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September 30, 2022

VIA E-Filing
Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street, 2nd Floor
Harrisburg, PA 17120

Re: PUC Docket No. M-2020-3020830
Phase IV Energy Efficiency and Conservation Program Final Annual Report for June 1, 2021 through May 31, 2022

Dear Secretary Chiavetta:

In accordance with Section IV.D.2 of the Commission's Opinion and Order Letter dated March 17, 2016 (Docket No. M-2015-2515691), enclosed is PECO's ("PECO" or "the Company") Phase IV Final Annual Energy Efficiency & Conservation Report for the period June 1, 2021 through May 31, 2022.

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 continuing COVID-19 pandemic, PECO's employees are working in the office on a part-time basis. Accordingly, PECO employees will have limited access to photocopying and U.S. mail, among other services. PECO requests that all communications with PECO employees continue to be transmitted by email.

Thank you for your assistance in this matter and please direct any questions regarding the above to Megan McDevitt, Senior Manager, Retail Rates at (215) 841 6361 or via email: megan.mcdevitt@exeloncorp.com.

Sincerely,

Enclosures

CC:K. Brown, Law Bureau (e-mail only)
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J. Sherrick, Policy & Planning/Conservation Supervisor (e-mail only)
K. G. Sophy, Director, Office of Special Assistants (e-mail only)
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Office of Small Business Advocate(e-mail only)
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Final Annual Report to the Pennsylvania Public Utility Commission

Phase IV of Act 129

Program Year 13
(June 1, 2021–May 31, 2022)

For Pennsylvania Act 129 of 2008
Energy Efficiency and Conservation Plan

Prepared for:

PECO℠
AN EXELON COMPANY

Submitted by:

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September 30, 2022

guidehouse.com

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Acronyms

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
ECM	Energy Conservation Measure
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	US Environmental Protection Agency
EUL	Effective Useful Life
FPL	Federal Poverty Level
GNI	Government/Education/Nonprofit
HER	Home Energy Report
HIM	High Impact Measure
HOU	Hours of Use
HSPF	Heating Seasonal Performance Factor
HVAC	Heating, Ventilating, and Air Conditioning
ICSP	Implementation Conservation Service Provider
IE	Income-Eligible
IMC	Incremental Measure Cost
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 & HVAC
LDV	Lagged Dependent Variable
LED	Light-Emitting Diode
LIURP	Low Income Usage Reduction Program
M&V	Measurement and Verification
MF	Multifamily
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
P4TD	Phase IV to Date
PA PUC	Pennsylvania Public Utility Commission
PILD	PECO Instant Lighting Discounts
PSA	Phase IV to Date Preliminary Savings Achieved; equal to VTD+PYRTD
PSA+CO	PSA Savings plus Carryover from Phase III
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
RCx	Retrocommissioning
RTD	Phase IV 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 IV to Date Verified Gross Savings
VTD+CO	Phase IV to Date Verified Gross Savings plus Carryover from Phase III
W	Watt

Types of Savings

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

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

Reported Gross: Also referred to as ex ante (Latin for "beforehand") savings. The energy and peak demand savings values calculated by the electric distribution company (EDC) or its program implementation conservation service providers (ICSPs) and stored in the program tracking system.

Unverified Reported Gross: The Phase IV 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 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 application of the results of the net impact evaluation. Typically calculated by multiplying the verified gross savings by a net-to-gross (NTG) ratio.

Annual Savings: Energy and demand savings expressed on an annual basis, or the amount of energy and/or peak demand an EE&C measure or program can be expected to save over the course of a typical year. Annualized savings are noted as MWh/year or MW/year. The Pennsylvania technical reference manual (TRM)[1] provides algorithms and assumptions to

[1] PA PUC. *Technical Reference Manual; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program & Act 213 Alternative Energy Portfolio Standards*. Dated August 2019, re-issued February 2021. https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/

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 (EUL). 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 IV to Date (P4TD): The energy and peak demand savings achieved by an EE&C program or portfolio within Phase IV of Act 129. Reported in several permutations described here:

- **Phase IV to Date Reported Gross Savings (RTD):** The sum of the reported gross savings recorded to date in Phase IV of Act 129 for an EE&C program or portfolio.

- **Phase IV to Date Verified Gross Savings (VTD):** The sum of the verified gross savings recorded to date in Phase IV of Act 129 for an EE&C program or portfolio, as determined by the impact evaluation finding of the independent evaluation contractor.

- **Phase IV to Date Preliminary Gross Savings Achieved (PSA):** The sum of the verified gross savings (VTD) from previous program years in Phase IV where the impact evaluation is complete plus the reported gross savings from the current program year (PYTD).

- **Phase IV to Date Preliminary Gross Savings Achieved + Carryover (PSA+CO):** The sum of the verified gross savings from previous program years in Phase IV plus the reported gross savings from the current program year plus any verified gross carryover savings from Phase III of Act 129. This value is the best estimate of an EDC's progress toward the Phase IV compliance targets.

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

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

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Portfolio
at a glance

Implementation of Phase IV of the Act 129 programs began on June 1, 2021. Phase IV includes Program Years 13-17 (PY13-PY17).

PY13

243,870 MWh/yr
claimed of electric energy savings, or 94% of target

42.22 MW/yr
claimed of peak demand savings, or 80% of target

$54,820,000
spent in the program year

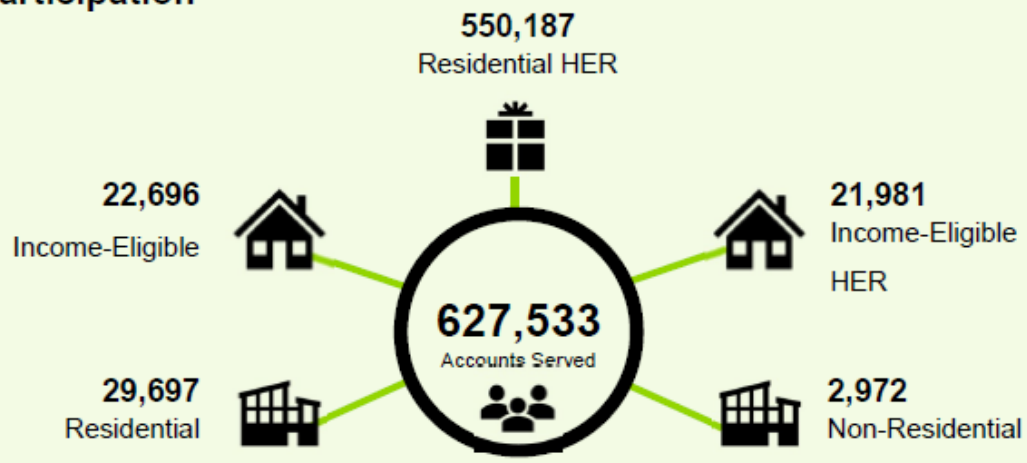
Phase IV

350,088 MWh/yr
claimed of electric energy savings (including Phase III carry-over), or 25% of target

42.22 MW/yr
claimed of peak demand savings, or 17% of target

$54,820,000
spent in the phase to date

Participation



Benefit-Cost Ratios

1.42
Residential

0.98
Portfolio TRC

0.88
Non-Residential

Note: Accounts served excludes Residential Rebates and Marketplace Upstream Lighting and Income-Eligible Giveaways. Details on participation counts are found in Section 2.4.

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 Phases I (2008 through 2013), II (2013 through 2016), and III (2016 through 2021). In late 2020, each EDC filed a new energy efficiency and conservation (EE&C) plan[2] with the Pennsylvania Public Utility Commission (PA PUC) detailing the proposed design of its portfolio for Phase IV. These plans were updated based on stakeholder input and subsequently approved by the PUC in 2021.

Implementation of Phase IV of the Act 129 programs began on June 1, 2021. This report documents the progress and effectiveness of the Phase IV EE&C accomplishments for PECO in Program Year 13 (PY13), which spans June 1, 2021, through May 31, 2022, as well as the cumulative accomplishments of the Phase IV programs since inception. This report additionally documents the energy savings carried over from Phase III. The Phase III carryover savings count toward EDC savings compliance targets for Phase IV.

This report details the participation, spending, reported gross, verified gross energy (MWh) and peak demand (MW), and verified net impacts of the energy efficiency programs in PY13. Compliance with Act 129 savings goals are ultimately based on verified gross savings. This report also includes estimates of cost-effectiveness according to the total resource cost (TRC)[3] test. PECO has retained Guidehouse Inc. (Guidehouse) as an independent evaluation contractor for Phase IV of Act 129. Guidehouse is responsible for the measurement and verification of the savings and calculation of gross verified and net verified savings.

Guidehouse performed a process evaluation for selected program components in PY13 to examine the design, administration, implementation, and market response to the EE&C program. This report presents the key findings and recommendations identified by the process evaluation and documents any changes to EE&C program delivery considered based on the recommendations.

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

[2] PECO, PECO Program Years 2021-2026 Act 129 – Phase IV Energy Efficiency and Conservation Plan, filed June 18, 2020, https://www.puc.pa.gov/pcdocs/1666981.docx .

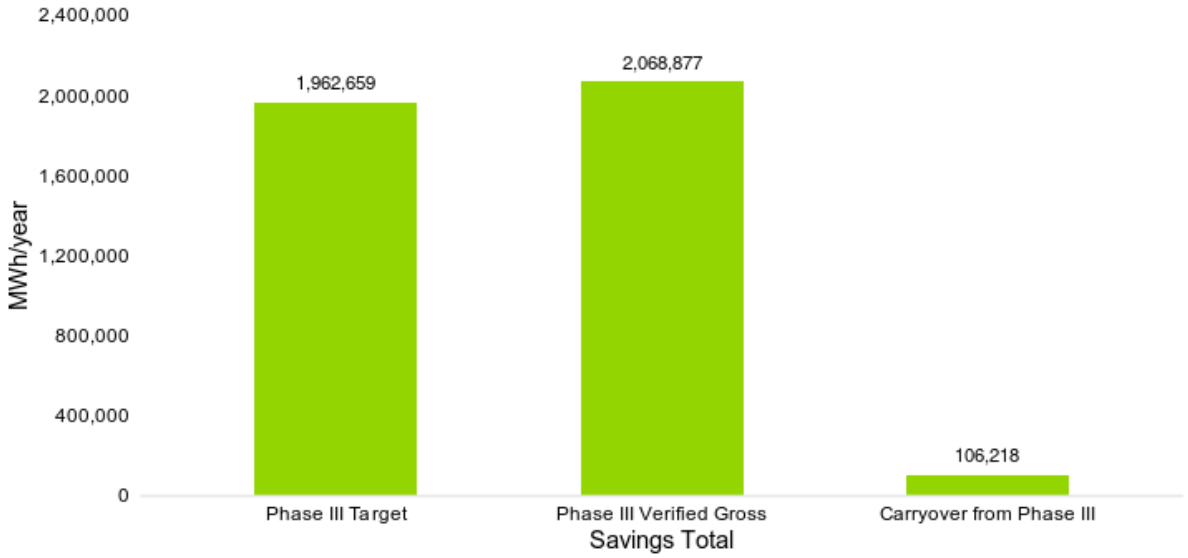
[3] The Pennsylvania TRC Test for Phase I was adopted by PUC Order at Docket No. M-2009-2108601 on June 23, 2009 (*2009 PA TRC Test Order*). The TRC Test Order for Phase I later was refined in the same docket on August 2, 2011 (*2011 PA TRC Test Order*). The 2013 TRC Test Order for Phase II of Act 129 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. The 2021 TRC Test Order for Phase IV of Act 129 was adopted by PUC Order at Docket No. M-2019-3006868 on December 19, 2019.

2. Summary of Achievements

2.1 Carryover Savings from Phase III of Act 129

PECO has a total of 106,218 MWh/year of portfolio-level carryover savings from Phase III. Figure 2-1 compares PECO's Phase III verified gross savings total to the Phase III compliance target to illustrate the carryover calculation.

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



Sources: SWE Phase III Report[4]

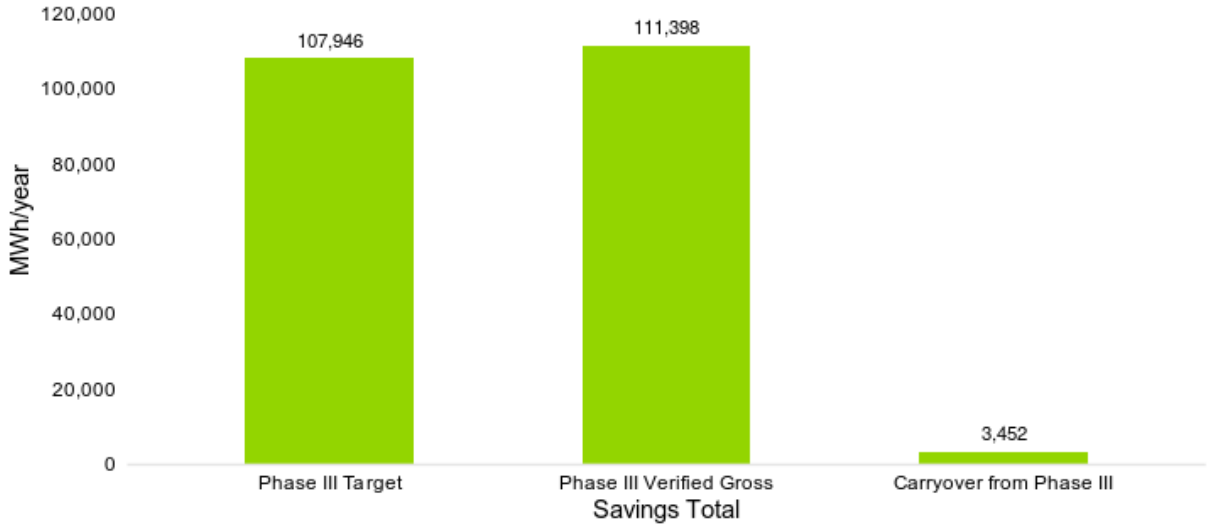
The Commission's Phase IV Implementation Order[5] also allowed EDCs to carry over savings in excess of the Phase III income-eligible (IE) savings goal.[6] Figure 2-2 shows the calculation of carryover savings for the IE customer segment.

[4] PA SWE, *SWE Annual Report Act 129 Phase III and Program Year 12*, March 31, 2022, https://www.puc.pa.gov/pcdocs/1746475.pdf.

[5] Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program Implementation Order*, at Docket No. M-2020-3015228, (*Phase IV Implementation Order*), entered June 18, 2020.

[6] Proportionate to those savings achieved by dedicated Phase III IE programs.

Figure 2-2. Income-Eligible Carryover from Phase III



Sources: SWE Phase III Report[7]

2.2 Phase IV Energy Efficiency Achievements to Date

Phase IV energy savings targets (MWh) were established at the meter level and peak demand reduction targets (MW) were set at the system level. Accordingly, the MWh totals in this report are presented at the meter level, while peak demand savings are adjusted for transmission and distribution losses to reflect system-level savings. Since the beginning of PY13 on June 1, 2021, PECO has claimed:

- 238,475 MWh/yr of reported gross electric energy savings (PYRTD)
- 43.24 MW/yr of reported gross peak demand savings (PYRTD)
- 243,870 MWh/yr of verified gross electric energy savings (PYVTD)
- 42.22 MW/yr of verified gross peak demand savings (PYVTD)
    - This represents 16.5% of the May 31, 2026, peak demand savings compliance target of 256 MW/yr.

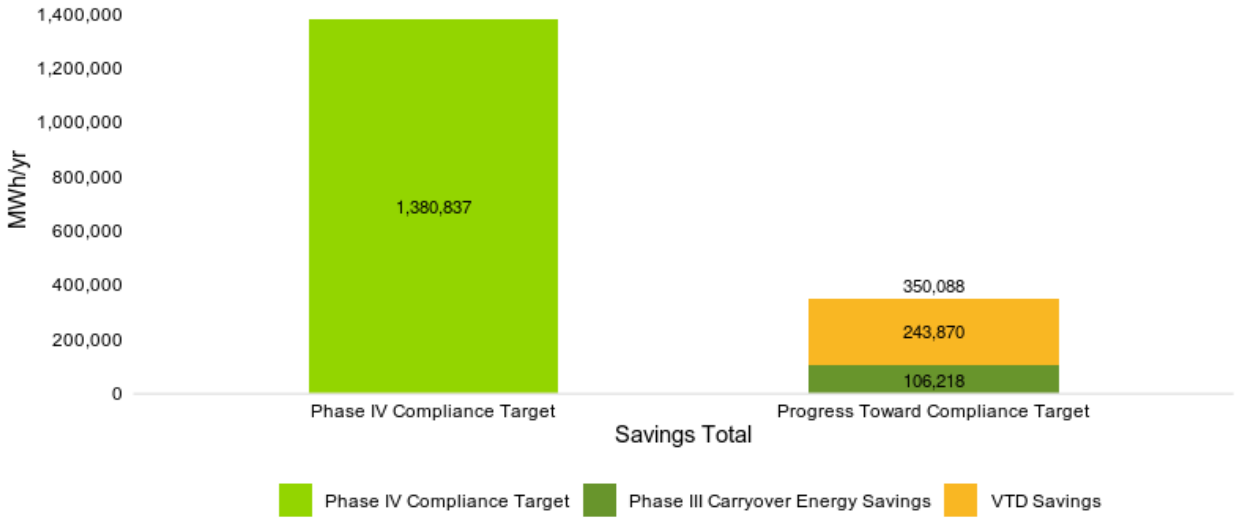
Including carryover savings from Phase III, PECO has achieved:

- 350,088 MWh/yr of VTD + portfolio-level CO energy savings
    - This represents 25.4% of the May 31, 2026, energy savings compliance target of 1,380,837 MWh/yr.

Figure 2-3 summarizes PECO's progress toward the Phase IV MWh portfolio compliance target and Figure 2-4 summarizes progress toward the Phase IV MW portfolio compliance target.

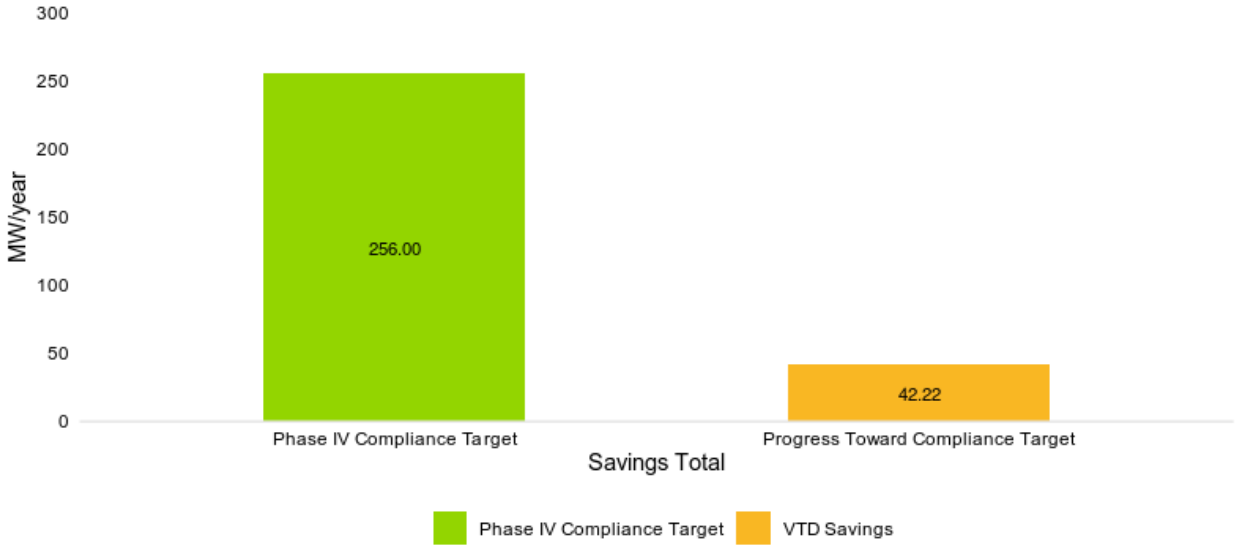
[7] PA SWE, *SWE Annual Report Act 129 Phase III and Program Year 12*, March 31, 2022, https://www.puc.pa.gov/pcdocs/1746475.pdf.

