 applies to homes that achieve 20% more savings than a code-level home, and Tier 2 applies to homes with an ENERGY STAR certification.

Performance Systems Development is the CSP for this solution. A New Home Rebates Program participant is defined as a new home.

### **F.4.1 Gross Impact Evaluation**

In the PY12 Residential New Construction Solution impact evaluation, Guidehouse reviewed project REM/Rate files and conducted building simulation modeling using REM/Rate software for weather-sensitive measures, namely heating and cooling. The evaluation team calculated verified impacts of non-weather-sensitive measures such as lighting and appliances based on TRM algorithms and inputs and data gathered from Residential New Construction files, REM/Rate files, and supplemental information from PECO's LAH Solution.

#### ***F.4.1.1 Engineering File Reviews***

The evaluation team reviewed an extract of all project REM/Rate models and all prescriptive measure calculations (lighting, appliances, and hot water measures) for compliance with the appropriate TRM sections. The team reviewed project tracking data, ex ante measure savings

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<sup>11</sup> A full process evaluation of the Whole Home Solution was conducted in PY11.

calculations, and REM/Rate model files submitted by raters for compliance with program requirements.<sup>12</sup>

#### ***F.4.1.2 Energy and Demand Savings Calculation – Weather-Sensitive Measures Analysis***

For weather-sensitive measure savings (thermal envelope, heating and cooling systems), Guidehouse independently recalculated heating and cooling savings by running the REM/Rate building simulation models. The evaluation team conducted building simulation modeling for a sample of projects completed in PY12. Each REM/Rate file was run using a batch process against the PECO reference home<sup>13</sup> based on TRM specifications. The team calculated the annual heating and cooling energy savings and demand savings<sup>14</sup> of program homes as the difference between the baseline (PECO reference home) and the as-built simulation results.

#### ***F.4.1.3 Energy and Demand Savings Calculation – Non-Weather-Sensitive Measures Analysis***

For non-weather-sensitive measures (lighting, appliances, and hot water measures), Guidehouse used a combination of data and assumptions from the TRM and PECO's LAH Solution. For ENERGY STAR appliances such as refrigerators, clothes dryers, clothes washers, dishwashers, water heaters, and ceiling fans, the evaluation team used the model number provided in the New Home Rebates Program lighting and appliance form to determine consumption and calculated savings using TRM algorithms. For lighting, the team obtained average per-unit savings from a subset of lamps in the LAH Solution, which is calculated using TRM algorithms, and scaled those with the number of fixtures reported in the New Home Rebates Program lighting and appliance form. Based on the PY12 TRM baseline assumptions, savings for LEDs under 21 W were considered as having an "efficient baseline," whereas savings for LEDs above 21 W, specialty fixtures, and reflector fixtures were considered as having an "inefficient baseline." To account for the 2009 International Energy Conservation Code baseline, which specifies that 50% of the fixtures in a building must be high-efficacy fixtures, Guidehouse assumed that the "efficient baseline" lamps met this requirement and applied a derating factor to a subset of the fixtures calculated with the inefficient baselines.<sup>15</sup>

In its PY9 Annual Report,<sup>16</sup> the SWE recommended that Guidehouse remove savings for non-weather-sensitive measures (lighting, appliances, and hot water measures) from the REM/Rate model and calculate them separately using the TRM algorithms. This approach requires granular data for non-weather-sensitive measures that is not being collected by the CSP. Therefore, in cases where project-level CSP data was not available, the evaluation team used data and assumptions from PECO's LAH Solution, as approved by the SWE. In general, the team considered the LAH Solution lighting data an appropriate proxy for the Residential

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<sup>12</sup> The Phase III CSP relies on nonproprietary software, REM/Rate, for energy savings estimation.

<sup>13</sup> The CSP shared the specifications for the Pennsylvania 2016 Savings Reference home for use in the REM/Rate models.

<sup>14</sup> REM/Rate demand savings has a built-in 0.9 coincident demand factor applied, and the PECO TRM prescribed that 0.647 should be used as the coincident demand factor for heating and cooling. These two factors are accounted for in the savings calculation.

<sup>15</sup> This derating factor is only applied if the number of fixtures whose savings are calculated with the inefficient baseline exceeds those calculated using the efficient baseline.

<sup>16</sup> *SWE Annual Report Act 129 Program Year 9*. January 15, 2019.

New Construction measure data because the configurations and sales were weighted toward customers' preferences in the PECO service territory.

Per the Phase III Evaluation Plan,<sup>17</sup> Guidehouse did not conduct onsite or phone verification for this solution because of the solution's overall size contribution to PECO's portfolio.

#### **F.4.1.4 Realization Rate Calculation**

The evaluation team obtained the total verified energy and demand savings by summing the savings from non-weather-sensitive measures and weather-sensitive measures. The team then compared the resulting total verified energy and demand savings to the reported savings to determine the realization rates.

#### **F.4.1.5 Sampling**

Guidehouse used a stratified random sample to select the files for review and building simulation modeling to achieve a minimum 15% relative precision at the 85% confidence level, assuming a coefficient of variation (CV) of 0.3 for all strata. This CV is a conservative estimate informed by PY11 evaluation results. The primary strata were large buildings (>2,500 kWh), medium buildings (1,750 kWh-2,500 kWh), and small buildings (570 kWh-1,750 kWh). Buildings under 570 kWh of savings were excluded from the sampling.

#### **F.4.1.6 Findings**

The solution realization rates can be attributed to the difference in the methodology and assumptions used by the REM/Rate software for non-weather-sensitive measures, which differs from the TRM.

Guidehouse identified the following findings during the impact evaluation:

- Per the TRM, water heater savings are only included for sites with heat pump water heaters. Among the 15 sampled projects, only two projects included an electric heat pump water heater. REM/Rate calculates ex ante water heating savings regardless of fuel or technology type, resulting in water heating savings in instances that would not qualify for TRM savings. The TRM methodology is more stringent in comparison and results in lower savings relative to REM/Rate.
- Per the TRM, energy savings for appliances other than water heaters are only calculated for ENERGY STAR equipment. REM/Rate calculates savings for all appliances using baseline federal minimum efficiencies as specified by the U.S. Department of Energy, regardless of ENERGY STAR certification. The TRM methodology is more stringent in comparison and results in lower savings relative to REM/Rate.
- The lighting counts are likely being underreported in the New Home Rebates Program lighting and appliance forms, which would lead to lower project-level lighting savings. For example, two of the sampled sites were reported to only have nine fixtures.

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<sup>17</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

## **F.4.2 Net Impact Evaluation**

Guidehouse did not conduct NTG research for this solution in PY12. The PY11 NTG ratio of 1.0 was applied.

## **F.4.3 Process Evaluation**

Guidehouse conducted PECO and CSP staff interviews in PY12 for the New Construction solution. The evaluation team used in-depth interviews to collect data regarding PY12 implementation. The interviews focused on implementation strategies, data tracking, program management, and areas for program improvement. Interviews found that this solution is operating as intended for PY12.