Figure 2-3. EE&C Plan Performance Toward Phase IV Portfolio Compliance Target (MWh)



Source: Guidehouse analysis

Figure 2-4. EE&C Plan Performance Toward Phase IV Portfolio Compliance Target (MW)



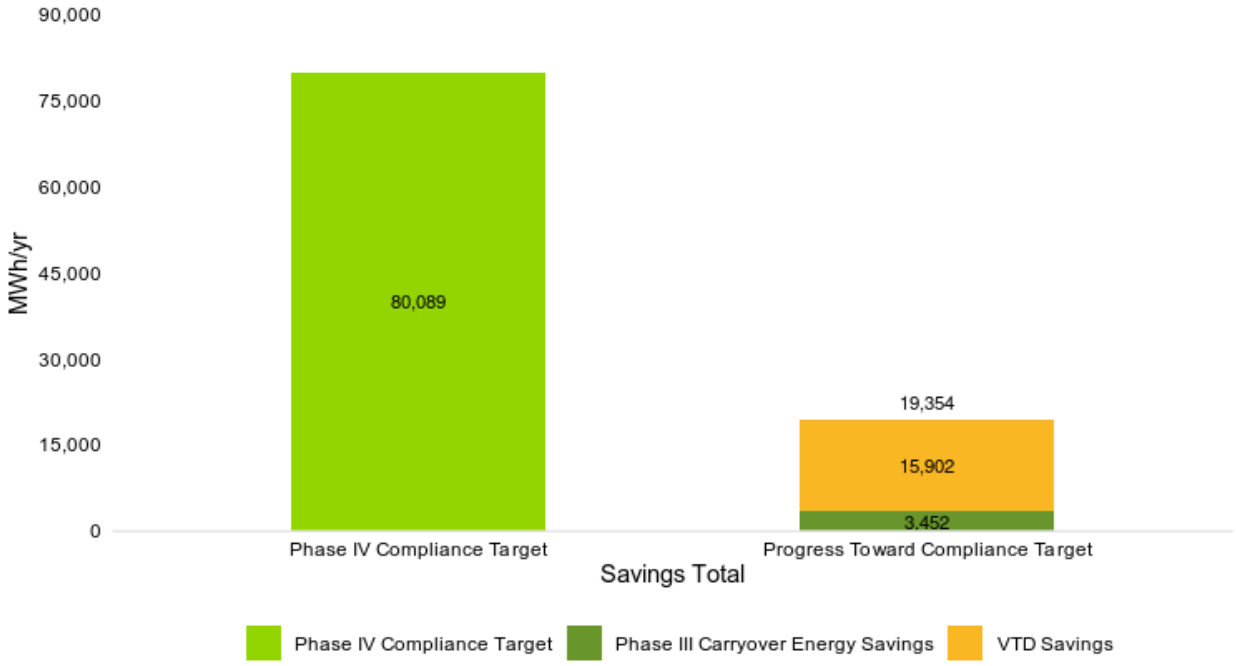
Source: Guidehouse analysis

The Phase IV Implementation Order directed EDCs to offer conservation measures to the IE customer segment based on the proportion of electric sales attributable to IE households. The proportionate number of measures target for PECO is 8.8%. PECO offers a total of 115 EE&C measures to its residential and non-residential customer classes. There are 80 measures available to the IE customer segment at no cost to the customer. This represents 69.6% of the

total measures offered in the EE&C plan[8] and exceeds the proportionate number of measures target.

The PA PUC also established an IE energy savings target of 5.8% of the portfolio savings goal. The IE savings target for PECO is 80,089 MWh/yr and is based on verified gross savings. Figure 2-5 compares the VTD performance for the IE customer segment to the Phase IV savings target. Based on the latest available information, PECO has achieved 24% of the Phase IV IE energy savings target.

Figure 2-5. EE&C Plan Performance Toward Phase IV Income-Eligible Compliance Target



Source: Guidehouse analysis

2.2.1 Phase IV Performance, Multifamily Housing

PECO has achieved 6,147 MWh/yr of verified gross electric energy savings (PYVTD) from multifamily housing. This includes 2,238 MWh/yr of verified gross electric savings through the Residential Program multifamily component, 3,041 MWh/yr of verified gross electric energy savings (PYVTD) through the IE Program multifamily component, and 868 MWh/yr PYVTD in multifamily common areas implemented through the Non-Residential program.

2.3 Phase IV Performance by Customer Segment

Table 2-1 presents the participation, savings, and spending by customer sector for PY13. The residential, small commercial and industrial (C&I), and large C&I sectors are defined by EDC tariff and the residential IE and governmental/educational/non-profit (GNI) sector were defined by statute (66 Pa. C.S. § 2806.1). The residential IE segment is a subset of the residential customer class and the GNI segment will include customers who are part of the small C&I or

[8] PECO. *PECO Program Years 2021-2026 Act 129 – Phase IV Energy Efficiency and Conservation Plan*. Filed June 18, 2020. https://www.puc.pa.gov/pcdocs/1666981.docx.

large C&I rate classes. The savings, spending, and participation values for the IE and GNI segments have been removed from the parent sectors in Table 2-1.

Table 2-1. PY13 Summary Statistics by Customer Segment

Parameter	Residen-tial (Non-IE)	Income-Eligible	Small C&I (Non-GNI)	Large C&I (Non-GNI)	Small C&I (GNI)	Large C&I (GNI)	Munici-pal Lighting	Total
Number of participants	590,358	33,567	2,076	964	372	174	22	**627,533**
PYVTD MWh/yr	61,409	12,924	52,141	99,335	7,869	9,208	986	**243,870**
PYVTD MW/yr (system)	11.11	1.26	11.14	15.37	1.60	1.74	0.01	**42.22**
Incentives[1] ($1000)	5,449	4,161	6,781	6,891	1,335	1,428	150	**26,195**

[1]Incentive totals also include Giveaway Costs as listed in the tracking data.

Source: Guidehouse analysis

2.4 Summary of Participation by Program

Participation is defined differently for certain programs and program components depending on the program delivery channel and data tracking practices. The nuances of the participant definition vary by program and are summarized by program in the following bullets. Participants are defined as a unique account number by program, program component, customer segment and program year, with the following notes and exceptions:

- For residential new construction, participation is defined as the count of unique job identifier by program year.
- Phase IV to date participant counts are additive across program years for all program components, except for the behavioral program component where participation is equal to the highest program year participation count observed in any program year during Phase IV.
- Master metered building with a single account number participants are counted as a single participant, even if the program serves multiple units.
- Account numbers are not tracked for the Residential Rebates and Marketplace Upstream Lighting delivery channel and Income-Eligible Single-Family Giveaways. Participation for those delivery channels is calculated as the sum of rebated measures. These are summarized separately in Table 2-3.

Table 2-2 provides the current participation for PY13 and Phase IV and Table 2-3 provides participation for upstream lighting and IE giveaways.

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

Program and Component	PYTD & P4TD Participation
Rebates and Marketplace (without Upstream Lighting)	14,403
Appliance Recycling	9,343
In-Home Assessment	3,899
New Construction	1,891

Program and Component	PYTD & P4TD Participation
Multifamily	161
Multifamily Income-Eligible	11,240
Residential Total	**40,937**
Single-Family (without giveaways)	9,714
Appliance Recycling	1,650
Long-Term Savings	92
Income-Eligible Total	**11,456**
Residential HER	**550,187**
Income-Eligible HER	**21,981**
Downstream	701
Midstream	2,153
Small Business Direct Install	87
New Construction	31
Non-Residential Total	**2,972**
Portfolio Total	**627,533**

Source: Guidehouse analysis

Table 2-3. Upstream Lighting and Giveaway Measures

Program and Component	PYTD Participation
Residential Rebates and Marketplace – Upstream Lighting	1,673,845
Income-Eligible Single-Family – Giveaways	237,957
Portfolio Total	**1,911,802**

Source: Guidehouse analysis

2.5 Summary of Impact Evaluation Results

During PY13, Guidehouse completed impact evaluations for several program components in the portfolio. Table 2-4 summarizes the realization rates and net-to-gross (NTG) ratios by evaluation component.

Table 2-4. Impact Evaluation Results Summary

Program and Component	Energy Realization Rate	Demand Realization Rate	NTG Ratio
Rebates and Marketplace	0.98	1.05	0.61
Appliance Recycling	1.06	1.04	0.53
In-Home Assessment	0.82	0.83	1.15
New Construction	1.01	0.67	0.92
Multifamily	0.99	0.95	0.87
Multifamily Income-Eligible	0.80	0.77	1.00
Residential Total	**0.97**	**0.97**	**0.73**
Single-Family	0.74	0.72	1.00

Program and Component	Energy Realization Rate	Demand Realization Rate	NTG Ratio
Appliance Recycling	0.96	0.98	1.00
Long-Term Savings	0.84	0.77	1.00
Income-Eligible Total	**0.76**	**0.75**	**1.00**
Residential HER	**1.00**	**1.06**	**1.00**
Income-Eligible HER	**1.00**	**-0.91**	**1.00**
Downstream	1.05	0.93	0.63
Midstream	1.16	1.14	0.69
Small Business Direct Install	0.92	0.99	0.88
New Construction	1.02	1.06	0.38
Non-Residential Total	**1.07**	**0.99**	**0.64**
Portfolio Total	**1.02**	**0.98**	**0.70**

Source: Guidehouse analysis

2.6 Summary of Energy Impacts by Program

Act 129 compliance targets are based on annualized savings estimates (MWh/year). Each program year, the annual savings achieved by EE&C program activity are recorded as incremental annual, or first-year, savings and added to an EDC's progress toward compliance. Incremental annual savings estimates are presented in Section 2.6.1. 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 2.6.2 presents the lifetime energy savings by program.

2.6.1 Incremental Annual Energy Savings by Program

Table 2-5 presents a summary of the PY13 and Phase IV to date energy savings by program. The energy impacts in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. The verified gross savings are adjusted by the energy realization rate and the verified net savings are adjusted by both the realization rate and the NTG ratio.

Table 2-5. Incremental Annual Energy Savings by Programs (MWh/Yr)

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)
Residential	42,009	40,788	27,821
Residential Income-Eligible	15,969	12,066	12,066
Residential HER	23,789	23,781	23,781
Residential Income-Eligible HER	793	795	795
Non-Residential	155,915	166,440	106,507
Portfolio Total	**238,475**	**243,870**	**170,969**

Source: Guidehouse analysis

2.6.2 Lifetime Energy Savings by Program

Table 2-6 presents the PYTD lifetime energy savings by program. The rebate programs' weighted average measure effective useful life (EUL) in PY13 ranges from 10-12 years while the home energy report programs' EULs are between 1 and 3 years. The weighted average portfolio EUL is ~10 years.

Table 2-6. Lifetime Energy Savings by Program (MWh)

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net (MWh)
Residential	491,568	358,845
Residential Income-Eligible	129,508	129,508
Residential HER	41,349	41,349
Residential Income-Eligible HER	795	795
Non-Residential	1,861,776	1,191,537
Portfolio Total	**2,524,996**	**1,722,033**

Source: Guidehouse analysis

2.7 Summary of Peak Demand Reduction Impacts by Program

Act 129 defines peak demand savings from energy efficiency 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. Peak demand impacts from energy efficiency in this report are presented at the system level, meaning they have been adjusted to account for transmission and distribution losses. PECO uses the following line loss multipliers by sector:

- Residential = 1.0799
- Small C&I = 1.0799
- Large C&I = 1.0799

Table 2-7 presents a summary of the peak demand impacts by energy efficiency program through the current reporting period.

Table 2-7. Peak Demand Savings by Energy Efficiency Program (MW/Yr)

Program	PYRTD (MW/yr) (system)	PYVTD Gross (MW/yr) (system)	PYVTD Net (MW/yr) (system)
Residential	7.64	7.43	5.13
Residential Income-Eligible	1.81	1.37	1.37
Residential HER	3.87	4.10	4.10
Residential Income-Eligible HER	0.13	-0.12	-0.12
Non-Residential	29.78	29.43	19.09
Portfolio Total	**43.24**	**42.22**	**29.57**

Source: Guidehouse analysis

2.7.1 Peak Demand Savings Nominated to PJM Forward Capacity Market

For Phase IV of Act 129, EDCs are expected to retain the capacity rights to Act 129 projects and nominate a portion of the resources acquired to PJM Forward Capacity Market (FCM).[9] If the resources clear, proceeds flow back to the rate class that generated the Act 129 savings to offset cost recovery via riders. Table 2-8 summarizes PECO's plans for wholesale recognition of Phase IV peak demand savings by Act 129 program year and PJM delivery year.

Table 2-8. Planned FCM Nominations by Act 129 Program Year and PJM Delivery Year

Act 129 Program Year	Estimated MW Acquisition for FCM	DY 23/24 MW Range	DY 24/25 MW Range	DY 25/26 MW Range	DY 26/27 MW Range	DY 27/28 MW Range	DY 28/29 MW Range	DY 29/30 MW Range
PY13	10 to 28	10 to 28	10 to 28	10 to 28				
PY14	10 to 36	10 to 36	10 to 36	10 to 36	10 to 36			
PY15	15 to 44		15 to 44	15 to 44	15 to 44	15 to 44		
PY16	15 to 44			15 to 44	15 to 44	15 to 44	15 to 44	
PY17	10 to 28				10 to 28	10 to 28	10 to 28	10 to 28
Phase IV Total	**60 to 180**	**20 to 64**	**35 to 108**	**50 to 152**	**50 to 152**	**40 to 116**	**25 to 72**	**10 to 28**

DY = Demand Year for PJM

Source: Guidehouse analysis

PECO will submit no less than ten (10) MW and up to (50) MWs of PJM verified peak demand savings associated with each Act 129 program year into the PJM FCM on behalf of its customers over the five-year Phase IV EE&C Plan. PECO will target installed EE measures from the Residential, Non-Residential, and Income Eligible Programs. PECO will prioritize PJM-qualified energy efficiency measures for submittal to PJM based on PJM eligibility, M&V requirements, and anticipated resulting MW savings in the PJM FCM. The measures may include lighting, retrocommissioning, variable speed drives, new construction, and more. PECO hired a turnkey service provider to handle the strategy and details for bidding into PJM's FCM. This approach balances the benefits to PECO customers with the risk posed to customers by the potential for deficiency charges from PJM. All revenues, net of those paid to the Provider, will be returned to customers as an offset to Plan costs.

[9] PECO has assigned capacity rights to CPower to nominate to the PJM FCM.

2.8 Summary of Fuel Switching Impacts

Act 129 allows EDCs to achieve electric savings by converting electric equipment to non-electric equipment. Table 2-9 summarizes key fuel switching metrics in PY13 and to date in Phase IV.

Table 2-9. Fuel Switching Summary

Metric	PY13
Fuel Switching Measures Offered	CHP
Fuel Switching Measures Implemented	1
VTD gross Energy Savings Achieved via Fuel Switching (MWh/yr)	57,870
P4TD gross Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	229,451
P4TD Incentive Payments for Fuel Switching Measures ($1,000)	$2,000

Source: Guidehouse analysis

2.9 Summary of Cost-Effectiveness Results

A detailed breakdown of portfolio finances and cost-effectiveness is presented in Table 2-10. TRC benefits in Table 2-10 were calculated using gross verified impacts. Net present value (NPV) PY13 costs and benefits are expressed in 2021 dollars.

Table 2-10. Summary of Portfolio Finances – Gross Verified

Row	Cost Category*	PYTD ($1,000)	
1	**Incremental Measure Costs (IMCs)**	**117,523**	
2	Rebates to Participants and Trade Allies	15,980	
3	Upstream/Midstream Incentives	5,576	
4	Material Cost for Self-Install Programs (EE&C Kits)	1,913	
5	Direct Installation Program Materials and Labor	871	
6	Participant Costs (row 1 minus the sum of rows 2 through 5)	93,183	
		EDC	**CSP**
7	Program Design	0	0
8	Administration and Management	22,219	0
9	Marketing	5,406	0
10	Program Delivery	0	0
11	EDC Evaluation Costs	1,001	
12	SWE Audit Costs	0	
13	**Program Overhead Costs (sum of rows 7 through 12)**	**28,626**	
14	**Total NPV TRC Costs (sum of rows 1 and 13)**	**146,150**	
15	Total NPV Lifetime Electric Energy Benefits	69,597	
16	Total NPV Lifetime Electric Capacity Benefits	51,037	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	15,037	
18	Total NPV Lifetime Fossil Fuel Impacts	-12,190	
19	Total NPV Lifetime Water Impacts	19,572	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**143,564**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.98**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025).

Source: Guidehouse analysis

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. It is important to note that TRC costs are materially different from the EDC spending and rate recovery tables presented later in the report. 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. 4.2Appendix D shows the TRC ratios by program and for the portfolio.

2.10 Comparison of Performance to Approved EE&C Plan

Table 2-11 presents PY13 expenditures compared with the budget estimates set forth in the EE&C plan for PY13. PY13 values are presented in 2021 dollars. Program-level comparisons of expenditures to plans are presented in 4.2Appendix D.

Table 2-11. Comparison of Expenditures to Phase IV EE&C Plan ($1,000)

Expenditures	Budget from EE&C Plan	Actual Expenditures	Ratio (Actual/Plan)
PY13 Portfolio	$74,460	$54,820	0.74

Source: Guidehouse analysis

Table 2-12 compares PY13 verified gross program savings with the energy savings projections set forth in the EE&C plan. Program-level comparisons of expenditures to plans are presented in 4.2Appendix D.

Table 2-12. Comparison of Actual Program Savings to EE&C Plan Projections

Expenditures	EE&C Plan Projections	VTD Gross MWh Savings	Ratio (Actual/Plan)
PY13 Portfolio MWh	258,619	243,870	0.94
PY13 Portfolio MW	52.90	42.22	0.80

Source: Guidehouse analysis

The list below briefly discusses specific reasons why verified savings exceeded or fell short of projected savings in PY13 as well as contextual market factors being faced by each program.

- The Residential EE Program achieved 92% of EE&C plan projections for PY13 for energy savings. This is a result of verified savings differing from reported savings for a variety of TRM-based measures, as discussed in Section 3.1 of this report. Additionally, contextual market factors impacting PY13 implementation included ramp up to Phase IV activities, supply chain disruptions, and lingering COVID-19 hesitation to in-person home audits.

- The Income-Eligible EE Program achieved 70% of EE&C plan projections for PY13 for energy savings. This is a result of verified savings differing from reported savings for a variety of TRM-based measures, most notably lighting kits, as discussed in Section 3.2 of this report. Additionally, contextual market factors impacting PY13 implementation included ramp up to Phase IV activities, supply chain disruptions, and lingering COVID-19 hesitation to in-person home audits.

- The Residential HER Program achieved 111% of EE&C plan projections for PY13 for energy savings. Differences between verified savings and EE&C plan projections for PY13 are due to modelled evaluation findings. This is discussed in Section 3.3 of this report.

- The Income-Eligible HER Program achieved 85% of EE&C plan projections for PY13 for energy savings. Differences between verified savings and EE&C plan projections for PY13 are due to modelled evaluation findings. This is discussed in Section 3.4 of this report.

- The Non-Residential EE Program achieved 95% of EE&C plan projections for PY13 for energy savings and realization rates of 107% for energy and 99% for demand when comparing verified to reported savings. The most influential items driving realization rates were updates to input parameters such as hours of use, coincidence factors, and heating and cooling types, based on evaluation findings. The evaluation of the one large CHP project also heavily influenced demand savings. These details are discussed in Section 3.5 of this report. Market factors impacting PY13 implementation and participation included ramp up to Phase IV activities and supply chain disruptions and may also include businesses being financially conservative with expenditures due to economic uncertainty.

Guidehouse and PECO will continue to conduct targeted evaluation activities on an ongoing basis to quantify performance and continually improve the programs.

2.11 Findings and Recommendations

The impact and process evaluation activities completed by Guidehouse led to specific recommendations for program improvement. See Sections 3.1.7, 3.2.7, 3.3.7, 3.4.7, and 3.5.7 for details of these recommendations. Guidehouse makes no overarching program recommendations this year.

3. Evaluation Results by Program

This section documents the gross impact, net impact, and process evaluation activities conducted in PY13 along with the outcomes of those activities. Not every program receives an evaluation every year. Table 3-1 provides an overview of planned impact evaluation activities Guidehouse will conduct for Phase IV.

Table 3-1. Gross Impact Evaluation Overview Table

Program	Component	PY13	PY14	PY15	PY16	PY17
Residential	Rebates and Marketplace	X		X		
Residential	Appliance Recycling		X		X	
Residential	In-Home Assessments		X		X	
Residential	New Construction	X		X		
Residential	Multifamily		X		X	
Residential HER	HER	X	X	X	X	X
Income-Eligible	Single-Family		X		X	
Income-Eligible	Appliance Recycling		X		X	
Income-Eligible	Long-Term Savings		X		X	
Income-Eligible HER	HER	X	X	X	X	X
Non-Residential	Downstream Rebates	X	X	X	X	X
Non-Residential	Midstream Rebates	X	X	X	X	X
Non-Residential	New Construction	X		X		X
Non-Residential	Small Business Direct Install		X		X	

Source: Guidehouse Evaluation Plan[10]

3.1 Residential EE Program

The Residential EE Program offers customers in single-family and multifamily buildings opportunities to save energy across their electric end uses. The Residential EE Program serves all customers who have a household income greater than 150% of the federal poverty level, also referred to as market-rate customers. The Appliance Recycling and Multifamily components serve both the Residential and IE EE programs.

CMC is the prime Conservation Service Provider (CSP) for the program, managing additional CSPs to implement specific program components:

- **Rebates and Marketplace:** The Rebates and Marketplace component includes customer instant discounts and rebates for lighting, HVAC, appliances, and energy-saving devices. There are multiple delivery channels to receive product rebates: Downstream, Trade Ally and Distributor Network, Marketplace, and Point of Purchase. The Phase IV Rebates and Marketplace component is implemented by CLEAResult.
- **Appliance Recycling:** The Appliance Recycling component focuses on recycling refrigerators, freezers, and window air conditioning units responsibly. The component

[10] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio*, January 14, 2022.

serves both IE and market-rate customers. The Appliance Recycling component is implemented by ARCA.

- **In-Home Assessments (Single-Family):** The In-Home Assessment component provides in-home or virtual assessments and comprehensive audits to educate customers, install energy efficient measures, and identify additional, potentially larger, energy efficiency opportunities (such as insulation and air sealing). The In-Home Assessment (Market-Rate) component is implemented by CLEAResult.

  All In-Home Assessment program participants receive an assessment of their home's energy performance and direct installation of basic efficiency measures (e.g., LED lighting, water conservation devices, hot water pipe insulation, smart strips). A subset of eligible participants may opt in for additional In-Home Assessment instant rebates for more comprehensive measures (such as insulation, air sealing, and HVAC services).

- **New Construction:** The Residential New Construction component supports the construction of more comfortable, durable, and energy efficient homes compared with those simply built to code. This component works with Home Energy Rating System raters and builders to create more energy efficient homes during the design and construction phases. The New Construction component is implemented by PSD.

- **Multifamily:** The Multifamily component provides analysis, direct install measures, and larger, investment-level upgrades to improve the energy efficiency of multifamily buildings, both in units and in common areas. The component serves buildings with market-rate customers, IE customers, and a mix of residential and commercial customer types. The Multifamily component for both the residential and IE segments is implemented by CMC. The IE and market-rate services are delivered consistently across sectors, although incentives may vary. Verifying, sampling, and reporting program savings will differentiate between and allocate savings to either the Residential or Income-Eligible customer segment accordingly.

  Program participants receive an assessment of their building's energy performance and direct installation of basic efficiency measures (e.g., LED lighting, water conservation devices, hot water pipe insulation, smart strips). A subset of participants may opt in for additional rebates of more comprehensive measures (such as insulation and air sealing).

3.1.1 Participation and Reported Savings by Customer Segment

Table 3-2 presents the participation counts, reported energy and demand savings, and incentive payments for the Residential EE Program in PY13 by customer segment.

Table 3-2. Residential EE Program Participation and Reported Impacts

Parameter	Residential (Non-IE)	Income-Eligible	Small C&I (Non-GNI)[1]	Large C&I (Non-GNI)[1]	Total
PY13 # Participants[2]	40,171	130	186	450	**40,937**
PYRTD MWh/yr	38,807	66	1,549	1,587	**42,009**
PYRTD MW/yr	7.19	0.01	0.14	0.30	**7.64**

Parameter	Residential (Non-IE)	Income-Eligible	Small C&I (Non-GNI)[1]	Large C&I (Non-GNI)[1]	Total
PY13 Incentives ($1,000)	5,449	8	110	158	**5,725**

[1] In certain circumstances, customers in the Small C&I or Large C&I rate classes participate in the Residential EE Program. Savings for those measures are captured in the Residential EE Program.
[2] Participant counts exclude upstream lighting
Source: Guidehouse analysis

3.1.2 Gross Impact Evaluation

Guidehouse conducted the gross impact evaluation for the Residential EE Program following the approach outlined in its Evaluation Plan[11] for PY13. The Residential EE Program gross impact evaluation included a comprehensive tracking database analysis of all TRM-based and interim measure protocols (IMP)-based measures to confirm that reported savings align with TRM and IMP standards. Guidehouse was able to review all measures within the Residential EE Program except the Multifamily component (C&I measures in common spaces) and New Construction component. Guidehouse adjusted the verified savings based on discrepancies identified in the tracking database analysis.

Additionally, for both the Rebates and Marketplace and New Construction components in PY13, Guidehouse conducted the following verification activities:

- **Rebates and Marketplace:** The evaluation team conducted survey-based verification activities for a sample of 334 projects in PY13. This activity covered the Downstream, Trade Ally and Distributor Network, and Marketplace delivery channels. The Point of Purchase delivery channel was excluded from survey-based verification and instead relied on a tracking database analysis.
- **New Construction:** The evaluation team conducted engineering project-based verification activities for a sample of 38 projects in PY13.

All samples were designed and implemented to meet the targets set in Guidehouse's sampling design memos.[12] Additional detail of the impact evaluation completed in PY13 can be found in 4.2Appendix E.

Table 3-3. Residential EE Program Gross Impact Results for Energy

Component	PYRTD MWh/yr	Energy Realization Rate	Sample CV or Error Ratio	Relative Precision at 85% C.L.
Rebates and Marketplace	22,522	0.98	0.04	0.003
Appliance Recycling[1]	8,480	1.06	0.28	0.06
In-Home Assessments[2]	2,870	0.82	0.69	0.25
New Construction	2,070	1.01	0.07	0.02
Multifamily[3]	2,267	0.99	0.12	0.04
Multifamily Income-Eligible[3, 4]	3,800	0.80	0.34	0.12
Program Total	**42,009**	**0.97**	**0.36**	**0.02**

Note: Guidehouse conducted tracking database analysis for all components and primary data collection and analysis for the Rebates and Marketplace and New Construction components in PY13.

[11] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.
[12] PECO, *PY13 Residential Energy Efficiency Program Sample Design Memo 02-28-22,* dated March 14, 2022.

[1] The verification ratio from PY12 was applied to the tracking database analysis ratio for the Appliance Recycling component. The coefficient of variation (CV) and the relative precision at 85% confidence level (C.L.) were taken from PY12.
[2] The Whole Home verification ratio from PY11 was applied to the tracking database analysis ratio for the In-Home Assessment component. The CV and the relative precision at 85% C.L. were taken from PY11.
[3] The Multifamily verification ratio from PY10 was applied to the tracking database analysis ratio for the Multifamily component. The CV and the relative precision at 85% C.L. were taken from PY10.
[4] The Multifamily Income-Eligible component is included with Residential EE Program savings due to how this is reported in the tracking database; savings are credited to the IE carveout.

Source: Guidehouse analysis

Table 3-4. Residential EE Program Gross Impact Results for Demand

Component	PYRTD MW/yr	Demand Realization Rate	Sample CV or Error Ratio	Relative Precision at 85% C.L.
Rebates and Marketplace	3.92	1.05	0.07	0.01
Appliance Recycling[1]	1.71	1.04	0.25	0.06
In-Home Assessment[2]	0.36	0.83	0.72	0.26
New Construction	0.88	0.67	0.14	0.03
Multifamily[3]	0.35	0.95	0.12	0.04
Multifamily Income-Eligible[3, 4]	0.42	0.77	0.33	0.12
Program Total	**7.64**	**0.97**	**0.30**	**0.02**

Note: Guidehouse conducted tracking database analysis for all components and primary evaluation activities for the Rebates and Marketplace and New Construction components in PY13.
[1] The verification ratio from PY12 was applied to the tracking database analysis ratio for the Appliance Recycling component. The CV and the relative precision at 85% C.L. were taken from PY12.
[2] The Whole Home verification ratio from PY11 was applied to the tracking database analysis ratio for the In-Home Assessment component. The CV and the relative precision at 85% C.L. were taken from PY11.
[3] The Multifamily verification ratio from PY10 was applied to the tracking database analysis ratio for the Multifamily component. The CV and the relative precision at 85% C.L. were taken from PY10.
[4] The Multifamily Income-Eligible component is included with Residential EE Program savings due to how this is reported in the tracking database; savings are credited to the IE carveout.

Source: Guidehouse analysis

The following factors led to variation between the reported and verified savings and led to the observed realization rates:

- **Tracking Database Analysis:** For all components except New Construction, Guidehouse adjusted savings across a variety of measures, including ductless heat pumps, energy conservation measure (ECM) fans, ENERGY STAR lighting, refrigerator and freezer recycling, air sealing, and pool pumps. The measure adjustment with the largest impact on savings was a correction to baseline wattage for decorative LED bulbs. This affected 6% of total residential savings and the tracking database savings ratio was 61%.

- **Rebates and Marketplace Survey:** The marketplace survey found that a portion of the population that purchased smart thermostats from the PECO marketplace had yet to install the measure due to either the complexity of installing on their own or the need for an adapter to work with their current wiring. This resulted in a verification ratio of 74% for the Marketplace component of the Rebates and Marketplace program.

3.1.3 Net Impact Evaluation

Guidehouse did not assess net impacts for the Residential EE Program in PY13. To calculate net savings, Guidehouse applied NTGRs from PY12, these are summarized in Table 2-4.

3.1.3.1 High Impact Measure Research

Guidehouse did not evaluate high impact measures (HIMs) for the Residential EE Program in PY13.

3.1.4 Verified Savings Estimates

In Table 3-5, the realization rates and NTG ratios determined by Guidehouse are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Residential EE Program in PY13.

Table 3-5. PY13 Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	42,009	7.64
PYVTD Gross	40,788	7.43
PYVTD Net	27,821	5.13

Source: Guidehouse analysis

3.1.5 Process Evaluation

As described in the Phase IV Evaluation Plan[13] approved by the SWE, Guidehouse did not conduct in-depth process evaluation activities for the Residential EE Program in PY13. Instead, the team interviewed the PECO program managers and CSP staff to understand the goals of the program, identify significant implementation changes, and identify areas of strength and areas of improvement. Guidehouse will use findings from these interviews to inform evaluation research in future years.

3.1.6 Program Finances and Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-6. TRC benefits in Table 3-6 were calculated using gross verified impacts. NPV PY13 costs and benefits are expressed in 2021 dollars.

Table 3-6. Summary of Program Finances – Gross Verified

Row	Cost Category*	PYTD ($1,000)
1	**Incremental Measure Costs (IMCs)**	**33,253**
2	Rebates to Participants and Trade Allies	5,310
3	Upstream/Midstream Incentives	0
4	Material Cost for Self-Install Programs (EE&C Kits)	397
5	Direct Installation Program Materials and Labor	18
6	Participant Costs (row 1 minus the sum of rows 2 through 5)	27,531

[13] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Row	Cost Category*	PYTD ($1,000)	
		EDC	CSP
7	Program Design	0	0
8	Administration and Management	4,963	0
9	Marketing	0	0
10	Program Delivery	0	0
11	EDC Evaluation Costs	0	
12	SWE Audit Costs	0	
13	**Program Overhead Costs (sum of rows 7 through 12)**	**4,963**	
14	**Total NPV TRC Costs (sum of rows 1 and 13)**	**38,217**	
15	Total NPV Lifetime Electric Energy Benefits	13,432	
16	Total NPV Lifetime Electric Capacity Benefits	14,032	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	9,146	
18	Total NPV Lifetime Fossil Fuel Impacts	-821	
19	Total NPV Lifetime Water Impacts	4,377	
20	**Total NPV TRC Benefits (sum of rows 15 through 19)**	**40,166**	
21	**TRC Benefit-Cost Ratio (row 20 divided by row 14)**	**1.05**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025).

Source: Guidehouse analysis

Table 3-7 presents program financials and cost-effectiveness on a net savings basis. Guidehouse applied NTGRs from the most recent analysis year from Phase III, which are summarized in Table 2-4.

The 2021 TRC Test Final Order stated that the NTGR should be applied to all benefits in the net TRC test, including but not limited to avoided energy and capacity costs, O&M, interactive effects, and secondary fossil fuel impacts. In addition, the NTGRs are applied to the IMC, therefore the IMC are different on a net savings basis compared to the gross savings basis.

Table 3-7. Summary of Program Finances – Net Verified

Row	Cost Category*	PYTD ($1,000)	
1	**IMCs**	**24,275**	
2	Rebates to Participants and Trade Allies	5,307	
3	Upstream/Midstream Incentives	0	
4	Material Cost for Self-Install Programs (EE&C Kits)	397	
5	Direct Installation Program Materials and Labor	18	
6	Participant Costs (row 1 minus the sum of rows 2 through 5)	18,553	
		EDC	CSP
7	Program Design	0	0
8	Administration and Management	4,963	0
9	Marketing	0	0
10	Program Delivery	0	0
11	EDC Evaluation Costs	0	
12	SWE Audit Costs	0	
13	**Program Overhead Costs (sum of rows 7 through 12)**	**4,963**	
14	**Total NPV TRC Costs (sum of rows 1 and 13)**	**29,238**	
15	Total NPV Lifetime Electric Energy Benefits	9,805	
16	Total NPV Lifetime Electric Capacity Benefits	10,243	

Row	Cost Category*	PYTD ($1,000)
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	6,677
18	Total NPV Lifetime Fossil Fuel Impacts	-599
19	Total NPV Lifetime Water Impacts	3,195
20	**Total NPV TRC Benefits (sum of rows 15 through 19)**	**29,322**
21	**TRC Benefit-Cost Ratio (row 20 divided by row 14)**	**1.00**

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025).

Source: Guidehouse analysis

3.1.7 Status of Recommendations

The impact and process evaluation activities in PY13 led to the following findings and recommendations from Guidehouse to PECO, along with a summary of how PECO plans to address the recommendations in program delivery.

Table 3-8. Summary of Evaluation Recommendations

Component	Evaluation Activity	Finding	Recommendation	EDC Status
New Construction	Impact	The coincidence factor (CF) used to calculate realized peak demand savings was inconsistent with the current TRM-defined CF.	Apply the appropriate CF based on TRM and SWE guidance for demand savings calculations for cooling loads.	In process to be implemented in PY15.[14]
New Construction	Impact	PECO claimed demand savings from lighting and appliances using outputs from the energy models, which is inconsistent with the TRM guidance. The TRM allows for claiming cooling demand savings using modeled outputs, but for other end uses the TRM specifies that "additional demand savings must be calculated using the algorithms from the applicable measures elsewhere in the TRM." Unlike past evaluation efforts additional EDC data for lighting and appliances is no longer being collected in Phase IV. Without additional supporting documentation, the evaluation efforts must rely solely on energy model inputs, which are limited and less precise, to perform demand savings calculations.	(1) Collect project lighting and appliance specifications and use the TRM to calculate non cooling demand savings. (2) As the TRM is updated to the new residential building code, advocate for alternative, simplified demand savings calculation methodologies.	Under consideration to be implemented in PY15.
Rebates and Marketplace	Impact	The marketplace energy verification ratio was 74% based primarily on customers who reported not installing smart thermostat measures. The majority of these reported that they did not feel comfortable installing the thermostat themselves and needed to hire a contractor, or that they needed an adapter to install (which they did not have).	Inform participants who are purchasing smart thermostats through the marketplace that they might need to purchase an adapter and provide educational material at the time of purchase to help the customer decide whether they need one. The marketplace could also sell the adapter as an add on at the point of sale (POS).	Implemented. Additional communication added to site and fliers. Power adapter is now available on the marketplace.
Rebates and Marketplace Appliance Recycling In-Home Assessments Multifamily	Impact	Based on the tracking database analysis, Guidehouse estimated 99% of reported energy savings and 104% of reported demand savings. Adjustments to savings occurred across a variety of measures, including ductless heat pumps, ECM fans, ENERGY STAR lighting, refrigerator and freezer recycling, air sealing, and pool pumps.	Update deemed savings algorithms and default inputs to match TRM and IMP guidance for all residential measures with discrepancies. Several discrepancies were addressed during PY13, but updates were not made retroactively.	In process. Currently reviewing calculations for measures identified.

Source: Guidehouse analysis

[14] The New Construction component is next scheduled to be evaluated in PY15.

3.2 Income-Eligible EE Program

The Income-Eligible EE Program offers IE customers opportunities to save energy across all their electric end uses. The Income-Eligible EE Program serves customers with household income less than or equal to 150% of the federal poverty level. The Residential EE Program serves all other customers, also referred to as market-rate. Some components (Multifamily and Appliance Recycling) allocate savings to both the Income-Eligible EE Program and the Residential EE Program.

CMC Energy is the prime CSP for the program, managing additional CSPs to implement program components:

- **Single-Family:** The Single-Family component improves the energy efficiency of single-family homes for IE customers to help reduce their electric bills and make their homes more comfortable. The Single-Family component is implemented by CMC. There are multiple channels to receive program services. The Free Home Energy Check-Ups Program and Low Income Usage Reduction Program (LIURP)[15] offer consistent services for IE households but are differentiated by funding sources. Giveaways are unique to the Single-Family component.

  All measures for the Single-Family component are 100% subsidized. When appropriate, measure installation funding is coordinated with the Long-Term Savings component. The implementation and evaluation approaches are consistent for these two components, although they are reported as discrete evaluation results.

- **Appliance Recycling:** The Appliance Recycling component focuses on responsibly recycling refrigerators, freezers, and window air conditioning units. The component serves both IE and market-rate customers. The Appliance Recycling component is implemented by ARCA.

- **Long-Term Savings:** The Long-Term Savings component is implemented as an overlay service through the Single-Family component to encourage the installation of long-term, comprehensive measures. All Long-Term Savings projects are Single-Family component participants, but not all Single-Family participants will be Long-Term Savings participants. The Long-Term Savings component is implemented by CMC.

  The Long-Term Savings component measures include insulation, air sealing, duct sealing, heat pumps, air conditioners, thermostats, and residential heat pump water heaters and solar water heaters. All measures are 100% subsidized. The implementation and evaluation approaches are consistent with the Single-Family component, although they are reported as discrete evaluation results.

3.2.1 Participation and Reported Savings by Customer Segment

Table 3-9 presents the participation counts, reported energy and demand savings, and incentive payments for the Income-Eligible EE Program in PY13 by customer segment.

[15] LIURP is funded outside of the Act 129 program.

Table 3-9. Income-Eligible EE Program Participation and Reported Impacts

Parameter	Income-Eligible	Total
PY13 # Participants[1]	11,456	**11,456**
PYRTD MWh/yr	15,969	**15,969**
PYRTD MW/yr	1.81	**1.81**
PY13 Incentives ($1,000)	4,153	**4,153**

[1] Participant counts exclude IE single-family giveaways. Savings and incentives from this pathway are included.