## **F.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 EE market and want to benefit from energy efficient products. To achieve these ends, the Behavioral Solution partners with Oracle (the solution's CSP) 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 use social norms to compare a 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. These reports also provide targeted recommendations or tips to customers, suggesting actions they 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. As of May 2021, the reports are being provided to roughly 330,000 PECO customers.

In addition to the RCT, the Behavioral Solution provides HERs to households enrolled in PECO's AC Saver Program. The AC Saver Program is a residential demand response initiative that primarily seeks to reduce participant peak demands. The HERs sent to these participants are intended to maintain customer satisfaction while enhancing customer education and awareness related to EE benefits.

One participant is counted as a utility account included in the solution's treatment group, including those accounts associated with the AC Saver Program.

Table F-7 and Table F-8 summarize the participating treatment group homes by cohort and month for those households included within the PY12 scope of evaluation activities.



**Table F-7. Behavioral Solution Treatment Group Counts – Waves 1-4**

Month	Wave 1	Wave 2	Wave 3	Wave 4
June 2020	23,384	30,182	52,055	165,793
July 2020	23,312	30,087	51,885	165,175
August 2020	23,180	29,933	51,637	164,283
September 2020	23,018	29,731	51,360	163,247
October 2020	22,884	29,598	51,108	162,380
November 2020	22,772	29,462	50,888	161,546
December 2020	22,655	29,327	50,673	160,706
January 2021	22,530	29,182	50,482	159,932
February 2021	22,457	29,065	50,295	159,303
March 2021	22,388	28,991	50,183	158,784
April 2021	22,298	28,889	50,030	158,141
May 2021	22,195	28,796	49,851	157,482

Source: Guidehouse analysis

**Table F-8. Behavioral Solution Treatment Group Counts – Waves 5, 6, AC Saver, and Total**

Month	Wave 5 – Electric	Wave 5 – Dual Fuel	Wave 6 – Electric	Wave 6 – Dual Fuel	AC Saver	Total
June 2020	22,126	13,929	16,726	5,170	32,383	<b>361,748</b>
July 2020	22,019	13,861	16,566	5,137	32,253	<b>360,295</b>
August 2020	21,829	13,773	16,370	5,096	32,039	<b>358,140</b>
September 2020	21,650	13,669	16,167	5,046	31,828	<b>355,716</b>
October 2020	21,450	13,583	16,013	5,006	31,662	<b>353,684</b>
November 2020	21,303	13,494	15,871	4,975	31,492	<b>351,803</b>
December 2020	21,140	13,411	15,718	4,937	31,336	<b>349,903</b>
January 2021	21,005	13,345	15,595	4,911	31,172	<b>348,154</b>
February 2021	20,875	13,282	15,467	4,890	31,062	<b>346,696</b>
March 2021	20,750	13,231	15,366	4,871	30,969	<b>345,533</b>
April 2021	20,638	13,168	15,239	4,846	30,859	<b>344,108</b>
May 2021	20,513	13,099	15,104	4,810	30,732	<b>342,582</b>

Source: Guidehouse analysis

### F.5.1 Impact Evaluation Methodology

Guidehouse followed the impact evaluation methodology outlined in Section 6.1.1 of the Phase III Evaluation Framework.<sup>18</sup> The evaluation team estimated savings using a monthly lagged

dependent variable model. For details on this model, refer to Section 6.1.1.5 of the Phase III Evaluation Framework.

## F.5.2 Summary Statistics and Results

Table F-9 through Table F-12 summarize the regression outputs and summary statistics by cohort in both the RCT and AC Saver groups. The tables also include the absolute precision results for each wave. The Phase III Evaluation Framework<sup>19</sup> Section 6.1.1.1.1 requires the solution-level verification achieve an absolute precision of  $\pm 0.5\%$  at the 95% confidence level (two-tailed); individual waves may have a wider margin of error. Given that the Behavioral Solution analysis examines the solution's entire population (a census evaluation), the precisions reported in Table F-9 and Table F-10 reflect the error of the regression analysis estimate rather than a sampling uncertainty. This uncertainty is reflected in the Behavioral Solution analysis only. The regression analysis estimation error is not reflected in the Residential EE Program or the PY12 portfolio total savings uncertainty. Those rolled up uncertainties only reflect sampling uncertainties that may be associated with other solutions.

Notably, Guidehouse did not detect anomalies in monthly savings due to the pandemic. Savings values for each month during PY12 aligned roughly with the savings values for the corresponding month of PY11. Per SWE guidance, the evaluation team did not attempt to modify or normalize savings. Any pandemic effects on the Behavioral Solution savings are part of the observed conditions.

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<sup>18</sup> SWE. *Evaluation Framework for Pennsylvania Act 129 Phase III Energy Efficiency and Conservation Programs*. May 8, 2018. [https://www.puc.pa.gov/Electric/pdf/Act129/SWE\\_PhaseIII-Evaluation\\_Framework050818.pdf](https://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework050818.pdf).

<sup>19</sup> SWE. *Evaluation Framework for Pennsylvania Act 129 Phase III Energy Efficiency and Conservation Programs*. May 8, 2018. [https://www.puc.pa.gov/Electric/pdf/Act129/SWE\\_PhaseIII-Evaluation\\_Framework050818.pdf](https://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework050818.pdf).

**Table F-9. Behavioral Solution Cohort Regression Details (kWh) – Waves 1-4**

Month	Wave 1		Wave 2		Wave 3		Wave 4	
	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error
June 2020	-0.46	0.14	-1.11	0.24	-1.04	0.16	-0.52	0.11
July 2020	-0.62	0.16	-1.42	0.27	-1.21	0.18	-0.69	0.13
August 2020	-0.51	0.15	-1.23	0.25	-1.17	0.17	-0.60	0.12
September 2020	-0.46	0.12	-1.04	0.20	-1.09	0.13	-0.43	0.09
October 2020	-0.46	0.11	-0.94	0.17	-0.90	0.11	-0.32	0.08
November 2020	-0.79	0.15	-0.96	0.20	-1.02	0.13	-0.32	0.09
December 2020	-1.21	0.21	-1.30	0.27	-1.31	0.17	-0.29	0.12
January 2021	-1.45	0.25	-1.38	0.31	-1.36	0.19	-0.30	0.13
February 2021	-1.62	0.26	-1.28	0.32	-1.30	0.19	-0.36	0.13
March 2021	-1.14	0.19	-0.93	0.24	-1.21	0.15	-0.34	0.10
April 2021	-0.75	0.13	-1.01	0.19	-0.95	0.12	-0.27	0.08
May 2021	-0.57	0.13	-0.96	0.21	-1.04	0.13	-0.39	0.09

Source: Guidehouse analysis

**Table F-10. Behavioral Solution Cohort Regression Details (kWh) – Waves 5, 6, and AC Saver**

Month	Wave 5 – Electric		Wave 5 – Dual Fuel		Wave 6 – Electric		Wave 6 – Dual Fuel		AC Saver	
	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error
June 2020	-0.59	0.17	-0.55	0.20	-0.42	0.13	-0.52	0.27	-0.52	0.09
July 2020	-0.61	0.21	-0.61	0.25	-0.42	0.18	-0.56	0.36	0.37	0.11
August 2020	-0.61	0.19	-0.55	0.23	-0.49	0.17	-0.76	0.34	-0.06	0.10
September 2020	-0.58	0.15	-0.36	0.17	-0.42	0.14	-0.44	0.27	-0.46	0.07
October 2020	-0.52	0.13	-0.28	0.14	-0.45	0.14	-0.47	0.24	-0.19	0.06

Month	Wave 5 – Electric		Wave 5 – Dual Fuel		Wave 6 – Electric		Wave 6 – Dual Fuel		AC Saver	
	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error
November 2020	-0.57	0.17	-0.12	0.15	-0.35	0.18	-0.64	0.26	-0.11	0.06
December 2020	-0.82	0.23	-0.10	0.19	-0.80	0.25	-0.78	0.32	-0.05	0.08
January 2021	-0.91	0.26	-0.07	0.21	-0.86	0.28	-1.03	0.36	-0.32	0.09
February 2021	-0.95	0.28	0.15	0.21	-0.91	0.29	-1.07	0.36	-0.30	0.09
March 2021	-0.51	0.20	-0.16	0.17	-0.67	0.21	-0.70	0.28	-0.48	0.07
April 2021	-0.51	0.14	-0.30	0.15	-0.50	0.15	-0.20	0.24	-0.45	0.06
May 2021	-0.53	0.15	-0.48	0.17	-0.34	0.14	-0.35	0.27	-0.57	0.07

Source: Guidehouse analysis

**Table F-11. Behavioral Solution Cohort Percent Savings – Waves 1-4**

Month	Wave 1		Wave 2		Wave 3		Wave 4	
	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision
June 2020	1.26%	0.74%	1.60%	0.67%	1.97%	0.57%	1.34%	0.55%
July 2020	1.42%	0.71%	1.70%	0.63%	1.82%	0.54%	1.37%	0.52%
August 2020	1.27%	0.75%	1.62%	0.65%	1.93%	0.55%	1.32%	0.52%
September 2020	1.47%	0.77%	1.80%	0.68%	2.49%	0.58%	1.37%	0.56%
October 2020	1.46%	0.71%	1.90%	0.69%	2.59%	0.61%	1.33%	0.60%
November 2020	1.80%	0.68%	1.61%	0.66%	2.60%	0.63%	1.18%	0.65%
December 2020	1.92%	0.66%	1.68%	0.68%	2.75%	0.70%	0.91%	0.73%
January 2021	2.01%	0.68%	1.63%	0.73%	2.77%	0.74%	0.89%	0.77%
February 2021	2.21%	0.70%	1.52%	0.75%	2.71%	0.77%	1.10%	0.81%
March 2021	2.21%	0.72%	1.45%	0.74%	3.05%	0.72%	1.25%	0.74%

Month	Wave 1		Wave 2		Wave 3		Wave 4	
	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision
April 2021	2.15%	0.74%	2.03%	0.74%	2.81%	0.68%	1.17%	0.68%
May 2021	1.81%	0.80%	1.79%	0.77%	2.67%	0.64%	1.42%	0.64%

Source: Guidehouse analysis

**Table F-12. Behavioral Solution Cohort Percent Savings – Waves 5, 6, and AC Saver**

Month	Wave 5 – Electric		Wave 5 – Dual Fuel		Wave 6 – Electric		Wave 6 – Dual Fuel		AC Saver	
	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision	Percent Savings	Absolute Precision
June 2020	1.52%	0.88%	1.37%	1.00%	0.93%	0.59%	0.90%	0.92%	1.73%	0.57%
July 2020	1.24%	0.83%	1.17%	0.93%	0.78%	0.66%	0.79%	0.99%	-0.94%	0.53%
August 2020	1.37%	0.84%	1.18%	0.94%	0.98%	0.67%	1.16%	1.01%	0.18%	0.54%
September 2020	1.79%	0.92%	1.14%	1.04%	1.08%	0.71%	0.94%	1.14%	1.92%	0.59%
October 2020	1.97%	0.99%	1.18%	1.15%	1.31%	0.77%	1.30%	1.30%	1.06%	0.62%
November 2020	1.79%	1.04%	0.47%	1.19%	0.79%	0.80%	1.66%	1.33%	0.54%	0.62%
December 2020	2.02%	1.10%	0.35%	1.29%	1.36%	0.82%	1.73%	1.41%	0.20%	0.68%
January 2021	2.08%	1.17%	0.23%	1.39%	1.31%	0.82%	2.23%	1.51%	1.32%	0.71%
February 2021	2.17%	1.25%	-0.51%	1.46%	1.36%	0.84%	2.36%	1.57%	1.32%	0.75%
March 2021	1.52%	1.15%	0.64%	1.39%	1.36%	0.82%	1.85%	1.45%	2.42%	0.74%
April 2021	1.92%	1.05%	1.34%	1.33%	1.36%	0.81%	0.59%	1.39%	2.62%	0.69%
May 2021	1.82%	0.99%	1.76%	1.19%	0.94%	0.78%	0.83%	1.26%	2.77%	0.66%

Source: Guidehouse analysis

Table F-13 summarizes monthly gross savings for the Behavioral Solution waves informed by the regression analysis activities. These results reflect the impacts before any consideration of the dual participation analysis, which is described in Section F.5.3.

**Table F-13. Behavioral Solution Monthly Verified Modeled Savings (MWh)**

Month	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5 – Electric	Wave 5 – Dual Fuel	Wave 6 – Electric	Wave 6 – Dual Fuel	AC Saver	Total
June 2020	323	1,002	1,630	2,591	390	229	209	80	508	<b>6,961</b>
July 2020	446	1,323	1,943	3,546	414	262	217	90	-374	<b>7,867</b>
August 2020	364	1,139	1,866	3,050	411	236	247	120	65	<b>7,497</b>
September 2020	320	927	1,677	2,125	374	149	202	67	440	<b>6,282</b>
October 2020	324	858	1,429	1,635	349	117	223	72	189	<b>5,196</b>
November 2020	538	844	1,556	1,548	362	48	165	95	102	<b>5,259</b>
December 2020	846	1,185	2,051	1,461	536	43	389	119	45	<b>6,676</b>
January 2021	1,009	1,249	2,134	1,477	593	29	417	157	305	<b>7,370</b>
February 2021	1,016	1,041	1,827	1,591	554	-54	393	146	264	<b>6,778</b>
March 2021	792	838	1,883	1,663	331	64	321	106	457	<b>6,455</b>
April 2021	499	874	1,422	1,293	316	117	228	29	419	<b>5,198</b>
May 2021	391	861	1,608	1,894	334	196	161	52	546	<b>6,044</b>

Source: Guidehouse analysis

### F.5.3 Dual Participation 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 the increase in participation in the solution among Behavioral Solution participants. This is also known as dual participation savings.

To generate estimates of dual participation, Guidehouse followed the Phase III Evaluation Framework<sup>20</sup> guidance on completing dual participation analyses. The Evaluation Framework conveys that exposure to the Behavioral Solution messaging often motivates participants to take advantage of other solution offerings promoted through Behavioral Solution 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.<sup>21</sup> The framework methodology calls for program-specific uplift calculations, and the SWE requests that those values be reported. Guidehouse estimated aggregate uplift across the Residential EE Program's solutions.