Source: Guidehouse analysis

3.2.2 Gross Impact Evaluation

Guidehouse conducted the gross impact evaluation for the Income-Eligible EE Program following the general approach outlined in its Evaluation Plan[16] for PY13. The Income-Eligible EE Program gross impact evaluation included a comprehensive tracking database analysis of all TRM-based and IMP-based measures to confirm that reported savings align with TRM and IMP standards. Guidehouse was able to review all measures within the Income-Eligible EE Program. Guidehouse adjusted the verified savings based on discrepancies identified in the tracking database analysis. No additional verification activities were performed in PY13.

Table 3-10. Income-Eligible EE Program Gross Impact Results for Energy

Component	PYRTD MWh/yr	Energy Realization Rate	Sample CV or Error Ratio	Relative Precision at 85% C.L.
Single-Family[1]	14,732	0.74	0.04	0.02
Appliance Recycling[2]	1,095	0.96	0.04	0.01
Long-Term Savings[1]	142	0.84	0.12	0.04
Program Total[3]	**15,969**	**0.76**	**0.08**	**0.01**

[1] The IE Whole Home verification ratio from PY12 was applied to the tracking database analysis ratio for the Single-Family and Long-Term Savings components. The CV and the relative precision at 85% C.L. were taken from PY12.
[2] The verification ratio from PY12 was applied to the tracking database analysis ratio for the Appliance Recycling component. The CV and the relative precision at 85% C.L. were taken from PY12.
[3] The Multifamily IE component is not included in this table; it is included with Residential EE Program savings due to how this is reported in the tracking database; savings are credited to the IE carveout.

Source: Guidehouse analysis

Table 3-11. Income-Eligible EE Program Gross Impact Results for Demand

Component	PYRTD MW/yr	Demand Realization Rate	Sample CV or Error Ratio	Relative Precision at 85% C.L.
Single-Family[1]	1.55	0.72	0.04	0.01
Appliance Recycling[2]	0.25	0.98	0.05	0.01
Long-Term Savings[1]	0.01	0.77	0.11	0.04
Program Total[3]	**1.81**	**0.75**	**0.06**	**0.01**

[1] The IE Whole Home verification ratio from PY12 was applied to the tracking database analysis ratio for the Single-Family and Long-Term Savings components. The CV and the relative precision at 85% C.L. were taken from PY12.
[2] The verification ratio from PY12 was applied to the tracking database analysis ratio for the Appliance Recycling component. The CV and the relative precision at 85% C.L. were taken from PY12.

[16] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* Revised January 14, 2022.

[3] The Multifamily IE component is not included in this table; it is included with Residential EE Program savings due to how this is reported in the tracking database; savings are credited to the IE carveout.

Source: Guidehouse analysis

The following factor led to variation between the reported and verified savings and led to the observed realization rates.

- **Tracking Database Analysis:** Guidehouse adjusted savings across a variety of measures, including air source heat pumps, insulation, ENERGY STAR lighting, ENERGY STAR room air conditioners, refrigerator recycling, and air sealing. The adjustment that had the largest impact on savings was a correction to the baseline wattage for decorative LED bulbs. This affected 23% of total savings and had a tracking database savings ratio of 19%.

3.2.3 Net Impact Evaluation

Guidehouse does not assess net impacts for the Income-Eligible EE Program as per guidance from the SWE's Evaluation Framework.[17]

3.2.3.1 High Impact Measure Research

Guidehouse did not evaluate HIMs for the Income-Eligible EE Program in PY13.

3.2.4 Verified Savings Estimates

In Table 3-12, the realization rates and NTG ratios determined by Guidehouse are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Income-Eligible EE Program in PY13.

Table 3-12. PY13 Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	15,969	1.81
PYVTD Gross	12,066	1.37
PYVTD Net	12,066	1.37

Source: Guidehouse analysis

3.2.5 Process Evaluation

As described in the Phase IV Evaluation Plan[18] approved by the SWE, Guidehouse did not conduct in-depth process evaluation activities for the Income-Eligible EE Program in PY13. Instead, the team interviewed the PECO program managers and CSP staff to understand the goals of the program, identify significant implementation changes, and identify areas of strength and areas of improvement. Guidehouse will use findings from these interviews to inform evaluation research in future years.

[17] SWE. Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs. July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

[18] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

3.2.6 Program Finances and Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-13. TRC benefits in Table 3-13 were calculated using gross verified impacts. NPV PY13 costs and benefits are expressed in 2021 dollars.

Table 3-13. Summary of Program Finances – Gross Verified

Row	Cost Category*	PYTD ($1,000)	
1	**IMCs**	**4,153**	
2	Rebates to Participants and Trade Allies	2,625	
3	Upstream/Midstream Incentives	0	
4	Material Cost for Self-Install Programs (EE&C Kits)	1,516	
5	Direct Installation Program Materials and Labor	12	
6	Participant Costs (row 1 minus the sum of rows 2 through 5)	0	
		EDC	**CSP**
7	Program Design	0	0
8	Administration and Management	1,578	0
9	Marketing	0	0
10	Program Delivery	0	0
11	EDC Evaluation Costs	0	
12	SWE Audit Costs	0	
13	**Program Overhead Costs (sum of rows 7 through 12)**	**1,578**	
14	**Total NPV TRC Costs (sum of rows 1 and 13)**	**5,731**	
15	Total NPV Lifetime Electric Energy Benefits	3,606	
16	Total NPV Lifetime Electric Capacity Benefits	2,268	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,069	
18	Total NPV Lifetime Fossil Fuel Impacts	-242	
19	Total NPV Lifetime Water Impacts	15,195	
20	**Total NPV TRC Benefits (sum of rows 15 through 19)**	**21,895**	
21	**TRC Benefit-Cost Ratio (row 20 divided by row 14)**	**3.82**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025).

Source: Guidehouse analysis

Program financials and cost-effectiveness on a net savings basis are the same values as Table 3-13 because verified net savings equal the verified gross savings for the IE EE Program.

3.2.7 Status of Recommendations

The impact and process evaluation activities in PY13 led to the following findings and recommendations from Guidehouse to PECO, along with a summary of how PECO plans to address the recommendations in program delivery.

Table 3-14. Summary of Evaluation Recommendations

Component	Evaluation Activity	Finding	Recommendation	EDC Status
Appliance Recycling Single-Family Long-Term Savings	Impact	Based on the tracking database analysis, Guidehouse estimated 81% of reported energy savings and 81% of reported demand savings. Adjustments to savings occurred across a variety of measures, including heat pumps, insulation, ENERGY STAR lighting, refrigerator recycling, and air sealing.	Update deemed savings algorithms and default inputs to match TRM and IMP guidance for all residential measures with discrepancies. Several discrepancies were addressed during PY13, but updates were not made retroactively.	In Process. Currently reviewing calculations for measures identified.

Source: Guidehouse analysis

3.3 Residential HER Program

The objective of the Residential Home Energy Report (HER) Program for market-rate customers is to reduce a home's energy use through print (mail) and online (email) reports sent directly to customers that give insight into their household energy usage. These programs leverage social norming to drive persistent energy savings through smart energy practices. The HER program is implemented by Oracle as a randomized control trial (RCT). HERs and the online content use social norms and usage summaries to compare a customer's household energy use to the average energy use of other households like theirs. In this way, these customers have a relative sense of where their energy use patterns fall. The reports also provide targeted recommendations or tips to customers, suggesting actions they can take to reduce consumption. The full content of HERs serves to encourage customers to reduce their consumption and enhance engagement and general satisfaction. The reports are sent to targeted cohorts of customers on an opt-out basis. In Phase IV, cohort activity is on a rotating activity schedule, meaning that some report recipient cohorts will not receive HERs in certain years.[19] During PY13, approximately 550,000 households received HERs across eight active residential cohorts, with reports paused for three legacy residential cohorts.

3.3.1 Participation and Reported Savings by Customer Segment

Table 3-15 presents the participation counts, reported energy and demand savings, and incentive payments for the Residential HER Program in PY13 by customer segment. Participants are defined as HER recipients that have savings in at least one month during the program year.

Table 3-15. Residential HER Program Participation and Reported Impacts

Parameter	Residential (Non-Income Eligible)	Total
PY13 # Participants	550,187	**550,187**
PYRTD MWh/yr	23,789	**23,789**
PYRTD MW/yr	3.87	**3.87**
PY13 Incentives ($1,000)	-	**-**

Source: Guidehouse analysis

3.3.2 Gross Impact Evaluation

Guidehouse evaluated savings for the eight residential HER cohorts. Using a lagged dependent variable (LDV) model, the evaluation team estimated monthly energy savings by cohort. Modeled energy savings are reduced through a double-counting (uplift) analysis on other EE program participation and through the application of persistence from past program years, also by cohort. This results in first-year incremental savings compliant with Phase IV requirements. For peak demand, Guidehouse used a simple difference model to estimate savings for each wave and applied both the modeled and first-year incremental energy savings to these demand savings to indirectly account for uplift and persistence reductions. Refer to 4.2Appendix B for the full impact evaluation detail. Evaluation results are presented in Table 3-16 and Table 3-17.

[19] In Phase III, all wave cohorts remained active after launch, but Phase IV uses a varied wave activation schedule for each program year due to now claiming only first-year incremental savings. For PY13, three residential cohorts active in Phase III were not sent reports and thus do not claim savings.

Table 3-16. Residential HER Program Gross Impact Results for Energy

	PYRTD MWh/yr	Energy Realization Rate	Sample CV or Error Ratio	Relative Precision at 85% C.L.
Program Total	**23,789**	**1.00**	**0**	**0**

Source: Guidehouse analysis

Table 3-17. Residential HER Program Gross Impact Results for Demand

	PYRTD MW/yr	Demand Realization Rate	Sample CV or Error Ratio	Relative Precision at 85% C.L.
Program Total	**3.87**	**1.06**	**0**	**0**

Source: Guidehouse analysis

The following factors led to variation between the reported and verified savings and led to the observed realization rates.

Guidehouse leveraged summer 2022 peak-hour metering data to conduct the peak demand analysis. Differences in data sources can drive discrepancies in reported and verified savings in either direction (e.g., using hourly data may provide a more accurate estimate of savings).

Approximately 80% of the population of active residential HER recipients are in their launch year. The peak demand analysis focuses on the summer months, which coincide with the first three months that these customers receive their reports. This means that most recipients have not had prolonged exposure to HERs and thus the measured savings are unpredictable due to noise. This is unlike energy savings estimates, which are measured for the full year and allow for longer exposure to HERs.

The demand regression coefficients for five of the eight residential cohorts are not jointly statistically significant, including the three newest cohorts. This is likely due to small wave size for legacy cohorts and lack of HER exposure for new cohorts. These results are thus not statistically different from zero and can unpredictably vary in either direction around zero.

3.3.3 Net Impact Evaluation

Guidehouse does not assess net impacts for the Residential HER Program as per guidance from the SWE's Evaluation Framework.[20]

3.3.4 Verified Savings Estimates

In Table 3-18, the realization rates and NTG ratios determined by Guidehouse are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Residential HER Program in PY13.

Table 3-18. PY13 Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	23,789	3.87
PYVTD Gross	23,781	4.10

[20] SWE. *Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs*. July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYVTD Net	23,781	4.10

Source: Guidehouse analysis

3.3.5 Process Evaluation

The PY13 process evaluation of the HER program included PECO program manager and CSP staff interviews and a survey for recipients of the HERs, including both residential and IE customers. This section summarizes the evaluation methods, data collection techniques, sample design, and key results related to the survey.

3.3.5.1 Methodology

The team interviewed the PECO program managers and CSP staff to understand the goals of the program in PY13, identify significant implementation changes, and identify areas of strength and areas of improvement.

Guidehouse distributed the survey to sampled participants via an online or telephone version of the survey, depending on the contact information available to Guidehouse. The survey assessed customer satisfaction, perceived accuracy of various report components, and awareness of energy-saving tips provided in the reports. See 4.2Appendix F for additional detail on the process evaluation for both the Residential and IE samples.

Guidehouse developed the survey instrument according to SWE requirements and had the SWE review and approve in advance of fielding. The evaluation team defined the survey population based on customer activity data from the program implementer, Oracle.

Guidehouse distributed the online survey to 24,001 recipients and contacted an additional 478 PECO customers over the phone—17 of whom survey fielders contacted a second time. The survey received 446 completed surveys, generating a 2% response rate.

As Table 3-19 and Table 3-20 present, Guidehouse created target completes based on strata and an IE flag provided by the implementer, Oracle, to collect data from a representative sample. The strata listed are the same for the Residential sample and IE sample, except for the Residential 2021 Phone and IE 2021 Low-to-Moderate Income (LMI[21]) + Phone strata. Guidehouse recruited all respondents via email if possible; all but one 2021 Phone and 2021 LMI + Phone strata respondents completed the survey online.

Table 3-19. Residential Sample Targets by Strata

Stratum	Target Completes	Achieved Completes	Achieved Percentage of Target
2013-2014 Electric	25	48	192%
2015-2016 Electric	40	84	210%
2017-2019 Dual + Electric	25	30	120%
2021 Email	40	59	148%
2021 Phone	30	7	23%

[21] Oracle named the stratum using the “Low-to-Moderate Income” (LMI) designation; this is interchangeable with the “Income Eligible” (IE) designation.

Stratum	Target Completes	Achieved Completes	Achieved Percentage of Target
Total	**160**	**228**	**143%**

Source: Guidehouse analysis

Table 3-20. Income-Eligible Sample Targets by Strata

Stratum	Target Completes	Achieved Completes	Achieved Percentage of Target
2013-2014 Electric	15	31	207%
2015-2016 Electric	30	42	140%
2017-2019 Dual + Electric	25	22	88%
2021 Email	20	33	165%
2021 LMI + Phone	50	90	180%
Total	**140**	**218**	**156%**

Source: Guidehouse analysis

Guidehouse presents survey results by participant wave; one wave targeted IE customers only while all other waves targeted market-rate customers. Note that the sample stratification described earlier differs from this participant wave distinction used to conduct analysis and present results, as customers with an IE flag may be included in any wave. This section presents results of the 358 responses from market-rate waves, while the following section, Section 3.4, presents results of the 88 responses from the one wave that targeted IE customers specifically.[22]

3.3.5.2 Key Findings from Process Evaluation

Several questions measured satisfaction levels with aspects of the HERs, as well as the reports overall and PECO in general. Respondents rated their satisfaction using a scale of 0 to 10 with 0 representing “extremely dissatisfied” and 10 representing “extremely satisfied.” Respondents could also select “don’t know;” Guidehouse excluded these responses from satisfaction analysis.

Respondents in the market-rate waves provided a satisfaction score for the HERs overall, as well as the usefulness of several components of the report. The mean satisfaction for the reports overall is 7.6 out of 10, similar to Guidehouse’s experience with HER program offerings in other jurisdictions.[23]

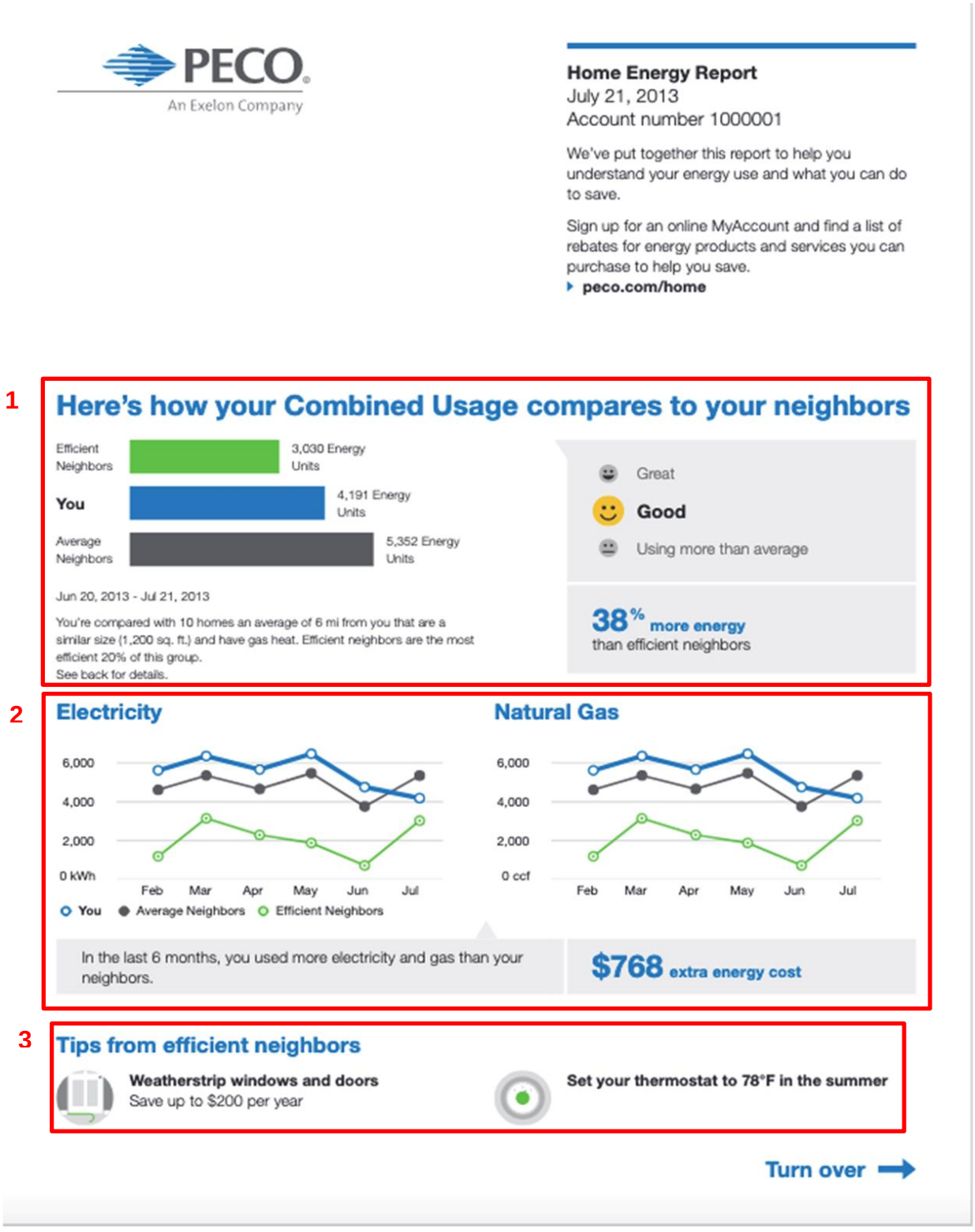
Respondents also rated the usefulness of five components of the HERs, shown in Figure 3-2. Respondents rated usefulness using a scale from 0 to 10, with 0 indicating “not useful at all” and 10 indicating “very useful.” The online version of the survey displayed a sample copy of the HER with each component identified with a red box for respondents to reference while providing usefulness scores, as Figure 3-1 shows. The comparison of homes to their own energy use in

[22] The Income-Eligible HER Program serves customers with household income less than or equal to 150% of the federal poverty level. The Residential HER Program serves all other customers, also referred to as market-rate.

[23] The comparison includes two long-running HER programs from Midwest utilities, one of which achieved 74% customer satisfaction rating (score of 6-10 on 0-10 scale) in 2021. The other achieved an average satisfaction score of 7.9 on a scale of 0 to 10.

previous years received the highest mean usefulness score of 8.2. The neighbor comparison received the lowest score of 6.9.

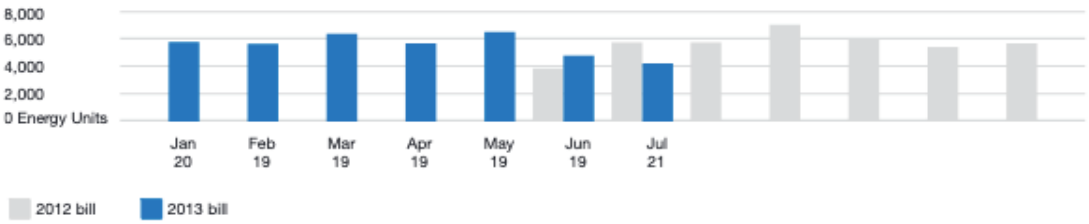
Figure 3-1. Sample Copy of a Home Energy Report



4

Track your progress

This bill, you used 27% less energy than last year.