Guidehouse's dual participation analysis also accounts for upstream EE solutions. The calculation of double counted savings from upstream solutions is complicated by participation not being tracked at the customer level; therefore, the approaches described previously for specific homes are infeasible. Per the Evaluation Framework in Section 6.1.1.8.2, the evaluation team used an assumed upstream reduction factor subtracted from the estimate of energy savings for each wave of Behavioral Solution participants after downstream double counted savings had been removed. The specific reduction factors used for the waves are shown in Table F-14.

**Table F-14. Default Upstream Adjustment Factors**

Years Since Cohort Inception	Default Upstream Reduction Factor	Behavior Waves
1	0.75%	-
2	1.50%	Wave 6
3	2.25%	-
4 and beyond	3.00%	Wave 1, Wave 2, Wave 3, Wave 4, Wave 5, AC Saver

*Source: 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, May 8, 2018.*

Table F-15 summarizes the dual participation 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 shown in Table F-13.

<sup>20</sup> SWE. *Evaluation Framework for Pennsylvania Act 129 Phase III Energy Efficiency and Conservation Programs*. May 8, 2018. [https://www.puc.pa.gov/Electric/pdf/Act129/SWE\\_PhaseIII-Evaluation\\_Framework050818.pdf](https://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework050818.pdf).

<sup>21</sup> Pennsylvania PUC. "Section 6.1.1.8. Dual Participation Analysis." *Evaluation Framework for Pennsylvania Act 129 Phase III Energy Efficiency and Conservation Programs*. May 8, 2018. [https://www.puc.pa.gov/Electric/pdf/Act129/SWE\\_PhaseIII-Evaluation\\_Framework050818.pdf](https://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework050818.pdf).

**Table F-15. Downstream and Upstream Savings Adjustments**

Behavior Waves	Downstream Dual Participation Savings (MWh/yr)	Upstream Dual Participation Savings (MWh/yr)	Total Dual Participation (MWh/yr)
Wave 1	583	189	772
Wave 2	1,303	325	1,628
Wave 3	1,100	598	1,698
Wave 4	1,252	679	1,930
Wave 5 – Electric	215	142	358
Wave 5 – Dual Fuel	104	40	144
Wave 6 – Electric	115	46	161
Wave 6 – Dual Fuel	58	16	74
AC Saver	2,435	16	2,451

Source: Guidehouse analysis

### F.5.4 Behavioral Program Impacts

By combining the regression and dual participation analysis results, Guidehouse created a final set of PY12 Behavioral Solution impact estimates, detailed in Table F-16. These energy savings reflect the net impacts for each of the six waves of RCT participants and AC Saver. The evaluation team used an assumed NTG ratio of 1.00 based on two assumptions. First, the RCT design eliminates free ridership concerns because the random assignment ensures balance in free riders between the recipient and control groups, thus cancelling out the possible effects. Second, engagement in additional EE actions outside of the program (spillover) is expected to be small for Behavioral programs. For more information on the possible effects of free riders and spillover for RCT studies, refer to the State and Local Energy Efficiency (SEE) Action protocol, Section 2.2.2.<sup>22</sup>

**Table F-16. Behavioral Solution Net Impacts**

Behavior Waves	Gross Verified Savings (MWh/yr)	Downstream Dual Participation Savings (MWh/yr)	Upstream Dual Participation Savings (MWh/yr)	Net Verified Savings (MWh/yr)	Demand Savings (MW) <sup>23</sup>
Wave 1	6,869	583	189	6,097	0.7
Wave 2	12,141	1,303	325	10,513	1.2
Wave 3	21,027	1,100	598	19,329	2.2
Wave 4	23,873	1,252	679	21,942	2.5
Wave 5 – Electric	4,965	215	142	4,607	0.5
Wave 5 – Dual Fuel	1,436	104	40	1,292	0.1
Wave 6 – Electric	3,173	115	46	3,012	0.3

<sup>22</sup> SEE Action. *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*. May 16, 2012.

[https://www7.eere.energy.gov/seeaction/system/files/documents/emv\\_behaviorbased\\_eeprograms.pdf](https://www7.eere.energy.gov/seeaction/system/files/documents/emv_behaviorbased_eeprograms.pdf).

<sup>23</sup> PECO claims the verified demand savings, but the implementer (Oracle) does not evaluate these savings as part of its standard reporting. Therefore, there is no realization rate for demand savings.



Behavior Waves	Gross Verified Savings (MWh/yr)	Downstream Dual Participation Savings (MWh/yr)	Upstream Dual Participation Savings (MWh/yr)	Net Verified Savings (MWh/yr)	Demand Savings (MW) <sup>23</sup>
Wave 6 – Dual Fuel	1,133	58	16	1,058	0.1
AC Saver	2,967	2,435	16	516	0.1
<b>Total</b>	<b>77,583</b>	<b>7,166</b>	<b>2,051</b>	<b>68,367</b>	<b>7.8</b>

Source: Guidehouse analysis

Total verified savings are 68,367 MWh/yr. Solution-reported savings by PECO for PY12 are 74,135 MWh/yr, resulting in an energy realization rate of 0.92.

## Appendix G. Residential Low-Income EE Program

This appendix details the evaluation sample design, methods, and activities deployed in PY12 for the Residential Low-Income EE Program Whole Home Solution. PECO discontinued the Lighting Solution in PY9. Refer to Section 3.2 in the main body report for evaluation findings, results, and conclusions for this solution.

The Multifamily Targeted Market Segment (described in Appendix I) does not contribute to the Low-Income EE Program. Income-eligible multifamily buildings are served through the Low-Income EE Program's Whole Home Solution.

### G.1 Whole Home Solution

PECO's Low-Income Whole Home Solution offers income-eligible customers multiple pathways to engage with PECO to improve the energy performance of their entire homes. These pathways include the following:

- Free Home Energy Checkups, providing site visits, education, and direct installation of energy efficient products.
- Free virtual energy checkups were offered during the pandemic, providing virtual site visits, education, and a custom kit with direct installation measures to be installed by the customer.
- Workshops are delivered to income-eligible multifamily buildings providing energy education and energy kits.
- Collaboration with property owners to deliver services to income-eligible customers living in multifamily buildings, consistent with the home energy checkup. This effort includes large private property owners and the city's public housing authority.
- Collaboration with complementary income-eligible programs from organizations such as the Philadelphia Gas Works, Philadelphia Water Department, and Weatherization Agencies to identify income-eligible customers and serve them comprehensively with free home energy checkups through a single outreach effort.
- Collaboration with the Low-Income Usage Reduction Program (LIURP), providing complementary efficient products to increase the LIURP service offering's comprehensiveness.
- LED lighting giveaways through food banks and community events in collaboration with community partner organizations.
- Mailed Energy Kits with educational materials and efficient products for direct installation by eligible customers. These were sent to customers who requested a Free Home Energy Checkup during the pandemic when in-home visits were suspended.
- Direct customer referrals are given to the Appliance Recycling Solution.