5

An easy way to save

Recycle your old fridge and save

Recycling your old working refrigerator or old freezer can save you up to $150 per year in energy savings. We'll pick up your old refrigerator or freezer, recycle it, and give you $75. While we're there, we can also pick up any working room air conditioner you don't need, and give you an additional $10.

Schedule your free pick-up online today at **peco.com/recycling** or call **1-888-5-PECO-SAVE (1-888-573-2672)**.

Frequently asked questions

What is an Energy Unit?
The term Energy Unit is an index that represents a combination of your electricity (kWh) and natural gas (ccf) usage. This index is created to allow an easy comparison of your combined energy usage to that of your neighbor or to your previous usage on a month-to-month or year-over-year basis.

How is my neighbor comparison calculated?
Your energy use is compared to homes with a similar size, building type, and heating system.

Why does PECO send these reports?
When customers save energy, we get closer to meeting our state energy efficiency goals. It's good for everyone.

How do I find more ways to save energy?
For more ways to save energy, call 1-888-5-PECO-SAVE (1-888-573-2672). To unsubscribe, use the email or number on the right.

We're here to help

- **To unsubscribe: 1-888-212-8090 or (267) 499-4256**
- **For questions: smartideas@peco-energy.com**

For More Report FAQs, visit

- **peco.com/homeenergyreport**

PECO
An Exelon Company

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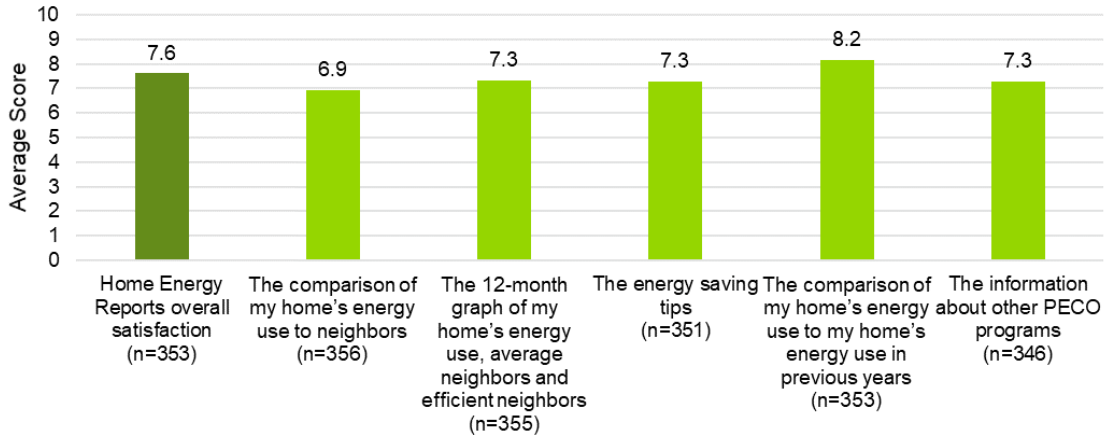
Printed on 100% post-consumer recycled paper using water-based inks.

Source: PECO

Figure 3-2. Residential HER Program Satisfaction and Usefulness[24]



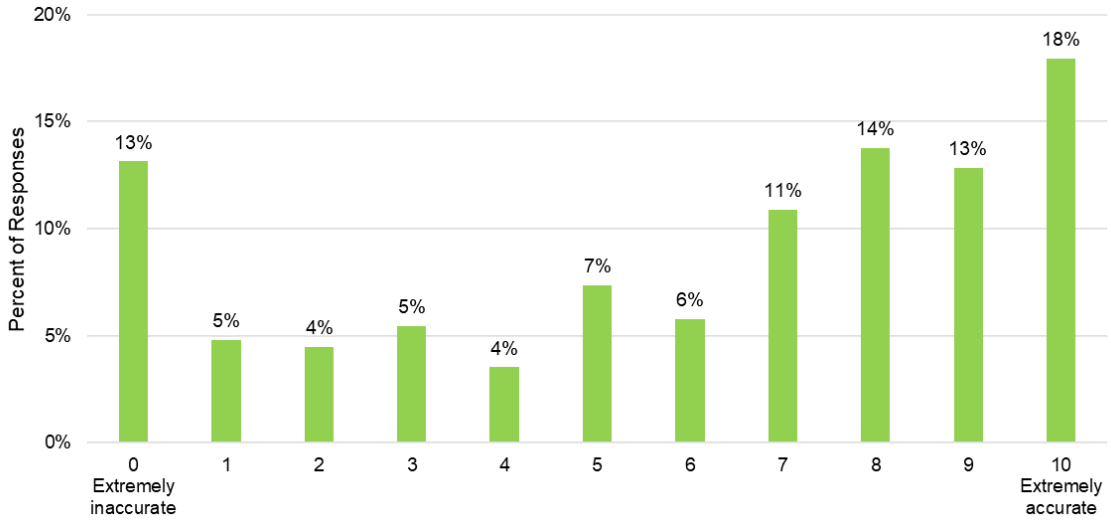
Respondents received the following questions: "Using a scale of 0 to 10, with 0 meaning 'Extremely Dissatisfied' and 10 meaning 'Extremely Satisfied,' how would you rate your satisfaction with the Home Energy Reports overall?" and "On a scale of 0 to 10, where 0 means 'not useful at all' and 10 means 'very useful,' please indicate how useful each of the following elements of the Home Energy Reports are to you."

Source: Guidehouse analysis

Respondents rated the accuracy of the neighbor comparison in the HERs as 6.0 out of 10 (scale of 0 to 10, where 0 is "extremely inaccurate" and 10 is "extremely accurate"). Respondents who rated accuracy lower than 7 were asked why they provided that score. Many respondents mentioned differences in household size and occupancy, as well as different household needs as reasons the comparison may not be accurate (Figure 3-3).

[24] Note that both satisfaction and usefulness scores are displayed in the same figure. The Home Energy Report Overall Satisfaction presents a satisfaction score, while all other components present a usefulness score.

Figure 3-3. Residential HER Program Accuracy of Neighbor Comparison (n=312)

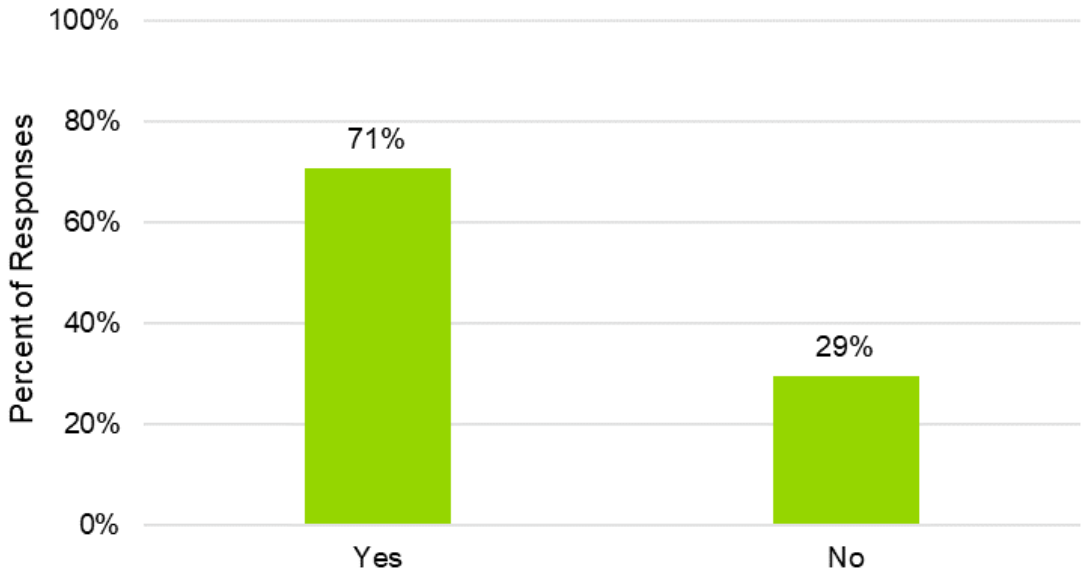


Respondents received the following prompt: "A prominent feature of the Home Energy Reports is its ability to show you how your energy use compares to neighbors. Please indicate how accurate you think these comparisons are using a scale from 0 to 10, where 0 is 'extremely inaccurate' and 10 is 'extremely accurate.'"

Source: Guidehouse analysis

When asked if they recall specific energy-saving tips from the HERs, 38% of market-rate customers said yes. Respondents who confirmed recalling suggestions from the report were asked to list up to three tips they remember. The most common response category was adjusting the temperature/thermostat in the home to save energy, given by 26% of respondents. The survey asked customers who reported recalling energy-saving tips whether they find the suggestions relevant to their household. Out of the 136 who provided a response, 71% find tips from the HERs relevant (Figure 3-4).

Figure 3-4. Residential HER Program Relevancy of Suggestions (n=136)



Source: Guidehouse analysis

Based on these process findings, Guidehouse recommends PECO highlight the explanation of neighbor comparison calculation. PECO may also consider adding a visual element to better draw attention to the explanation of the neighbor comparison calculation.

Guidehouse also recommends PECO consider promoting energy-saving tips customers are less aware of. PECO may coordinate savings tips and PECO program referral to align recommended action with a PECO rebate or service to reduce customer cost.

3.3.6 Program Finances and Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-21. TRC benefits in Table 3-21 were calculated using gross verified impacts. NPV PY13 costs and benefits are expressed in 2021 dollars.

Table 3-21. Summary of Program Finances – Gross Verified

Row	Cost Category*	PYTD ($1,000)	
1	**IMCs**	**$0**	
2	Rebates to Participants and Trade Allies	$0	
3	Upstream/Midstream Incentives	$0	
4	Material Cost for Self-Install Programs (EE&C Kits)	$0	
5	Direct Installation Program Materials and Labor	N/A	
6	Participant Costs (row 1 minus the sum of rows 2 through 5)	$0	
		EDC	**CSP**
7	Program Design	$0	$0
8	Administration and Management	$1,418	$0
9	Marketing	$0	$0
10	Program Delivery	$0	$0

Row	Cost Category*	PYTD ($1,000)
11	EDC Evaluation Costs	$0
12	SWE Audit Costs	$0
13	**Program Overhead Costs (sum of rows 7 through 12)**	**$1,418**
14	**Total NPV TRC Costs (sum of rows 1 and 13)**	**$1,418**
15	Total NPV Lifetime Electric Energy Benefits	$1,184
16	Total NPV Lifetime Electric Capacity Benefits	$1,226
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0
18	Total NPV Lifetime Fossil Fuel Impacts	$0
19	Total NPV Lifetime Water Impacts	$0
20	**Total NPV TRC Benefits (sum of rows 15 through 19)**	**$2,409**
21	**TRC Benefit-Cost Ratio (row 20 divided by row 14)**	**1.70**

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025).

Source: Guidehouse analysis

Program financials and cost-effectiveness on a net savings basis are the same values as Table 3-21 because verified net savings equal the verified gross savings for the Residential HER Program.

3.3.7 Status of Recommendations

The impact and process evaluation activities in PY13 led to the following findings and recommendations from Guidehouse to PECO, along with a summary of how PECO plans to address the recommendations in program delivery.

Table 3-22. Summary of Evaluation Recommendations

Evaluation Activity	Finding	Recommendation	EDC Status
Process	Respondents rated the accuracy of the neighbor comparison in the HERs as 6.0 out of 10 (scale of 0 to 10, where 0 is "extremely inaccurate" and 10 is "extremely accurate"). The mean accuracy score for the market-rate stratum is 6.0 out of 10. Respondents who rated accuracy lower than 7 were asked why they provided that score. Many respondents mentioned differences in household size and occupancy, as well as different household needs as reasons the comparison may not be accurate.	Highlight explanation of neighbor comparison calculation. Consider adding a visual element to better draw attention to the explanation of the neighbor comparison calculation.	Under consideration. Explanation of comparison provided via online My Account marketing module.
Process	When asked if they recall specific energy-saving tips from the HERs, 38% of market-rate customers said yes. Respondents who confirmed recalling suggestions from the report most often recalled adjusting the temperature/thermostat in the home to save energy (26%). Seventy-one percent of customers who reported recalling energy-saving tips indicated they find tips from the HERs relevant.	Consider promoting energy-saving tips customers are less aware of. Coordinate savings tips and PECO program referral to align recommended action with a PECO rebate or service to reduce customer cost.	Under consideration. New tips can be added in the marketing modules to promote other residential programs.

Source: Guidehouse analysis

3.4 Income-Eligible HER Program

The IE HER Program objective is to reduce a home's energy use through print (mail) and online (email) reports sent directly to customers that give insight into their household energy usage. These programs leverage social norming to drive persistent energy savings through smart energy practices. The IE HER program is implemented by Oracle as an RCT. HERs and the online content use social norms and usage summaries to compare a customer's household energy use to the average energy use of other households like theirs. In this way, these customers have a relative sense of where their energy use patterns fall. The reports also provide targeted recommendations or tips to customers, suggesting actions they can take to reduce consumption. Different from the Residential HER program, customers on IE rates receive messaging tailored towards low-cost and no-cost recommendations. The full content of HERs serves to encourage customers to reduce their consumption and enhance engagement and general satisfaction. The reports are sent to targeted cohorts of customers on an opt-out basis. During PY13, approximately 22,000 households received HERs for the one active IE cohort.

3.4.1 Participation and Reported Savings by Customer Segment

Table 3-23 presents the participation counts, reported energy and demand savings, and incentive payments for IE HER Program in PY13 by customer segment. Participants are defined as HER recipients that have savings in at least one month during the program year.

Table 3-23. Income-Eligible HER Program Participation and Reported Impacts

Parameter	Income-Eligible	Total
PY13 # Participants	21,981	**21,981**
PYRTD MWh/yr	793	**793**
PYRTD MW/yr	0.13	**0.13**
PY13 Incentives ($1,000)	-	**-**

Source: Guidehouse analysis

3.4.2 Gross Impact Evaluation

Guidehouse evaluated savings for the one IE HER cohort. The evaluation follows the same approach as the Residential HER Program, as described in Section 3.3.2. Refer to 4.2Appendix B for the full impact evaluation detail. Evaluation results are presented in Table 3-24 and Table 3-25.

Table 3-24. Income-Eligible HER Program Gross Impact Results for Energy

	PYRTD MWh/yr	Energy Realization Rate	Sample C_V or Error Ratio	Relative Precision at 85% C.L.
Program Total	**793**	**1.00**	**0**	**0**

Source: Guidehouse analysis

Table 3-25. Income-Eligible HER Program Gross Impact Results for Demand

	PYRTD MW/yr	Demand Realization Rate	Sample C_V or Error Ratio	Relative Precision at 85% C.L.
Program Total	**0.13**	**-0.91**	**0**	**0**

Source: Guidehouse analysis

The following factors led to variation between the reported and verified savings and led to the observed realization rates.

Guidehouse leveraged summer 2022 peak-hour metering data to conduct the peak demand analysis. Differences in data sources can drive discrepancies in reported and verified savings in either direction (e.g., using hourly data may provide a more accurate estimate of savings).

Approximately 4% of the population of active HER recipients are in the IE cohort and are also in their launch year. With a small group size and lack of HER exposure (i.e., the peak demand analysis focuses on their first three months of HER receipt), the demand savings estimates are not statistically significant and thus are unpredictable.

The IE HER customers may differ from their residential HER counterparts, causing wider variations in verified versus reported savings based on methodology.

3.4.3 Net Impact Evaluation

Guidehouse does not assess net impacts for the IE HER Program as per guidance from the SWE's Evaluation Framework.[25]

3.4.4 Verified Savings Estimates

In Table 3-26, the realization rates and NTG ratios determined by Guidehouse are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the IE HER Program in PY13.

Table 3-26. PY13 Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	793	0.13
PYVTD Gross	795	-0.12
PYVTD Net	795	-0.12

Source: Guidehouse analysis

3.4.5 Process Evaluation

The PY13 process evaluation included PECO program manager and CSP staff interviews and a survey for recipients of the HERs, including both residential and IE recipient customers, as discussed in Section 3.3.5. This section presents the results for the one HER wave that targeted IE customers. See Section 3.3.5 for the methodology and sampling discussion.

3.4.5.1 Key Findings from Process Evaluation

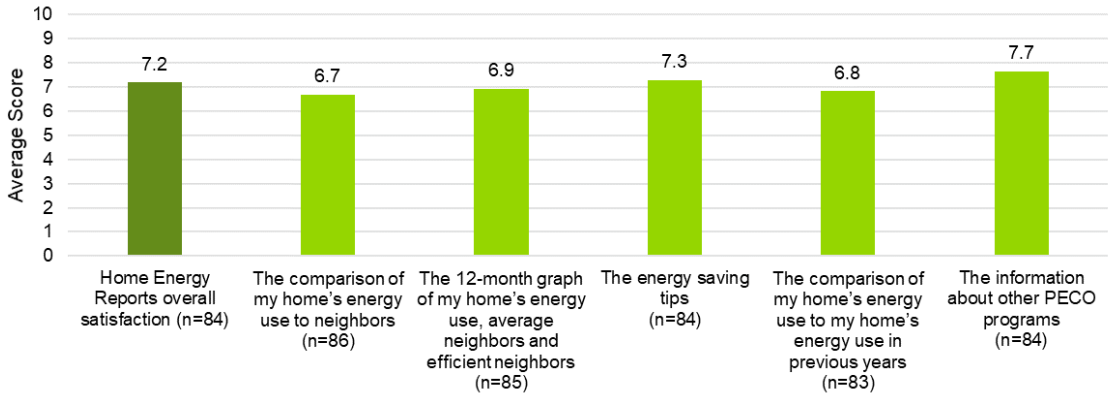
Respondents in the IE wave received the same survey questions detailed in Section 3.3.5. The IE wave is considerably smaller than the combined market-rate waves; 88 respondents from the IE wave answered the survey. See 4.2Appendix F for additional results from both the Residential and IE surveys.

[25] SWE. *Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs*. July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

When asked to provide a satisfaction score for the HERs overall, respondents provided an average rating of 7.2 out of 10, similar to Guidehouse's experience with HER program offerings in other jurisdictions.[26]

Respondents also rated the usefulness of five components of the HERs, shown in Figure 3-5. Respondents rated usefulness using a scale from 0 to 10, with 0 indicating "not useful at all" and 10 indicating "very useful." The online version of the survey displayed a sample copy of the HER with each component identified with a red box for respondents to reference while providing usefulness scores. Information about other PECO programs received the highest mean usefulness score of 7.7. The neighbor comparison received the lowest score of 6.7 out of 10 (Figure 3-5).

Figure 3-5. Income-Eligible HER Program Satisfaction and Usefulness[27]



Respondents received the following questions: "Using a scale of 0 to 10, with 0 meaning 'Extremely Dissatisfied' and 10 meaning 'Extremely Satisfied,' how would you rate your satisfaction with the Home Energy Reports overall?" and "On a scale of 0 to 10, where 0 means 'not useful at all' and 10 means 'very useful,' please indicate how useful each of the following elements of the Home Energy Reports are to you."

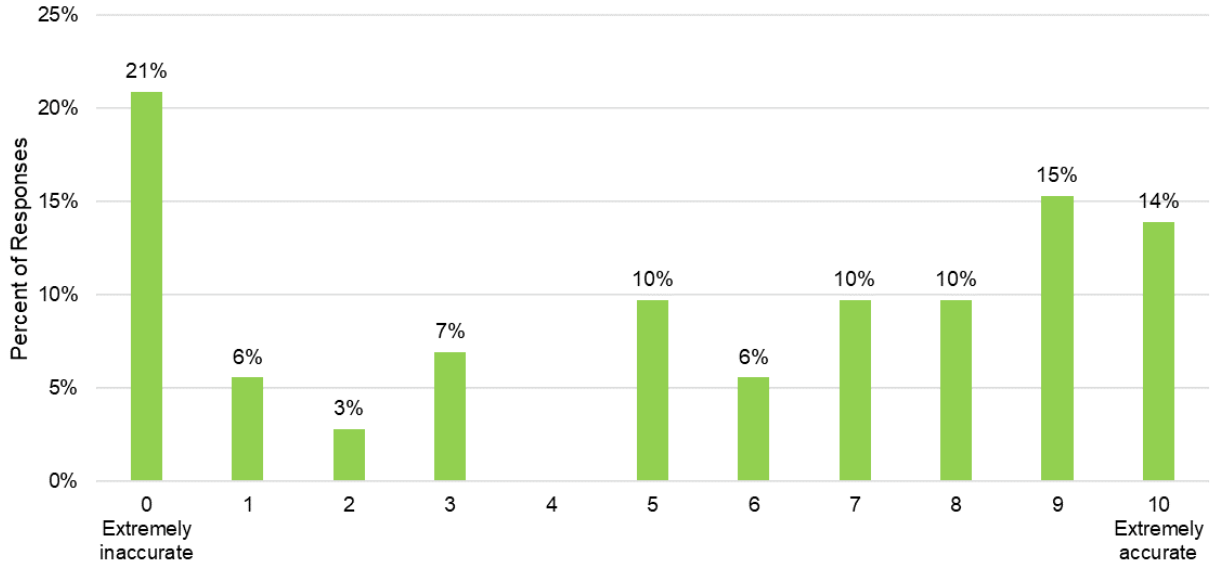
Source: Guidehouse analysis

Respondents rated the accuracy of the neighbor comparison in the HERs as 5.4 out of 10 (scale of 0 to 10, where 0 is "extremely inaccurate" and 10 is "extremely accurate"). This is lower than the market-rate mean accuracy score of 6.0 out of 10 – which is within Guidehouse's expectations and considered a negligible difference. Respondents who rated accuracy lower than 7 were asked why they provided that score. IE respondents mentioned similar reasoning to the market-rate strata regarding their rating of the neighbor comparison, specifically that some households have more members and higher energy needs. Some respondents also mentioned doubts that their usage is actually higher than their neighbors' when the neighbor comparison indicated their usage was higher than their neighbors' (Figure 3-6).

[26] The comparison includes two long-running HER programs from Midwest utilities, one of which achieved 74% customer satisfaction rating (score of 6-10 on 0-10 scale) in 2021. The other achieved an average satisfaction score of 7.9 on a scale of 0 to 10.

[27] Note that both satisfaction and usefulness scores are displayed in the same figure. The Home Energy Report Overall Satisfaction presents a satisfaction score, while all other components present a usefulness score.

Figure 3-6. Income-Eligible HER Program Accuracy of Neighbor Comparison (n=72)

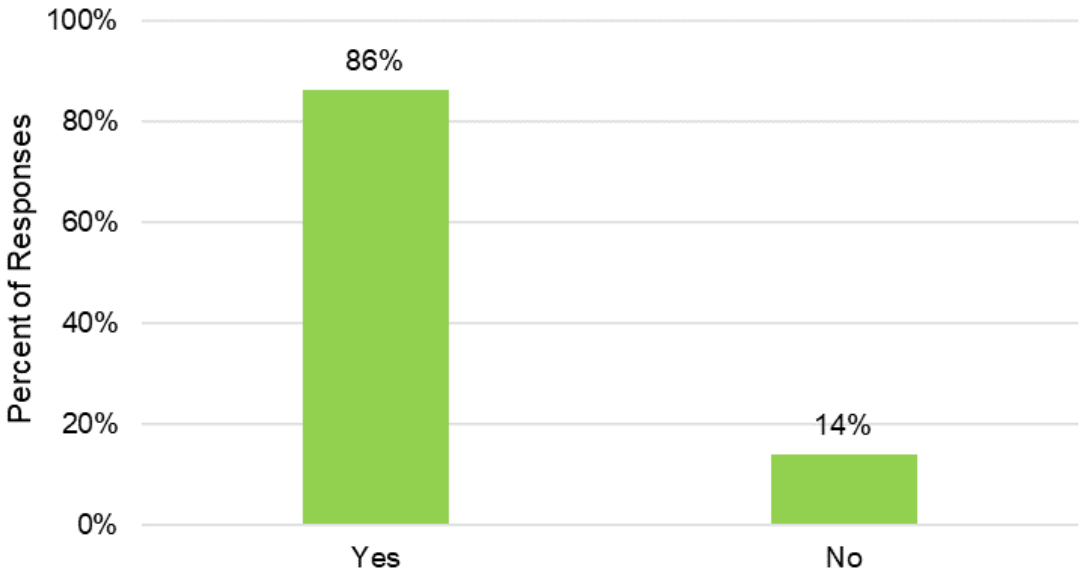


Respondents received the following prompt: "A prominent feature of the Home Energy Reports is its ability to show you how your energy use compares to neighbors. Please indicate how accurate you think these comparisons are using a scale from 0 to 10, where 0 is 'extremely inaccurate' and 10 is 'extremely accurate.'"

Source: Guidehouse analysis

When asked if they recall specific energy-saving tips from the HERs, 33% of IE customers said yes. Respondents who confirmed recalling suggestions from the report were asked to list up to three tips they remember. Unplugging or turning off electronics or lights that are not in use was the most common response, given by 24% of respondents. This differs from the most common response in the market-rate waves, as the tips listed in the IE wave focus on simple, no-cost or low cost actions. Customers who reported recalling energy-saving tips were also asked whether they find the suggestions relevant to their household. Almost all, 86%, of IE respondents find tips from the HERs relevant (Figure 3-7).

Figure 3-7. Income-Eligible HER Program Relevancy of Suggestions (n=29)



Respondents received the following question: "On average, do you find the suggestions relevant to your household?"
Source: Guidehouse analysis

Based on these process findings, Guidehouse recommends PECO highlight the explanation of neighbor comparison calculation. PECO may consider adding a visual element to better draw attention to the explanation of the neighbor comparison calculation.

Guidehouse also recommends PECO continue to promote low-cost and no-cost energy savings tips. PECO may consider promoting energy-saving tips customers are less aware of. PECO can also coordinate savings tips and PECO program referral to align recommended action with a PECO rebate or service to reduce customer cost.

3.4.6 Program Finances and Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-27. TRC benefits in Table 3-27 were calculated using gross verified impacts. NPV PY13 costs and benefits are expressed in 2021 dollars.

Table 3-27. Summary of Program Finances – Gross Verified

Row	Cost Category*	PYTD ($1,000)	
1	**IMCs**	**$0**	
2	Rebates to Participants and Trade Allies	$0	
3	Upstream/Midstream Incentives	$0	
4	Material Cost for Self-Install Programs (EE&C Kits)	$0	
5	Direct Installation Program Materials and Labor	N/A	
6	Participant Costs (row 1 minus the sum of rows 2 through 5)	$0	
		EDC	**CSP**
7	Program Design	$0	$0
8	Administration and Management	$60	$0

Row	Cost Category*	PYTD ($1,000)	
9	Marketing	$0	$0
10	Program Delivery	$0	$0
11	EDC Evaluation Costs	$0	
12	SWE Audit Costs	$0	
13	**Program Overhead Costs (sum of rows 7 through 12)**	**$60**	
14	**Total NPV TRC Costs (sum of rows 1 and 13)**	**$60**	
15	Total NPV Lifetime Electric Energy Benefits	$23	
16	Total NPV Lifetime Electric Capacity Benefits	($22)	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0	
18	Total NPV Lifetime Fossil Fuel Impacts	$0	
19	Total NPV Lifetime Water Impacts	$0	
20	**Total NPV TRC Benefits (sum of rows 15 through 19)**	**$1**	
21	**TRC Benefit-Cost Ratio (row 20 divided by row 14)**	**0.01**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025).

Source: Guidehouse analysis

Program financials and cost-effectiveness on a net savings basis are the same as the values in Table 3-27 because verified net savings equal the verified gross savings for the IE HER Program.

3.4.7 Status of Recommendations

The impact and process evaluation activities in PY13 led to the following findings and recommendations from Guidehouse to PECO, along with a summary of how PECO plans to address the recommendation in program delivery.

Table 3-28. Summary of Evaluation Recommendations

Evaluation Activity	Finding	Recommendation	EDC Status
Process	Respondents rated the accuracy of the neighbor comparison in the HERs as 5.4 out of 10 (scale of 0 to 10, where 0 is "extremely inaccurate" and 10 is "extremely accurate"). Respondents who rated accuracy lower than 7 were asked why they provided that score. Many respondents mentioned differences in household size and occupancy, as well as different household needs as reasons the comparison may not be accurate.	Highlight explanation of neighbor comparison calculation. Consider adding a visual element to better draw attention to the explanation of the neighbor comparison calculation.	Under consideration. Explanation of comparison provided via online My Account marketing module.
Process	When asked if they recall specific energy-saving tips from the HERs, 33% of IE customers said yes. Respondents who confirmed recalling suggestions from the report most often recalled unplugging or turning off electronics or lights that are not in use (24%). Eighty-six percent of customers who reported recalling energy-saving tips indicated they find tips from the HERs relevant.	Continue to promote low cost and no-cost energy-saving tips. Consider promoting energy-saving tips customers are less aware of. Coordinate savings tips and PECO program referral to align recommended action with a PECO rebate or service to reduce customer cost.	Under consideration. New tips can be added in the marketing modules to promote other residential programs.

Source: Guidehouse analysis

3.5 Non-Residential EE Program

The Non-Residential EE Program offers an array of opportunities to assist C&I customers in reducing their energy consumption and associated energy costs. The program encompasses a variety of energy efficiency components and measures to achieve this goal. Common measures within the Non-Residential EE Program include efficient lighting equipment, lighting controls, HVAC equipment, HVAC retrocommissioning, variable frequency drives (VFDs), refrigeration, and building automation systems, among others. The Non-Residential EE Program is implemented by DNV and is made up of four components:

- **Downstream:** The Downstream component, including Combined Heat and Power (CHP), is the most diverse delivery pathway, including both custom measures and prescriptive measures described by the TRM.[28] Baselines may be established as existing equipment (in situ), code minimum efficiency, or by using custom comparisons for custom projects. Downstream projects typically involves working directly with customers or with their contractors on potential projects.
- **Midstream "Instant Discounts" [29]:** The Midstream component involves working directly with distributors, incentivizing efficient equipment by reducing the sale price at the point of sale (POS) for customers. Midstream measures are all prescriptive, with baselines predefined by the TRM and IMP documents. Midstream also encompasses an LED aggregation pathway (which captures savings from manufacturer and national distributor direct-to-consumer transactions that did not go through the POS pathway), and a lighting lookback pathway (which reviews distributor transaction data, identifies program-qualifying projects that did not receive an incentive, and issues incentives to both the purchaser and the distributor).
- **Small Business Direct Install:** The Small Business Direct Install component offers rebates to small businesses for the direct installation of energy efficiency measures to improve overall energy performance. Typical measure offerings include efficient lighting and lighting controls, refrigeration lighting, door gaskets, and efficient motors on refrigerators and freezers.
- **New Construction:** New Construction is the smallest component, targeting customers at the time of building design, before construction or major renovations. Implementing energy conservation measures at the time of construction or renovation is often the most time and cost-effective pathway to building energy efficiency. New Construction participants are typically either constructing new buildings, constructing new additions onto existing buildings, or performing renovations of existing buildings significant enough that the new modified building must be compared with modern energy efficiency codes. Baselines for New Construction projects are established by city, county, and state energy efficiency codes.

[28] PA PUC, *Technical Reference Manual, State of Pennsylvania Act 129 Energy Efficiency and Conservation Program*, dated February 2021, https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/.

[29] "Midstream" is industry standard nomenclature used to describe this type of project in which incentives are provided at the distributor level and reflects the historical name for PECO's Midstream component. The name of PECO's Midstream component was changed in Phase IV to "Instant Discounts". These two terms, Midstream and Instant Discounts, are used interchangeably throughout this report.

3.5.1 Participation and Reported Savings by Customer Segment

Table 3-29 presents the participation counts, reported energy and demand savings, and incentive payments for the Non-Residential EE Program in PY13 by customer segment.

Table 3-29. Non-Residential EE Program Participation and Reported Impacts

Parameter	Small C&I (Non-GNI)	Large C&I (Non-GNI)	Small C&I (GNI)	Large C&I (GNI)	Municipal Lighting	Total
PY13 # Participants	1,890	514	372	174	22	**2,972**
PYRTD MWh/yr	52,141	99,335	7,869	9,208	986	**169,538**
PYRTD MW/yr	11.14	15.37	1.60	1.74	0.01	**29.85**
PY13 Incentives ($1,000)	6,781	6,891	1,335	1,428	150	**16,585**

Source: Guidehouse analysis

3.5.2 Gross Impact Evaluation

Guidehouse conducted the gross impact evaluation for the Non-Residential EE Program following the general approach outlined in its Evaluation Plan[30] for PY13. In PY13, the Non-Residential EE Program gross impact evaluation included both a tracking database analysis of all prescriptive measures and project-specific M&V activities for a sample of projects. The tracking database analysis included analysis of prescriptive TRM- and IMP-based measures to confirm data completeness, that reported savings algorithm assumptions aligned with TRM and IMP standards, and that all values fell within expected ranges. Project-specific evaluation included one or more of the following: engineering desk reviews, phone verifications, onsite verifications, and onsite metering.

- **Downstream:** The evaluation team conducted project-specific verification activities for a sample of 33 projects from the Downstream pathway in PY13, including one CHP project.
- **Midstream:** The evaluation team conducted project-specific verification activities for a sample of 78 projects from the Midstream pathway in PY13.
- **Small Business Direct Install:** The evaluation team applied a combination of tracking database analysis results and PY11 realization rates to the PY13 reported savings.
- **New Construction:** The evaluation team conducted project-specific verification activities for a sample of 14 projects from the New Construction pathway in PY13.

All samples were designed and implemented to meet the targets set in Guidehouse's sampling design memo.[31] Additional detail of the impact evaluation completed in PY13 can be found in 4.2Appendix G. The PY13 evaluations realization rates and statistical relative precision for energy and demand are shown in Table 3-30 and Table 3-31, respectively.

[30] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.
[31] PECO, *PY13 NonResidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

Table 3-30. Non-Residential EE Program Gross Impact Results for Energy

Component	PYRTD MWh/yr	Energy Realization Rate	Sample CV or Error Ratio	Relative Precision at 85% C.L.
Downstream	111,721	1.05	0.24	0.06
Midstream	34,977	1.16	0.67	0.11
Small Business Direct Install[1]	4,077	0.92	0.13	0.05
New Construction	5,140	1.02	0.17	0.07
Program Total	**155,915**	**1.07**	**0.41**	**0.05**

[1] Small Business Direct Install applied the PY11 Whole Building realization rate to the result of the tracking database analysis. The CV and the relative precision at 85% C.L. were taken from PY11.

Source: Guidehouse analysis

Table 3-31. Non-Residential EE Program Gross Impact Results for Demand

Component	PYRTD MW/yr	Demand Realization Rate	Sample CV or Error Ratio	Relative Precision at 85% C.L.
Downstream	20.64	0.93	0.44	0.11
Midstream	7.43	1.14	0.65	0.11
Small Business Direct Install[1]	0.68	0.99	0.09	0.04
New Construction	1.04	1.06	0.31	0.13
Program Total	**29.78**	**0.99**	**0.64**	**0.08**

[1] Small Business Direct Install applied the PY11 Whole Building realization rate to the result of the tracking database analysis. The CV and the relative precision at 85% C.L. were taken from PY11.

Source: Guidehouse analysis

The following factors led to variation between the reported and verified savings and led to the observed realization rates.

3.5.2.1 Downstream

The most common changes the Guidehouse evaluation team made to projects from the Downstream component were to update control types, HVAC types, and HOU for lighting measures, based on site-specific data from customer interviews. The team also recalculated demand savings for two retrocommissioning projects to account for specific timing of the measure savings and associated demand impacts.

For the CHP project, the evaluation team reviewed trend data for the actual system operation. The team then calculated average system availability and capacity during peak times and used this to estimate typical peak demand savings, which were lower than reported. This single large CHP project represented 38% of reported peak demand savings and 48% of reported energy savings for the Downstream component. The reduction in demand savings for this one project reduced the total Downstream demand savings by five percent.

3.5.2.2 Midstream

The Midstream component is built to streamline and simplify participation for customers. As such, minimal information is collected at the POS for the purchased EE equipment, such as lightbulbs and fixtures. Because limited information is collected at the POS, reported equipment hours of use (HOU) are assumed and deemed based on the building type identified through an address lookup. During evaluation, the evaluation team updates the HOU with actual HOU confirmed on an individual site-specific basis. This change from assumed and deemed HOU to

actual HOU can lead to variability in HOU and savings at the individual site level. The variability includes both increases and decreases in savings for any individual site.

Similarly, the implementer assumes all fixtures and lamps purchased through the Midstream component are to be placed in comfort cooled spaces due to limited data collection. Lamps placed in comfort cooled spaces are awarded extra savings due to a reduction in waste heat that would otherwise have to be removed by the cooling system. However, some portion of lamps purchased through the Midstream component are installed in exterior areas or other unconditioned spaces and therefore do not receive additional savings for the reduction in waste heat during evaluation. This change causes a 16% reduction in savings for all affected measures. As only a small fraction of lamps and fixtures are installed in these unconditioned spaces, this has a much smaller impact on the overall Midstream population.

Additionally, there is a typo in the Phase IV TRM measure specific to Midstream lighting (TRM Measure number 3.1.7) and its corresponding IMP.[32] Correcting this typo caused a 6.7% reduction in savings for all lighting measures where savings were calculated using the algorithm from the TRM measure number 3.1.7. Further detail is provided in Section 3.5.7.

3.5.3 Net Impact Evaluation

As described in the Phase IV Evaluation Plan for PY13, Guidehouse conducted NTG research for the Non-Residential Midstream component, known to customers as Instant Discounts. The evaluation team used the NTG values established in Phase III for all other Non-Residential components. Table 2-4 summarizes all program component level NTGR applied to the Non-Residential program.

3.5.3.1 Methodology

Guidehouse followed the SWE's framework[33] and the Illinois technical reference manual (IL TRM)[34] for conducing NTG research and analysis for Midstream programs. This guidance included detail on gathering feedback from distributors regarding changes in stocking and selling practices due directly to their participation in the Instant Discounts component. Guidehouse did not conduct surveys with PECO customers participating in the Midstream offering due to lack of contact information gathered at the time of purchase. See 4.2G.2.2 for further detail on the methodology and NTG algorithms used to estimate NTG in PY13.

Guidehouse attempted to interview a census of distributors operating in the PECO service territory and participating in the Instant Discounts component. The implementer provided a list of current distributors and contact information for the individuals responsible for the decision to participate in the program. The team developed the NTG interview instrument according to SWE requirements and the SWE reviewed and approved the instrument in advance of fielding.

[32] This issue is known to the SWE and is documented in the TRM issues tracker "2021 TRM Questions & Comments.xlsx" on line 48 of the tab "2021 TRM Questions."

[33] SWE. *Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs*. July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

[34] ILSAG. *Illinois Statewide Technical Reference Manual version 10.0*. August 1, 2022. https://www.ilsag.info/technical-reference-manual/il-statewide-technical-reference-manual-version-10-0/. Guidehouse has not conducted NTG research for PECO's Midstream programs in past program years, nor is there supporting documentation from the SWE that includes algorithms for quantifying NTG results in Pennsylvania. Therefore, Guidehouse looked outside of Pennsylvania for detailed methods on estimating NTG for Midstream pathways.

3.5.3.2 Results

Guidehouse completed five interviews with participating lighting distributors (23% response rate) through the phone interview effort. Distributors provided feedback for estimating free ridership for the Instant Discounts component, and the impact the program had on sales of energy efficient equipment offering insight into the effects of the program on the overall lighting market.[35] Of the five interviewed distributors, four provided high influence scores (a 9 or 10 on a 0-10 scale) to the question of whether the program influenced their stocking and selling practices of energy efficient lighting. Three of the five distributors also said participation in Instant Discounts increased their sale of efficient lighting in a significant way (25%-30% increase in sales compared with the year prior to participation). Two of the distributors said their sales stayed about the same compared with the year prior to participation. For further detail on the NTG results, see 4.2G.2.2.