Income eligibility is defined as residential electric customers with a household income of less than or equal to 150% of the federal poverty level.

## G.1.1 Gross Impact Evaluation

The PY12 impact evaluation focused on verifying reported savings; activities conducted included tracking database analysis, phone verifications, and desk reviews of a sample of projects. The evaluation team conducted phone verifications on direct installation measures as part of the core home energy checkup pathway. Additionally, an online survey was launched to evaluate the mailed kits initiative.

The Low-Income EE Program Whole Home Solution referred eligible customers to the Residential EE Program Appliance Recycling Solution. Subsequent appliance recycling projects were implemented and evaluated consistent with the Appliance Recycling Solution's procedures. Reported and verified Appliance Recycling Solution savings attributable to income-eligible customers are reported through the Low-Income EE Program Whole Home Solution.

### G.1.1.1 Tracking Database Review

Guidehouse evaluated reported savings through a preliminary database review, comparing reported savings with TRM<sup>24</sup> assumptions and algorithms. The evaluation team analyzed a census of reported measures, resulting in an adjustment to reported savings. The database review identified three discrepancies between reported savings and verified savings, as Table G-1 illustrates.

**Table G-1. Low-Income EE Program Whole Home Solution Tracking Database Review**

Measure	Discrepancy	Recommendation	Realization Rate (kWh)	Realization Rate (kW)
<b>ENERGY STAR LED</b>	The incorrect deemed hours of use (HOU) and coincidence factor (CF) were used for the program's direct installation components.	Guidehouse recommends calculating savings using the correct TRM-deemed inputs.	0.90	0.97
<b>Low Flow Aerators</b>	A mix of TRM-deemed and custom temperature values (Tout) are being applied when only a deemed value is allowed.	Guidehouse recommends calculating savings using TRM algorithms for accuracy and consistency.	0.70	0.69
<b>Low Flow Showerheads</b>	A mix of TRM-deemed and custom temperature values (Tout) are being applied when only a deemed value is allowed.	Guidehouse recommends calculating savings using TRM algorithms for accuracy and consistency.	0.84	0.84

Source: Guidehouse analysis

Discrepancies between reported savings and verified savings identified in the tracking database review are included in the phone verification savings results detailed in Section G.1.1.2.

<sup>24</sup> PA PUC. *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.

Although Guidehouse confirmed measure installation, the phone verification realization rates reflect TRM inputs and tracking database review results.

### ***G.1.1.2 Phone Verification and File Review***

Guidehouse used phone surveys to confirm measure installation. The impact evaluation sampling strategy used a random sample of projects from the population of program participants in the PY12 tracking database. Guidehouse selected sampled projects based on project size to confirm that the sample reflected the participant population.

Multifamily projects (all sizes), large SF (>2,300 kWh), medium SF (1,600 kWh-2,300 kWh), and small SF (500 kWh-1,599 kWh) projects were sampled for phone verifications. The evaluation team did not sample very small projects (<500 kWh); instead, the small project stratum realization rates were applied to the very small project strata.

The Low-Income Whole Home Solution serves income-eligible multifamily properties. Projects are implemented and reported based on meter configuration. Projects are reported individually at the apartment level on individually metered buildings. Conversely, projects are reported at the building level for master-metered buildings. The evaluation team worked with the CSP to identify groups of SF projects that belonged to a larger multifamily building. By sampling multifamily buildings in their own stratum, the team accounted for program implementation differences due to the split incentive barriers common in multifamily buildings (where property owners are responsible for building upgrades but the energy savings benefits may be realized by residents). The average measure realization rate of a verified apartment was applied to the unverified apartments within each building within the multifamily sample.

Phone verifications confirmed product installations. In cases where a customer could not remember the quantity of products installed, the team verified the reported savings. In cases where a customer provided definitive quantity values, the team used the customer's reported values and adjusted the verified savings accordingly.

Differences between reported and verified savings were due to the following reasons:

- **Multifamily strata phone verification:** Guidehouse verified measure installations in six apartments within a sample of three multifamily buildings.
  - **Lighting:** One customer reported that they never received ENERGY STAR LED bulbs, and none were installed.
  - **Smart strip plug outlets:** One customer removed their smart strip because they did not like how it kept shutting their television off.
- **Single-family small, medium, and large strata phone verification:** Guidehouse verified measure installations in 25 SF home projects.
  - **Lighting:** Four customers reported that some or all of the ENERGY STAR LED bulbs had not been installed or were removed because of performance issues (not working, burnt out, brightness, or color).
  - **Smart strip plug outlets:** Three customers reported that they had not received some or all of the reported quantity of smart strips. Three other customers reported that they no longer have the smart strip plugged into a television or entertainment system.

Guidehouse conducted a project file review on the projects sampled for phone verifications. The team did not identify any discrepancies between the sampled project files and reported savings in the files reviewed.

The evaluation team calculated final program realization rates by applying TRM tracking database review findings to all projects. Phone verification project results were applied to the sampled population, as detailed in this section.

### **G.1.1.3 Review of Mailed Kits Initiative**

Guidehouse conducted an online survey for all PECO customers who participated in the Mailed Energy Kit Program pathway. A census of participants was mailed a postcard with a link to the survey, in which 154 valid responses were collected.

Differences between reported and verified savings were due to the following reasons:

- Seven customers said they did not receive a kit.
- Twenty customers said they had not installed the measures in the kit yet.
  - However, all but one of these customers said that they intended to install the measures within the kit.
- Only 60% of LED bulbs were installed at the time the survey was administered.
  - However, participants who had installed or intended to install measures from the kit indicated that they intended to install all remaining bulbs in the future.
- Only 67% and 74% of LED nightlights and smart strips, respectively, were verified as installed.
- Only 50% of all hot water measures combined (showerheads, kitchen aerators, and bathroom aerators) were verified as installed.
  - Additionally, 55% of respondents verified that they had gas hot water heaters and therefore achieved zero electric savings.

### **G.1.2 Process Evaluation**

Guidehouse conducted PECO and CSP staff interviews in PY12 for the Whole Home solution. The evaluation team used in-depth interviews to collect data regarding PY12 implementation. The interviews focused on implementation strategies, data tracking, program management, and areas for program improvement. Interviews found that although this solution is operating as intended for PY12, it saw a decrease in customer participation for both the in-home and virtual assessments likely due to the continued presence of the pandemic.<sup>25</sup>

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<sup>25</sup> A full process evaluation of the Whole Home Solution was last conducted in PY8.

## Appendix H. Small and Large C&I EE Programs

This appendix details the evaluation sample design, methods, and activities deployed in PY12 for select Small and Large C&I EE Program solutions (listed below). Refer to Sections 3.3 and 3.4 in the main body report for evaluation findings, results, and conclusions for these solutions.