Table 3-32 shows the NTG results of the Non-Residential EE Program components including Midstream.

Table 3-32. Non-Residential EE Program Net Impact Evaluation Results

Component	PYVTD	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Midstream	40,573	31%	0%	0.69	0.11

Source: Guidehouse analysis

Guidehouse estimates that nearly one-third of savings claimed through the Midstream component would have occurred in absence of Instant Discounts (free ridership of 31%). The primary driver of free ridership for the Midstream component is the distributor-reported percentage of bulb sales that would have occurred if the program had not been available.

3.5.3.3 High Impact Measure Research

Guidehouse did not evaluate HIMs for the Non-Residential EE Program in PY13.

3.5.4 Verified Savings Estimates

In Table 3-33, the realization rates and NTG ratios determined by Guidehouse are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Non-Residential EE Program in PY13.

Table 3-33. PY13 Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	155,915	29.78
PYVTD Gross	166,440	29.43
PYVTD Net	106,507	19.09

Source: Guidehouse analysis

[35] Guidehouse attempted to complete surveys with the two HVAC distributors participating in Instant Discounts but were unable to reach these businesses for feedback.

3.5.5 Process Evaluation

As described in the Phase IV Evaluation Plan[36] for PY13, Guidehouse conducted PECO program manager and CSP staff interviews for the Non-Residential EE Program. The team also asked a small selection of process questions during the NTG distributor interviews for the Instant Discounts component as described in Section 3.5.3.

The team interviewed the PECO program managers and CSP staff to determine the current operation of the program, identify implementation changes to the program from the prior program year, and identify planned program changes in the future. Guidehouse used findings from these interviews to inform the evaluation research in PY13 and for future program years.

Distributors reported high overall satisfaction with the Instant Discounts component, with all interviewees providing a rating of at least 7 on a 0 to 10 scale. Distributors also reported high satisfaction (at least 7 out of 10) with the program's portal for confirming customer eligibility, the rebate check tracking system, the time required to receive the rebates for lighting sales, the eligible products, the program's outreach and marketing materials, and the program staff's responsiveness. One distributor reported a low satisfaction rating (5 out of 10) for the program's training materials and communications about how to participate. Interviewees found program participation very easy, and most would strongly recommend it to other businesses. When asked for additional feedback, distributors expressed interest in continuing their participation in the program.

Guidehouse also asked distributors about the influence of the COVID-19 pandemic on their ability to stock program-qualified fixtures. Three of the five respondents experienced supply chain issues that delayed the arrival of equipment this year. All three reported finding suitable, program-qualifying alternative bulbs for the customer to prevent project delays or cancellations.

3.5.6 Program Finances and Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 3-34. TRC benefits in Table 3-34 were calculated using gross verified impacts. NPV PY13 costs and benefits are expressed in 2021 dollars.

Table 3-34. Summary of Program Finances – Gross Verified

Row	Cost Category*	PYTD ($1,000)	
1	**IMCs**	**80,117**	
2	Rebates to Participants and Trade Allies	8,908	
3	Upstream/Midstream Incentives	5,576	
4	Material Cost for Self-Install Programs (EE&C Kits)	N/A	
5	Direct Installation Program Materials and Labor	841	
6	Participant Costs (row 1 minus the sum of rows 2 through 5)	64,792	
		EDC	**CSP**
7	Program Design	0	0
8	Administration and Management	10,134	0
9	Marketing	0	0
10	Program Delivery	0	0
11	EDC Evaluation Costs	0	

[36] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Row	Cost Category*	PYTD ($1,000)
12	SWE Audit Costs	0
13	**Program Overhead Costs (sum of rows 7 through 12)**	**10,134**
14	**Total NPV TRC Costs (sum of rows 1 and 13)**	**90,252**
15	Total NPV Lifetime Electric Energy Benefits	51,352
16	Total NPV Lifetime Electric Capacity Benefits	34,046
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	4,822
18	Total NPV Lifetime Fossil Fuel Impacts	-11,127
19	Total NPV Lifetime Water Impacts	0
20	**Total NPV TRC Benefits (sum of rows 15 through 19)**	**79,092**
21	**TRC Benefit-Cost Ratio (row 20 divided by row 14)**	**0.88**

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025).

Source: Guidehouse analysis

Table 3-35 presents program financials and cost-effectiveness on a net savings basis. Guidehouse conducted primary NTGR data collection and analysis for the Non-Residential Midstream component in PY13. For the other program components Guidehouse applied NTGRs from the most recent analysis year from Phase III. The NTGRs are summarized in Table 2-4.

The 2021 TRC Test Final Order stated that the NTGR should be applied to all benefits in the net TRC test, including but not limited to avoided energy and capacity costs, O&M, interactive effects, and secondary fossil fuel impacts. In addition, the NTGRs are applied to the IMC, therefore the IMC are different on a net savings basis compared to the gross savings basis.

Table 3-35. Summary of Program Finances – Net Verified

Row	Cost Category*	PYTD ($1,000)	
1	**IMCs**	**51,275**	
2	Rebates to Participants and Trade Allies	8,908	
3	Upstream/Midstream Incentives	5,576	
4	Material Cost for Self-Install Programs (EE&C Kits)	N/A	
5	Direct Installation Program Materials and Labor	841	
6	Participant Costs (row 1 minus the sum of rows 2 through 5)	35,950	
		EDC	**CSP**
7	Program Design	0	0
8	Administration and Management	10,134	0
9	Marketing	0	0
10	Program Delivery	0	0
11	EDC Evaluation Costs	0	
12	SWE Audit Costs	0	
13	**Program Overhead Costs (sum of rows 7 through 12)**	**10,134**	
14	**Total NPV TRC Costs (sum of rows 1 and 13)**	**61,409**	
15	Total NPV Lifetime Electric Energy Benefits	32,865	
16	Total NPV Lifetime Electric Capacity Benefits	21,789	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	3,086	
18	Total NPV Lifetime Fossil Fuel Impacts	-7,121	
19	Total NPV Lifetime Water Impacts	0	
20	**Total NPV TRC Benefits (sum of rows 15 through 19)**	**50,619**	

Row	Cost Category*	PYTD ($1,000)
21	**TRC Benefit-Cost Ratio (row 20 divided by row 14)**	**0.82**

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025).

Source: Guidehouse analysis

3.5.7 Status of Recommendations

The impact and process evaluation activities in PY13 led to the following findings and recommendations from Guidehouse to PECO, along with a summary of how PECO plans to address the recommendations in program delivery.

Table 3-36. Summary of Evaluation Recommendations

Component	Evaluation Activity	Finding	Recommendation	EDC Status
Downstream	Impact	Two retrocommissioning projects had peak demand realization rates of 0% because demand savings were incorrectly assigned to the project. The demand for both projects was calculated as the overall energy savings divided by 8760 hours in the year. However, these measures behave differently based on outdoor conditions and do not have consistent demand savings over all hours of the year. For these projects, savings during the peak period (2pm-6pm on non-holiday weekdays, June -August) were 0kW.	Do not calculate peak demand savings as energy savings divided by 8,760 hours unless the equipment usage and demand savings have a flat load shape throughout the year indicative of consistent annual usage, such as security lights that are never turned off. For measures with variable demand savings throughout the day, month, or year, the savings should be calculated for the specific peak demand period (2 p.m.–6 p.m. on non-holiday weekdays in the months of June, July, and August) using project-specific inputs and custom calculations.	In Process
Downstream	Impact	In eTrack, it appears that the two sampled ductless mini-split heat pump projects were calculating the base HSPF and SEER incorrectly for the Ductless Mini-Split Heat Pump measure (Section 3.2.4 of the Non-Residential TRM). It appears that footnotes 27 and 28 in the TRM section were not being included in the ex ante calculations, which cap the heating and cooling capacities on the low and high side (PRJ-00184-2021, PRJ-00767-2021).	For the Ductless Mini-Split Heat Pump measure, ensure the ex ante calculations are applying the minimum and maximum capacities per the footnotes in TRM Section 3.2.4. As best practice for all measures, confirm that stipulations provided in the TRM footnotes are applied in the measure savings calculations.	In Process
Downstream	Impact	The most common changes the Guidehouse evaluation team made to Downstream projects were to update control types, HVAC equipment types, and HOU for lighting measures, based on site-specific data collected during customer interviews or onsite data collection. Verifying a different control type changes the SVG savings multiplier. Similarly, updating the HVAC type changes the IF, or Interactive Factor, savings multiplier resulting from reduced waste heat from lighting fixtures.	Guidehouse recommends confirming the control types pre- and post-retrofit, as well as the heating fuel for the location in which lights are installed. Also, it is recommended that the implementer collect and use site-specific information for usage schedules if they are significantly different than TRM-estimated deemed values (prioritized for larger projects). PECO and the CSP should also document the source of these schedules within the project documentation.	In Process

Component	Evaluation Activity	Finding	Recommendation	EDC Status
Downstream	Impact	In eTrack, three of the six refrigerated display case projects had ex ante demand savings that were 100x too high. It appears that there is a unit conversion mistake in the eTrack input (PRJ-00668-2021, PRJ-00223-2021, PRJ-00218-2021).	Double-check that the variables input into eTrack are in the correct units for the refrigerated display case measure.	In Process
Midstream	Impact	There is a typo in the TRM and IMP for Midstream lighting (TRM measure 3.1.7). The TRM and IMP both have a ""plus"" sign that should be a ""minus"" sign, inflating savings by seven percent. The Midstream measures in the TRM and IMP read ""… = [kWbase x (1 + SVGbase) - kWee x (1 + SVGee)] ..."" but should instead read ""...= [kWbase x (1 - SVGbase) - kWee x (1 - SVGee)] ..."" "	Midstream lighting calculations should convert the “plus” sign to a “minus” sign and correct the algorithm in the appropriate calculators.	In Process
Midstream	Impact	All Midstream lighting projects characterize the installation space type as comfort cooled; however, some of the installations are in outdoor spaces. For these exterior fixtures, this incorrectly applies a 0.192 value rather than 0 value for the interactive demand factor.	Identifying specific measures or product sales as Exterior can be challenging with the limited information collected as part of Midstream at the POS. Guidehouse recommends identifying fixture types that are more likely to be exterior than interior and having those lamp types default to exterior and receive no additional savings from interactive factors.	In Process

Source: Guidehouse analysis

4. Portfolio Finances and Cost Recovery

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 PY13 are shown in Table 4-1. The columns in Table 4-1 are adapted from the Direct Program Cost categories in the Commission's EE&C Plan template[37] for Phase IV. Non-incentives include EDC Materials, Labor, and Administration costs (including costs associated with an EDC's own employees) as well as ICSP Materials, Labor, and Administration costs (including both the program implementation contractor and the costs of any other outside vendors and EDC employees to support program delivery). The dollar figures Table 4-1 are based on EDC tracking of expenditures with no adjustments to account for inflation.[38]

Table 4-1. PY13 Program and Portfolio Total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Residential	$5,725	$4,963	**$10,689**
Income-Eligible	$4,153	$1,578	**$5,731**
Residential HER	$0	$1,418	**$1,418**
Income-Eligible HER	$0	$60	**$60**
Non-Residential	$16,316	$10,134	**$26,451**
Common Portfolio Costs[1]			**$10,473**
Portfolio Total	**$26,195**	**$28,626**	**$54,821**
SWE Costs[2]	**N/A**	**N/A**	**N/A**
Portfolio Total	**$26,195**	**$28,626**	**$54,821**

[1] Portfolio Common Costs include administrative, marketing, evaluation, and other shared expenses

[2] Statewide Evaluation costs are outside of the 2% spending cap

Source: PECO, CSP tracking data

4.2 Cost Recovery

Act 129 allows Pennsylvania EDCs to recover EE&C plan costs through a cost-recovery mechanism. PECO's cost-recovery charges are organized separately by 4 customer sectors to ensure that the electric rate classes that finance the programs are the rate classes that receive the direct energy conservation benefits. Cost recovery is governed by tariffed rate class, so it is necessarily tied to the way customers are metered and charged for electric service. Readers should be mindful of the differences between Table 4-2 and Section 2.3. For example, the IE customer segment is a subset of PECO's residential tariff(s) and therefore not listed in Table 4-2.

[37] PA PUC, *State of Pennsylvania Act 129 Energy Efficiency Conservation Plan Template*, September 9, 2020, https://www.puc.pa.gov/pcdocs/1676672.docx.

[38] The cost recovery of program expenses through riders generally happens promptly so that costs are being recovered from ratepayers in the same dollars that they are incurred.

Table 4-2. EE&C Plan Expenditures by Cost-Recovery Category

Cost-Recovery Sector	Rate Classes Included[1]	PY13 Spending ($1,000)	P4TD Spending ($1,000)
Residential	R, RH, and CAP	$23,259	$23,259
Small C&I	GS	$13,417	$13,417
Large C&I	PD, HT, and EP	$17,916	$17,916
Municipal	SLE, AL, and TLCL	$229	$229
Portfolio Total	**All**	**$54,821**	**$54,821**

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

Source: PECO

Appendix A. Site Inspection Summary

Guidehouse's impact evaluation team completed four in-person site inspections to collect and verify site-specific operation parameters and to verify equipment installation as reported. The EcoMetric team performed all four onsite visits, and their findings are discussed in Table A-1.

Table A-1. PY13 Site Visit Summary

Program	Component	Project Number	Type of Project	Onsite Tasks	Summary of Findings, Updates, and Impacts
Non-Residential	Downstream	PRJ-00258-2021	Lighting	Verify lighting control type	During the site visit, the lighting control type was confirmed as photocells. This caused a drop in both the energy and demand savings because the ex-ante assumption was that a portion of the lights were on 8,760 hours.
Non-Residential	Downstream	PRJ-00644-2021	Lighting	Verify fixture type and quantity, space conditioning, and controls type(s)	The HOU and CF for interior space were updated based on site visit for one of the Home Depot projects (PRJ-00644) and lighting schedule information provided by the customer. Outdoor garden center hours were confirmed during customer interview, which also led to HOU and CF updates. Overall, the energy savings decreased but the demand savings increased.
Non-Residential	Midstream	ORD-04361-H2X8Q8	Lighting	Verify fixture type and quantity, space conditioning, and controls type(s); install lighting loggers to record HOU	The HOU and CF were updated from 6,631 and 0.96 to 8,760 and 1.0, respectively, after metering. However, during the site visit, the onsite team confirmed that the pre-retrofit fixtures included occupancy sensors which were removed with the installation of the new fixtures due to changes in operation and occupancy. Additionally, savings further decreased because ex ante calculations assumed the space was comfort cooled, but the onsite visit found it to be an uncooled space. Overall, both the energy and demand savings decreased.
Non-Residential	Midstream	ORD-02316-D2P1J9	Lighting	Verify location address, fixture type and quantity, space conditioning, and controls type(s)	Through the site visit and phone verification, the HOU and CF were increased from 2,545 and 0.48 to 2,972 and 1.0, respectively. Also, the space conditioning was updated from comfort cooled to unconditioned. Overall, both the energy and demand savings increased.

Source: Guidehouse analysis

Appendix B. HER Impact Evaluation Detail

This appendix details the full HER Program impact evaluation. All cohorts are included together, regardless of residential or IE status. According to the Phase IV plan, the HER programs are planned to account for 7% of total portfolio energy savings and 14% of total portfolio demand savings. The HER programs are implemented by Oracle.

B.1 Billing Data Management

Guidehouse used monthly billing data from Oracle to perform the energy savings analysis. The evaluation team applied the following preliminary data management steps on this billing data prior to carrying out the energy regression analysis.

- Remove exact duplicate bills from the data as provided, by account
- Drop all bills for accounts that went inactive prior to the later of (a) the start of the current program year (May 1, 2021) and (b) the launch month of an account's wave
- Normalize consecutive estimated reads by account, per Section 6.1.4 of the Phase IV Evaluation Framework[39]
- Convert usage billing data to monthly "calendarized" observations, per Section 6.1.4 of the Phase IV Evaluation Framework[39]
- Remove monthly observations outside of each wave's 12-month pre-period and current post-period
- Remove outlier data, per Section 6.1.4.1 of the Phase IV Evaluation Framework,[39] defined as monthly observations outside median monthly usage by wave plus or minus ten times that median usage

B.2 Impact Regression Results

Guidehouse followed the impact evaluation methodology outlined in Section 6.1.5 of the Phase IV Evaluation Framework.[40] The evaluation team estimated energy savings using a monthly LDV model. For details on model selection, refer to Section 6.1.5 of the Phase IV Evaluation Framework.

[39] PA SWE, *"Section 6.1.4 Data Management." Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs,* July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

[40] PA SWE, *"Section 6.1.5 Model Specification". Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs,* July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

Table B-1. through Table B-4. summarize the regression outputs and statistics by wave, including the absolute precision for percentage savings estimates. The Phase IV Evaluation Framework Section 6.1.1.1 requires that the solution-level verification achieve an absolute precision of ±0.5% at the 95% confidence level (two-tailed), but individual cohorts may have a wider margin of error.[41] The precisions in Table B-3. and Table B-4. reflect the error of the individual regression analysis estimates using a two-tailed 95% confidence level.