- Equipment and Systems Solution
- New Construction Solution
- Whole Building Solution
- Data Centers Targeted Market Segment

### H.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, refrigeration, and controls. Participation is defined as an activity with a unique project number; more than one measure per participant is permitted. In addition, a single customer is permitted to participate in multiple projects with unique project numbers. PECO's C&I and Government/Education/Nonprofit (G/E/NP) customers who own or rent their spaces 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 CSP, before completing the project. Once approved, each project is implemented by the customer's own contractor. Either the customer or the contractor submits the rebate paperwork to the CSP.

The PECO Instant Lighting Discounts (PILD) pathway allows customers to receive discounts on qualified products without completing application paperwork. In the POS midstream pathway, customers must provide basic information on the facility where lighting will be installed, including verification that the facility is associated with a PECO C&I account. The distributor completes a simplified application on behalf of the customer; the customer must submit proof of installation within 45 days of the purchase.

The midstream lookback pathway issues midstream incentives and savings attribution letters to program-qualifying lighting projects that are currently not captured through the POS pathway (the customer does not receive an instant discount during purchase at the distributor). The lookback pathway reviews distribution transaction data, identifies program-qualifying projects that did not receive an incentive, and issues incentives to both the purchaser and the distributor.

The LED aggregation pathway is a component of the PILD pathway and captures savings from manufacturer and national distributor direct-to-consumer transactions that did not go through the POS pathway. Manufacturer and national distributor (channel partner) sales and transaction data are collected and processed by Encentiv Energy, which identifies program-qualifying LED sales. The program then disperses incentive funds to the channel partners and Encentiv Energy to accelerate market transformation through product pricing buy-downs, sales promotions, and other mechanisms. Both the purchaser (contractor, trade ally, or end-use customer) are notified upon purchase that they benefited as a result of the Midstream Lighting Program, both from EE and cost perspectives. The end-use customer also receives notification that the equipment they installed was a result of the Midstream Lighting Program.

PECO continued to offer the Race is On limited time offer in PY12 (started in September 2020, extended through May 2021). PECO also offered a bonus incentive to trade allies who drove higher savings through the program in PY12 relative to the average savings achieved in the prior 12 months.

During the first few weeks of PY12, CSP implementation teams were still unable to conduct onsite walkthroughs and inspections due to the pandemic and continued to support customers through phone calls, webinars, Skype/Zoom calls, and other remote channels. In some cases, inspections were delayed until onsite visits could resume. Implementation teams were able to return to customer sites in July 2020 with additional safety and training protocols in place.

## **H.1.1 Gross Impact Evaluation**

### ***H.1.1.1 Methodology***

#### *H.1.1.1.1 Engineering Desk Reviews and Phone Verification*

Guidehouse conducted desk reviews for all projects in the evaluation sample. The desk reviews used 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 evaluation team supplemented desk reviews with phone verifications, which the team assigned to projects per the sampling memo.<sup>26</sup> Phone verifications consisted of interviews with customers about their projects. Common discussion points included 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.

#### *H.1.1.1.2 Onsite Verification*

Guidehouse conducted onsite verification for sampled projects per the sampling memo.<sup>27</sup> Projects assigned an onsite visit first received a desk review to create the Site-Specific Measurement and Verification Plan (SSMVP).

The primary objective of the site visits was to collect the data required by the TRM<sup>28</sup> and the Phase III Evaluation Framework.<sup>29</sup> This data included verifying the quantities and type of each measure, equipment nameplate data, operating schedules, and carefully describing the site conditions. Guidehouse verified this information through visual inspection of the measures and by interviewing the customers.

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<sup>26</sup> PECO. *PY12 Large Small CI EE Impact Sample Design Memo 03-23-21*. Dated March 23, 2021.

<sup>27</sup> PECO. *PY12 Large Small CI EE Impact Sample Design Memo 03-23-21*. Dated March 23, 2021.

<sup>28</sup> PA PUC. *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.

<sup>29</sup> SWE. *Evaluation Framework for Pennsylvania Act 129 Phase III Energy Efficiency and Conservation Programs*. October 21, 2016. [http://www.puc.pa.gov/Electric/pdf/Act129/SWE\\_PhaseIII-Evaluation\\_Framework102616.pdf](http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf).

To reduce risks associated with the pandemic, Guidehouse hosted a discussion with the SWE to prioritize onsite visits for projects where data could not be obtained through a phone call, video call, or a separate data request made to the customer. The evaluation team and the SWE reviewed site-specific project details and the SSMVP, deciding whether to solicit additional data from the customer remotely or to conduct a site visit to collect verification data or metered data.

Nine projects received onsite verification (including three with supplemented metering or trend data collection), and 52 projects received additional phone verification or virtual verification.<sup>30</sup>

#### *H.1.1.1.3 Onsite Verification with Metering*

For projects that surpassed the expected energy (kilowatt-hour) savings thresholds set in Table 1-2 of the TRM and for which the evaluation team and the SWE agreed that onsite verification was advised, Guidehouse conducted onsite verification or collected additional trend data. This effort was accomplished through contact with the customer and collecting site-specific information for open variables used to calculate energy and demand savings. Site-specific information included end-use trend data and trend data from building management systems. Six projects received an onsite visit supplemented with additional trend data.

#### *H.1.1.1.4 Handling Non-Response and Customer Refusal*

Guidehouse made every attempt to complete its verification efforts. The evaluation team made repeated attempts via email and phone calls to schedule site visits or complete phone interviews. For projects that were unresponsive and assigned an onsite verification or onsite metering, the team dropped the sample point and replaced it with another from the same stratum. For projects that were assigned a phone verification, the team converted the project to a file review only after making at least five attempts to call or email the customer in alignment with the Evaluation Plan.<sup>31</sup> Two projects were replaced, and 35 projects were converted to file review after the team exhausted all customer contact attempts. These customers may have been affected by the pandemic, which likely contributed to the lower response rates.

#### **H.1.1.2 Sampling**

Using tracking data from PY12, Guidehouse obtained the total number of projects and the total amount of energy savings in the population. With this project data, the evaluation team sampled at the project level for the impact evaluation activities in PY12 to bin projects within eight strata, as outlined in the PY12 sample design memo.<sup>32</sup>

Guidehouse first created a census stratum (Stratum 1 – Very Large Projects) for projects exceeding the kilowatt-hour thresholds described in the main body report's Stratum Structure table. Next, the evaluation team excluded all projects making up the lowest 2% of total solution energy savings. Projects completed through the midstream pathway were then separated and put into their own strata. Finally, the team sorted the remaining projects by size and divided the population into three additional strata: those projects making up the top third, the middle third, and the lowest third of the total energy savings.

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<sup>30</sup> Virtual verification included virtual tours and interviews using videoconferencing software as allowed by the SWE according to its June 3, 2020 memo RE: "PY11 EM&V and the Coronavirus Outbreak."

<sup>31</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

<sup>32</sup> PECO. *PY12 Large Small CI EE Impact Sample Design Memo 03-23-21*. Dated March 23, 2021.



During the previous year's evaluation, retrocommissioning (RCx) projects were identified as having large differences between the reported and verified savings, leading to high CVs. The team decided, in consultation with the SWE, to re-stratify all RCx projects into a separate stratum to address the large variability of these types of projects. This separate RCx stratum was repeated this year.

Partway through the evaluation, the evaluation team tested possible results and relative precision based on current trends and found that the final results may not have met the required precision targets. The evaluation team chose to add additional projects to achieve the relative precision targets as presented in the sampling memo. The team selected two projects from the large sector's small stratum and two projects from the large sector's midstream to large stratum.

For Small C&I Equipment and Systems, of the 44 projects evaluated:

- 42 included lighting or lighting control retrofits
- 1 included lighting, EC motors, and refrigeration night covers classified as custom HVAC
- 1 was an AC project

For Large C&I Equipment and Systems, of the 52 projects evaluated:

- 40 included lighting or lighting control retrofits<sup>33</sup>
- 5 were RCx projects
- 3 were custom motors or drives projects
- 3 projects had other custom measures
- 1 was a chiller project
- 1 was a heat pump project

The SWE sampled 12 total projects for its review. It conducted site visits for four of the projects but conducted desk reviews for all 12. Eight projects received only a desk review from the SWE. Details of the impact sample by stratum can be seen in Table 3-19 and Table 3-27 in the main body report.

### ***H.1.1.3 Findings***

The majority of sampled projects for the Equipment and Systems Solution achieved realization rates for both energy and demand within 20% of the expected values. Eighteen projects had verified energy savings values fall below 80% of the reported values, and 18 projects had verified energy savings values above 120% of reported values. For demand savings, 14 projects fell below 80% of reported values while 15 projects were above 120% of reported values. Three projects claimed no demand savings but achieved peak demand savings based on Guidehouse's evaluation. The following factors led to significant variation between the reported and verified savings and to the observed project-level realization rates:

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<sup>33</sup> Non-lighting projects may include lighting measures in addition to other measures. Therefore, the summary of projects by measure category does not equal the total number of projects evaluated.

- The most common discrepancy between ex ante and ex post calculations was in the annual HOU for lighting measures. The evaluation team uncovered discrepancies both higher and lower than reported, as determined through phone or onsite verifications. In most of these cases, the verified HOU was more than 10% different from the deemed HOU.<sup>34</sup> Discrepancies discovered during peak demand hours or summertime operating schedules had the additional consequence of changing the demand calculation.
- Other primary drivers for lighting measure realization rates include the following:
  - Two midstream lighting projects were determined to have zero energy and demand savings due to double counting of the same fixtures through two pathways. Through the evaluation, the team found that these lighting fixtures were sold to a contractor or customer and incentivized through the midstream pathway. Then, these were later installed and included within a large aggregated prescriptive project and incentivized again through the standard equipment and systems prescriptive pathway.
  - Four sampled projects revealed lighting fixture wattages that differed from reported values.
  - Four sampled projects verified a different heating fuel type than reported values, affecting the HVAC interactive factors.
  - In two cases, the evaluation team found pre- or post-retrofit lighting control types that differed from reported values.
  - One project had 30% fewer fixtures than were recorded on the project application, as determined through an onsite verification visit.
- For all five RCx projects, the evaluation team incorporated additional months of post-retrofit billing and advanced metering infrastructure data to improve the savings estimate for all seasons throughout the year. The team also modified some of the regression models or used temperature bins in the analysis to improve the estimate of pre- and post-retrofit consumption and measure impacts.
- Similar to RCx projects, one custom motors and drives project originally included only 6 weeks of fall trend data to calculate annual savings. The fall period is when VFDs provide higher savings relative to their annual average savings. The evaluation team included an additional 7,500 hours of trend data over several seasons, including peak periods, which resulted in approximately 35% lower savings.
- One chiller project for comfort cooling claimed full load HOU nearly double those documented by the TRM without any supporting documentation. Without any documentation to support the claim, the evaluation team used the TRM-deemed effective full load hours.
- One project installed 12 custom-made cooling systems and claimed a custom baseline. The project did not include any documentation of system performance or efficiency, nor any documentation supporting the custom baseline. Additionally, the original savings calculations included multiple errors, including using the wrong line voltage (claiming 460 V for a 230 V system). In combination, these errors resulted in zero savings for the project.

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<sup>34</sup> As allowed by the evaluation protocols described in Section 3.1.1 of the TRM.

## H.1.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this solution in PY12.

## H.1.3 Process Evaluation

Guidehouse reviewed program materials and conducted in-depth interviews with PECO and CSP staff in PY12 to better understand any changes to the program design, updates to measure mix, program successes and challenges, and barriers to participation. Interviews covered topics such as the current state of the solution, current challenges, opportunities for improvement, the customer rebate application, midstream pathways, the solution tracking database, and opportunities for Phase IV.<sup>35</sup>

Key insights from the interviews included the following:

- **The pandemic has proved a hindrance to some program processes, but the project pipeline remains strong.** The pandemic has not materially affected the communications with trade allies or customers. PECO and the CSP are hosting meetings over video calls, conducting virtual webinars and educational events, and having periodic coffee hours with customers and market players. There were some delays in finalizing large projects that required onsite verification prior to incentive disbursement.
- **PECO promotes use of the online application portal.** While most applications are submitted via email with the Excel application, PECO encourages use of the online portal by offering a 25% bonus incentive for projects submitted online by trade allies. Additionally, PECO published a new resource documenting the benefits of using the online portal. The PECO website now also contains a countdown bar for incentive funds and segment-specific market materials (e.g., guides to energy savings for schools). PECO built out these guides for all major C&I segments.
- **The midstream pathway saw increased participation during PY12.** PECO continued the LED aggregation pathway and lookback pathways in PY12.

## H.2 New Construction Solution

The C&I New Construction Solution is designed to accelerate adoption of energy efficient design and construction practices in new and retrofit facilities. The program covers both new construction and buildings undergoing major renovation; major renovation 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 in addition to 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. Participation is defined as an activity with a unique project number; more than one measure per participant is permitted. In

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<sup>35</sup> A full process evaluation of the Equipment and Systems Solution was last conducted in PY11.

addition, a single customer is permitted to participate in multiple projects with unique project numbers. ICF is the CSP for the C&I New Construction Solution.

During the first few weeks of PY12, CSP implementation teams were still unable to conduct onsite walkthroughs and inspections due to the pandemic and continued to support customers through phone calls, webinars, Skype/Zoom calls, and other remote channels. In some cases, inspections were delayed until onsite visits could resume. Implementation teams were able to return to customer sites in July 2020 with additional safety and training protocols in place.

### **H.2.1 Gross Impact Evaluation**

Guidehouse did not conduct an impact evaluation for this solution in PY12. Guidehouse used the realization rates calculated in PY11 and applied them to the PY12 reported energy and demand savings results to arrive at PY12 gross impact results.

### **H.2.2 Net Impact Evaluation**

As described in the Phase III Evaluation Plan, Guidehouse used the realization rates calculated in PY11 and applied them to the PY12 reported energy and demand savings results to arrive at PY12 gross impact results.

### **H.2.3 Process Evaluation**

Guidehouse reviewed program materials and conducted in-depth interviews with PECO and CSP staff in PY12 to understand any changes to program design, updates to measure mix, program successes and challenges, and barriers to participation. Interviews covered topics such as the current state of the solution, current challenges, opportunities for improvement, the customer rebate application, midstream pathways, the solution tracking database, and opportunities for Phase IV.<sup>36</sup>

Similar to the Equipment and Systems Solution, the pandemic resulted in a small hindrance to program implementation in PY12; however, customer communications remained strong.

## **H.3 Whole Building Solution**

The Whole Building Solution offers the direct installation of EE measures to customers who want to improve the overall energy performance of their small businesses. PECO and SmartWatt, the CSP, identify eligible small C&I customers with a monthly demand of 100 kW or less.<sup>37</sup> The CSP audits the 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 project cost, up to a minimum of a 1-year simple payback for the customer. PECO offers two financing options to cover the remaining costs: 12-month, 0% interest, or long-term financing at 7% interest. The CSP tracks energy savings and participation in PECO's eTrack

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<sup>36</sup> A full process evaluation of the New Construction Solution was last conducted in PY11.

<sup>37</sup> Religious institutions and nonprofits with monthly demand of 200 kW or less are also eligible to participate in the Whole Building Solution.

database and defines participation as an activity at a customer premise with a unique project number. A project can include the installation of more than one measure.

### H.3.1 Gross Impact Evaluation

As described in the Phase III Evaluation Plan, Guidehouse used the realization rates calculated in PY11 and applied them to the PY12 reported energy and demand savings results to arrive at PY12 gross impact results.

#### H.3.1.1 Methodology

Guidehouse conducted a desk review of the Whole Building Solution in PY12, including a record-level TRM review and an administrative cost analysis.

Guidehouse’s desk review process included quarterly verification of program-reported savings in the program tracking database. The evaluation team also applied energy and demand savings algorithms, as specified in the PA TRM, to verify that savings were accurately reported within the program tracking data. The team completed desk reviews for a census of projects completed by Whole Building participants.

#### H.3.1.2 Sampling

As described in the Phase III Evaluation Plan, Guidehouse did not conduct sampling activities for the Whole Building Solution in PY12.

#### H.3.1.3 Findings

Table H-1 summarizes the results of the desk review activities.

**Table H-1. Small C&I EE Program Whole Building Solution Tracking Database Review**

Measure	Finding	Resolution	Realization Rate (kWh)	Realization Rate (kW)
<b>Low Flow Aerators</b>	The solution did not install or claim savings for Low Flow Aerators in PY12.	Guidehouse removed the measure from the Tracking Database Review.	-	-
<b>Low Flow Showerheads</b>	The solution did not install or claim savings for Low Flow Showerheads in PY12.	Guidehouse removed the measure from the Tracking Database Review.	-	-
<b>Refrigerator Case Lighting</b>	The solution did not install or claim savings for LED Refrigerator Case Lighting in PY12.	Guidehouse removed the measure from the Tracking Database Review.	-	-

Measure	Finding	Resolution	Realization Rate (kWh)	Realization Rate (kW)
<b>Night Covers for Refrigerated Display Cases</b>	The solution added Night Covers on Refrigerated Display Cases to the portfolio of offerings in PY12.	Guidehouse included the new measure in the Tracking Database Review and did not find any issues.	1.0	1.0

Source: Guidehouse analysis

### H.3.2 Net Impact Evaluation

As described in the Phase III Evaluation Plan, Guidehouse used the realization rates calculated in PY11 and applied them to the PY12 reported energy and demand savings results to arrive at PY12 gross impact results.

Guidehouse did not conduct NTG research for this solution in PY12. See Table 3-22 in the main body report for the PY11 NTG results that Guidehouse applied to the PY12 gross savings estimates.

### H.3.3 Process Evaluation

Guidehouse conducted in-depth interviews with PECO and CSP staff in PY12 to better understand any changes to the program design, successes, challenges, and barriers to participation. Interviews covered topics such as the current state of the solution, current challenges, opportunities for improvement, the customer rebate application, the solution tracking database, and opportunities for Phase IV.<sup>38</sup>

## H.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 on the project details. On account of their high energy usage profiles and specialized technologies, data centers 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 comes 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 CSP for data center projects.

### H.4.1 Gross Impact Evaluation

Guidehouse did not conduct an impact evaluation for data centers in PY12. Only one exceptionally small project was reported. There were no data center projects completed in PY11. Because the size of the project was extremely small (less than 10,000 kWh), the evaluation team forewent site-specific measurement and verification activities and applied the

<sup>38</sup> A full process evaluation of the Whole Building Solution was last conducted in PY11.

PY10 data center realization rates of 0.60 for energy and 0.61 for demand in an effort to develop a conservative estimate.

#### **H.4.2 Net Impact Evaluation**

Guidehouse did not conduct NTG research for this solution in PY12.

#### **H.4.3 Process Evaluation**

As described in the Phase III Evaluation Plan,<sup>39</sup> Guidehouse did not complete any in-depth process evaluation activities for the Data Centers Targeted Market Segment due to lack of participation in PY12. Instead, the evaluation team interviewed the PECO program manager and CSP to identify significant implementation changes to inform the impact evaluation activities. No significant changes were found.

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<sup>39</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

## Appendix I. Multifamily Targeted Market Segment

This appendix details the evaluation sample design, methods, and activities deployed in PY12 for the Multifamily Targeted Market Segment. Refer to Section 3 in the main body report for evaluation findings, results, and conclusions for this targeted market segment.

The Multifamily Targeted Market Segment contributes savings to the Residential EE, Small C&I EE, and Large C&I EE Programs. The decision makers for the projects in this targeted market segment consist of condominium owners, small multifamily building owners, property managers of large multifamily complexes, and executives at real estate investment companies who own multiple buildings in the PECO territory. Franklin Energy is the CSP for this program. The program offers direct install, prescriptive, and custom measures installed in common areas and in-unit tenant spaces of participating multifamily buildings.

The Multifamily Targeted Market Segment restarted in-home building assessments and measure installations in PY12 after being affected by the pandemic during the second half of PY11.

### I.1 Gross Impact Evaluation

#### I.1.1 Methodology

The PY12 impact evaluation consisted of a tracking system review. As indicated in the PY12 Evaluation Plan,<sup>40</sup> PY10 realization rates were applied to the reported PY12 energy and demand savings to develop the verified numbers.

##### *I.1.1.1 Tracking System Review*

Guidehouse reviewed the program tracking data quarterly to verify the program-reported savings and confirmed that all the inputs needed to quantify the energy and demand savings were provided as specified in the TRM.<sup>41</sup>

#### I.1.2 Findings

Guidehouse did not find any major discrepancies as a result of its tracking system review. No onsite verification was conducted in PY12, and the verified energy and demand savings were calculated using the realization rates developed in PY10.

### I.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this solution in PY12.

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<sup>40</sup> PECO. *Phase III Evaluation Plan, Energy Efficiency and Conservation Portfolio*. Revised March 4, 2021.

<sup>41</sup> PA PUC. *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.



### **I.3 Process Evaluation**

Guidehouse conducted in-depth interviews with PECO and CSP staff in PY12. No significant changes were found. A full process evaluation of the Multifamily Targeted Market Segment was last conducted in PY10.

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