Table B-1. HER Energy Regression Details (kWh/day) – Wave 1, 2, 3, and 6 Cohorts

Month	Wave 1		Wave 2		Wave 3		Wave 6 Electric		Wave 6 Dual Fuel	
	ATE	Std. Err.	ATE	Std. Err.	ATE	Std. Err.	ATE	Std. Err.	ATE	Std. Err.
2021-Jun	-0.441	0.145	-1.239	0.247	-1.090	0.163	-0.446	0.167	-0.510	0.320
2021-Jul	-0.577	0.155	-1.323	0.266	-1.182	0.182	-0.496	0.203	-0.839	0.394
2021-Aug	-0.565	0.156	-1.385	0.259	-1.126	0.176	-0.606	0.199	-0.990	0.383
2021-Sep	-0.519	0.136	-1.061	0.226	-0.970	0.150	-0.559	0.174	-0.972	0.338
2021-Oct	-0.519	0.120	-0.993	0.188	-0.808	0.120	-0.506	0.159	-0.966	0.278
2021-Nov	-0.866	0.166	-1.026	0.222	-0.996	0.142	-0.714	0.215	-0.878	0.300
2021-Dec	-1.246	0.206	-1.226	0.272	-1.209	0.169	-0.966	0.264	-1.080	0.346
2022-Jan	-1.477	0.273	-1.699	0.340	-1.257	0.202	-1.284	0.323	-1.212	0.398
2022-Feb	-1.304	0.246	-1.411	0.313	-1.090	0.187	-1.197	0.298	-1.212	0.373
2022-Mar	-0.975	0.184	-1.045	0.246	-0.923	0.149	-0.984	0.230	-0.778	0.298
2022-Apr	-0.751	0.147	-0.951	0.212	-0.841	0.131	-0.882	0.189	-0.523	0.281
2022-May	-0.569	0.136	-0.871	0.227	-0.902	0.137	-0.553	0.171	-0.538	0.307

Note: Average Treatment Effect (ATE)

Source: Guidehouse analysis of monthly billing data

Table B-2. HER Energy Regression Details (kWh/day) – Wave 7 Cohorts

Month	Wave 7 Dual Fuel		Wave 7 Has Email		Wave 7 Income Eligible		Wave 7 No Email	
	ATE	Std. Err.	ATE	Std. Err.	ATE	Std. Err.	ATE	Std. Err.
2021-Jun	-0.005	0.049	-0.018	0.057	0.126	0.084	0.039	0.054
2021-Jul	-0.019	0.055	-0.025	0.065	0.108	0.097	0.030	0.061

[41] *SWE. "Section 6.1.1.1 Group Sizes". Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs.* July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

Month	Wave 7 Dual Fuel		Wave 7 Has Email		Wave 7 Income Eligible		Wave 7 No Email	
	ATE	Std. Err.	ATE	Std. Err.	ATE	Std. Err.	ATE	Std. Err.
2021-Aug	-0.111	0.054	-0.118	0.063	-0.038	0.095	-0.076	0.059
2021-Sep	-0.149	0.047	-0.128	0.053	-0.152	0.080	-0.134	0.049
2021-Oct	-0.122	0.039	-0.098	0.045	-0.102	0.071	-0.063	0.043
2021-Nov	-0.099	0.040	-0.070	0.058	-0.011	0.101	-0.059	0.060
2021-Dec	-0.111	0.047	-0.027	0.068	-0.143	0.121	-0.098	0.073
2022-Jan	-0.130	0.053	-0.038	0.083	-0.131	0.139	-0.028	0.086
2022-Feb	-0.121	0.050	-0.043	0.076	-0.348	0.130	-0.030	0.078
2022-Mar	-0.099	0.042	-0.108	0.059	-0.249	0.107	-0.110	0.062
2022-Apr	-0.085	0.039	-0.149	0.052	-0.213	0.090	-0.059	0.051
2022-May	-0.171	0.043	-0.193	0.050	-0.199	0.073	-0.091	0.044

Source: Guidehouse analysis of monthly billing data

Table B-3. HER Percentage Energy Savings – Wave 1, 2, 3, and 6 Cohorts

Month	Wave 1		Wave 2		Wave 3		Wave 6 Electric		Wave 6 Dual Fuel	
	% Savings	Abs. Prec.	% Savings	Abs. Prec.	% Savings	Abs. Prec.	% Savings	Abs. Prec.	% Savings	Abs. Prec.
2021-Jun	1.23%	0.79%	1.82%	0.71%	2.09%	0.61%	1.00%	0.73%	0.89%	1.09%
2021-Jul	1.47%	0.77%	1.75%	0.69%	1.98%	0.60%	0.99%	0.79%	1.28%	1.18%
2021-Aug	1.48%	0.80%	1.90%	0.70%	1.95%	0.60%	1.23%	0.79%	1.56%	1.18%
2021-Sep	1.62%	0.83%	1.78%	0.74%	2.10%	0.64%	1.36%	0.83%	1.89%	1.29%
2021-Oct	1.72%	0.78%	2.04%	0.76%	2.30%	0.67%	1.45%	0.89%	2.56%	1.45%
2021-Nov	1.90%	0.71%	1.71%	0.73%	2.59%	0.72%	1.57%	0.92%	2.32%	1.55%
2021-Dec	2.17%	0.70%	1.71%	0.74%	2.73%	0.75%	1.73%	0.93%	2.54%	1.59%
2022-Jan	1.96%	0.71%	1.97%	0.77%	2.59%	0.82%	1.89%	0.93%	2.64%	1.70%
2022-Feb	1.94%	0.72%	1.81%	0.79%	2.46%	0.83%	1.92%	0.94%	2.87%	1.73%
2022-Mar	1.99%	0.73%	1.72%	0.79%	2.45%	0.78%	2.04%	0.93%	2.14%	1.61%
2022-Apr	2.01%	0.77%	1.85%	0.81%	2.48%	0.76%	2.23%	0.93%	1.54%	1.62%
2022-May	1.82%	0.86%	1.65%	0.84%	2.34%	0.70%	1.48%	0.90%	1.28%	1.43%

Source: Guidehouse analysis of monthly billing data

Table B-4. HER Percentage Energy Savings – Wave 7 Cohorts

Month	Wave 7 Dual Fuel		Wave 7 Has Email		Wave 7 Income Eligible		Wave 7 No Email	
	% Savings	Abs. Prec.	% Savings	Abs. Prec.	% Savings	Abs. Prec.	% Savings	Abs. Prec.
2021-Jun	0.02%	0.35%	0.08%	0.48%	-0.52%	0.67%	-0.18%	0.48%
2021-Jul	0.06%	0.32%	0.09%	0.46%	-0.37%	0.66%	-0.11%	0.45%
2021-Aug	0.35%	0.33%	0.44%	0.45%	0.13%	0.66%	0.30%	0.45%
2021-Sep	0.60%	0.37%	0.60%	0.48%	0.68%	0.70%	0.67%	0.48%
2021-Oct	0.69%	0.43%	0.61%	0.55%	0.59%	0.81%	0.41%	0.55%
2021-Nov	0.57%	0.45%	0.39%	0.64%	0.06%	0.99%	0.33%	0.66%
2021-Dec	0.57%	0.48%	0.13%	0.65%	0.62%	1.03%	0.48%	0.69%
2022-Jan	0.63%	0.50%	0.16%	0.68%	0.51%	1.05%	0.12%	0.72%
2022-Feb	0.63%	0.51%	0.20%	0.68%	1.43%	1.04%	0.14%	0.71%
2022-Mar	0.59%	0.49%	0.59%	0.63%	1.22%	1.03%	0.61%	0.68%
2022-Apr	0.54%	0.48%	0.94%	0.64%	1.20%	0.99%	0.38%	0.64%
2022-May	0.87%	0.43%	1.10%	0.55%	1.08%	0.77%	0.56%	0.53%

Source: Guidehouse analysis of monthly billing data

B.3 Recipient Household Counts

Monthly impacts for the HER Program depend on the total number of active recipients with consumption data during each month. Recipients accrue savings for the full month, for each active month they have consumption data. Additionally, customers that opt out of receiving reports still accrue savings for as long as they remain active to retain the validity of the RCT design and savings.[42] Guidehouse multiplied the total number of active recipients by the number of days in the month and by the treatment estimates for each month and by cohort. Table B-5. and Table B-6. show the number of active recipients that accrued savings in each month by cohort.

Table B-5. HER Active Recipient Households – Wave 1, 2, 3, and 6 Cohorts

Month	Wave 1	Wave 2	Wave 3	Wave 6 Electric	Wave 6 Dual Fuel
2021-Jun	22,073	28,675	49,628	14,971	4,776
2021-Jul	21,911	28,516	49,353	14,760	4,737
2021-Aug	21,779	28,362	49,086	14,596	4,690
2021-Sep	21,647	28,179	48,773	14,411	4,648
2021-Oct	21,502	28,040	48,551	14,258	4,611
2021-Nov	21,381	27,938	48,343	14,123	4,577
2021-Dec	21,290	27,837	48,169	13,993	4,559
2022-Jan	21,193	27,734	48,009	13,880	4,535
2022-Feb	21,130	27,645	47,855	13,766	4,515
2022-Mar	21,078	27,557	47,737	13,682	4,500
2022-Apr	20,981	27,470	47,584	13,573	4,485
2022-May	20,894	27,388	47,413	13,478	4,463

Source: Guidehouse analysis of monthly billing data

Table B-6. HER Active Recipient Households – Wave 7 Cohorts & Program Totals

Month	Wave 7 Dual Fuel	Wave 7 Has Email	Wave 7 Inc. Elig.	Wave 7 No Email	Program Total
2021-Jun	105,392	234,774	21,981	89,892	**572,162**
2021-Jul	104,011	229,531	21,726	88,803	**563,348**
2021-Aug	102,757	224,556	21,458	87,808	**555,092**
2021-Sep	101,446	219,127	21,149	86,743	**546,123**
2021-Oct	100,381	215,713	20,942	85,849	**539,847**
2021-Nov	99,492	212,732	20,725	84,987	**534,298**
2021-Dec	98,650	210,013	20,508	84,163	**529,182**
2022-Jan	97,941	207,690	20,324	83,472	**524,778**
2022-Feb	97,283	205,364	20,116	82,890	**520,564**
2022-Mar	96,756	203,423	19,908	82,332	**516,973**
2022-Apr	96,140	201,112	19,659	81,632	**512,636**

[42] *SWE. "Section 6.1.1.2". Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs.* July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

Month	Wave 7 Dual Fuel	Wave 7 Has Email	Wave 7 Inc. Elig.	Wave 7 No Email	Program Total
2022-May	95,527	198,974	19,443	81,011	**508,591**

Source: Guidehouse analysis of monthly billing data

B.4 Dual Participation Analysis

To the extent that the HER Program 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 programs that track participation at the customer level by estimating the increase in program participation among HER recipients. This is also known as dual participation savings or uplift savings.

To generate estimates of dual participation, Guidehouse followed the Phase IV Evaluation Framework Section 6.1.8 for both downstream and upstream program accounting.[43] The assumption is that exposure to the HER messaging motivates participants to take advantage of other programs' offerings promoted through HER materials. This exposure creates a situation where households in the treatment groups are likely to participate in other programs at a higher rate than households in the control groups. The methodology calls for program-specific uplift calculations. To that end, Guidehouse estimated aggregate uplift across the Residential EE Program's components.

Guidehouse's dual participation analysis also accounts for upstream savings, which functions differently than for downstream programs. Because upstream participation is not tracked at the customer level, the approach for specific homes is not feasible. Therefore, the evaluation team used an assumed percentage reduction factor for each recipient cohort to account for upstream dual participation. This factor determines total upstream reduction based on the estimate of energy savings less downstream double-counted savings. Percentage upstream reduction values for each wave are shown in Table B-7.

Table B-7. HER Default Upstream Reduction Factors

Year of Wave Activity	Default Upstream Reduction Factor	HER Waves Included
1	0.75%	Wave 7
2	1.50%	-
3	2.25%	Wave 6
4 and beyond	3.00%	Wave 1, Wave 2, Wave 3

Source: Phase IV Evaluation Framework Section 6.1.8.2

Table B-8. summarizes the dual participation savings associated with both downstream and upstream programs across each of the HER recipient cohorts.

Table B-8. HER Double-Counting Savings Adjustments

HER Wave	Downstream Adjustment (MWh)	Upstream Adjustment (MWh)	Total Adjustment (MWh)
Wave 1	638	171	809

[43] *SWE. "Section 6.1.8 Dual Participation Analysis". Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs.* July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

HER Wave	Downstream Adjustment (MWh)	Upstream Adjustment (MWh)	Total Adjustment (MWh)
Wave 2	1,307	324	1,631
Wave 3	996	518	1,514
Wave 6 – Electric	204	83	287
Wave 6 – Dual Fuel	72	31	103
Wave 7 – Dual Fuel	65	27	92
Wave 7 – Has Email	104	48	152
Wave 7 – Income-Eligible	6	6	12
Wave 7 – No Email	47	13	60

Source: Guidehouse analysis of PECO program tracking data

B.5 Persistence and First-Year Savings

In compliance with Phase IV incremental annual accounting requirements and per Section 6.1.9 of the Phase IV Evaluation Framework,[44] Guidehouse performed a persistence analysis to estimate first-year savings (FYS) for all cohorts in their third or later year of activity.

The calculations for persistence reductions follow the algorithms in the 2021 Pennsylvania TRM, Volume 2, Section 2.7.3.[45] Guidehouse used a default decay rate of 31.3% to calculate monthly persistence based on Average Treatment Effect (ATE) from prior program years and proportionate to estimated savings net-of-uplift from the current program year. Table B-9. and Table B-10. contain the monthly persistence reductions for all active cohorts.

Table B-9. HER Monthly Persistence (MWh) – Wave 1, 2, 3, and 6 Cohorts

Month	Wave 1	Wave 2	Wave 3	Wave 6 Electric	Wave 6 Dual Fuel
2021-Jun	163	524	1,128	117	39
2021-Jul	228	581	1,263	132	69
2021-Aug	220	607	1,192	162	81
2021-Sep	190	431	981	140	77
2021-Oct	194	408	828	128	78
2021-Nov	335	409	1,003	175	68
2021-Dec	516	518	1,272	242	87
2022-Jan	616	738	1,321	323	97
2022-Feb	485	543	1,029	269	88
2022-Mar	387	427	953	242	61
2022-Apr	278	370	836	207	38
2022-May	211	343	928	129	40

Source: Guidehouse analysis of monthly billing data and ATE from prior program years

[44] PA SWE. *"Section 6.1.9 Incremental Annual Accounting and Measure Life". Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs*, July 16, 2021. https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

[45] PA PUC. "Section 2.7.3 Home Energy Reports." *Technical Reference Manual, Volume 2; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program*. Dated February 2021. https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/.

Table B-10. HER Monthly Persistence (MWh) – Wave 7 Cohorts and Program Totals

Month	Wave 7 Dual Fuel	Wave 7 Has Email	Wave 7 Inc. Elig.	Wave 7 No Email	Program Total
2021-Jun	0	0	0	0	1,970
2021-Jul	0	0	0	0	2,273
2021-Aug	0	0	0	0	2,262
2021-Sep	0	0	0	0	1,819
2021-Oct	0	0	0	0	1,637
2021-Nov	0	0	0	0	1,989
2021-Dec	0	0	0	0	2,635
2022-Jan	0	0	0	0	3,096
2022-Feb	0	0	0	0	2,413
2022-Mar	0	0	0	0	2,071
2022-Apr	0	0	0	0	1,729
2022-May	0	0	0	0	1,652

Source: Guidehouse analysis of monthly billing data and ATE from prior program years

To calculate FYS values, Guidehouse subtracted the persistence reductions from total savings net-of-uplift for the current program year. Table B-11. and Table B-12. contain final FYS calculations by month for all active cohorts.

Table B-11. HER FYS (MWh) – Wave 1, 2, 3, and 6 Cohorts

Month	Wave 1	Wave 2	Wave 3	Wave 6 Electric	Wave 6 Dual Fuel
2021-Jun	73	406	355	70	26
2021-Jul	102	450	397	79	45
2021-Aug	99	470	375	97	53
2021-Sep	85	334	309	84	50
2021-Oct	87	316	260	77	51
2021-Nov	150	317	315	105	44
2021-Dec	231	401	400	145	57
2022-Jan	276	572	415	194	64
2022-Feb	217	420	324	161	57
2022-Mar	174	331	300	145	40
2022-Apr	125	286	263	124	25
2022-May	94	266	292	77	26

Source: Guidehouse analysis

Table B-12. HER FYS (MWh) – Wave 7 Cohorts and Program Totals

Month	Wave 7 Dual Fuel	Wave 7 Has Email	Wave 7 Income Eligible	Wave 7 No Email	Program Total
2021-Jun	17	128	-83	-104	887
2021-Jul	59	175	-72	-82	1,154
2021-Aug	350	814	25	204	2,487
2021-Sep	450	835	96	342	2,585
2021-Oct	375	648	66	162	2,042
2021-Nov	290	432	7	144	1,804
2021-Dec	332	159	90	249	2,065
2022-Jan	384	215	79	66	2,265
2022-Feb	315	228	193	62	1,978
2022-Mar	281	651	152	274	2,348
2022-Apr	232	886	124	135	2,201
2022-May	486	1,179	118	222	2,761

Source: Guidehouse analysis

B.6 Demand Savings

Guidehouse conducted an analysis to estimate average peak demand savings for the HER Program. To this end, Guidehouse developed a methodology in accordance with the Phase IV Evaluation Framework Section 6.1.6.[46] The methodology is bipartite, composed of a regression model that estimates hourly kW savings and a proportional conversion factor that accounts for uplift and persistence, by month.

Guidehouse used a simple difference regression model leveraging hourly interval data for peak hours to estimate gross average kW savings by month. Peak hours are defined as 2 p.m. to 6 p.m. on non-holiday weekdays during June through August.

The evaluation team applied the following preliminary data management steps on the hourly metering data prior to carrying out the demand regression analysis.

- Limit the data to only observations within the definition of peak hours (2:00pm to 6:00pm on non-holiday weekdays during June through August) in PY13
- Remove exact duplicate meter reads by account
- Drop meter reads that occur after an account's inactive date
- Remove outlier hourly reads, defined as observations greater than or less than four standard deviations from the mean peak hourly usage, by cohort
- Drop zero usage meter reads, as missing reads that are included in the data set are shown as zero usage
- Average the peak hourly reads to the daily level to create a daily average kW value, by account and date

[46] PA SWE, "Section 6.1.6 Peak Demand Impacts," *Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs,* July 16, 2021, https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

- Remove averaged account-date observations that incorporate less than three of the four possible peak hourly meter reads.

Table B-13. and Table B-14. contain the resulting kW regression estimates by month for all cohorts.

Table B-13. HER Demand Regression Details (kW) – Wave 1, 2, 3, and 6 Cohorts

Month	Wave 1		Wave 2		Wave 3		Wave 6 Electric		Wave 6 Dual Fuel	
	Est.	Prec.	Est.	Prec.	Est.	Prec.	Est.	Prec.	Est.	Prec.
2021-Jun	-0.0349	0.0190	-0.0607	0.0332	-0.0505	0.0199	-0.0078	0.0258	-0.0370	0.0538
2021-Jul	-0.0426	0.0216	-0.0596	0.0379	-0.0515	0.0232	-0.0060	0.0301	-0.0385	0.0611
2021-Aug	-0.0440	0.0212	-0.0723	0.0374	-0.0477	0.0227	0.0027	0.0298	-0.0358	0.0604

Source: Guidehouse analysis of hourly metering data

Table B-14. HER Demand Regression Details (kW) – Wave 7 Cohorts

Month	Wave 7 Dual Fuel		Wave 7 Has Email		Wave 7 Income Eligible		Wave 7 No Email	
	Est.	Prec.	Est.	Prec.	Est.	Prec.	Est.	Prec.
2021-Jun	-0.0010	0.0104	-0.0059	0.0111	0.0082	0.0133	0.0026	0.0093
2021-Jul	-0.0056	0.0126	-0.0086	0.0131	0.0076	0.0155	0.0016	0.0110
2021-Aug	-0.0082	0.0125	-0.0103	0.0130	-0.0008	0.0155	-0.0003	0.0109

Source: Guidehouse analysis of hourly metering data

To account for uplift and persistence, the evaluation team applied the ratio of the First-Year Savings Average Treatment Effect (FYSATE) to the modeled ATE from the impact analysis for proportional parity in reductions for both the energy and demand savings. Each modified monthly kW value is multiplied by the total number of recipient households in that month (refer to Table B-5. and Table B-6. for counts). The resulting monthly total demand savings are weighted together using total peak days for active households to create a single demand savings value by cohort.

B.7 Summary

Table B-15. contains the final values from the impact and demand analyses by cohort. Final MWh savings combine modeled energy savings, double-counted savings reductions, and persistence savings reductions. Final demand savings incorporate modeled demand savings and a ratio between gross and first-year energy savings, weighted by month.

Table B-15. HER Program Impacts Summary

Cohort	Modeled Savings (MWh)	Uplift Reduction (MWh)	Net-of-Uplift Savings (MWh)	Persistence Reduction (MWh)	FYS (MWh)	Demand Savings (MW)
Wave 1	6,346	809	5,536	3,824	1,713	0.227
Wave 2	12,100	1,631	10,469	5,900	4,569	0.703
Wave 3	18,252	1,514	16,739	12,734	4,004	0.539
Wave 6 – Electric	3,910	287	3,622	2,264	1,358	0.019
Wave 6 – Dual Fuel	1,464	103	1,361	824	537	0.063
Wave 7 – Dual Fuel	3,665	92	3,573	-	3,573	0.503
Wave 7 – Has Email	6,505	152	6,352	-	6,352	1.860
Wave 7 – Income-Eligible	807	12	795	-	795	-0.109
Wave 7 – No Email	1,734	60	1,675	-	1,675	-0.114

Source: Guidehouse analysis

Appendix C. PY13 Summary by Customer Segment and IE Carveout

Table C-1. presents a summary of the programs, components, and customer segments that contribute to the IE carveout in PY13.

Table C-1. Summary of Income-Eligible Carveout Energy Savings (MWh/Yr)

Component	Customer Segment	PYVTD Gross (MWh/yr)
Multifamily Income-Eligible	Multifamily Income-Eligible	3,041
Residential Total		**3,041**
Single-Family	Income-Eligible	10,899
Appliance Recycling	Income-Eligible	1,047
Long-Term Savings	Income-Eligible	120
Income-Eligible Total		**12,066**
Income-Eligible HER	Income-Eligible	**795**
Portfolio Total		**15,902**

Source: Guidehouse analysis

Appendix D. Summary of Program-Level Impacts, Cost-Effectiveness, and HIM NTG

D.1 Program- and Component-Level Impacts Summary

A summary of energy impacts by program and component through PY13 is presented in Table D-1.

Table D-1. Incremental Annual Energy Savings by Program and Component (MWh/Yr)

Program and Component	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)
Rebates and Marketplace	22,522	22,068	13,415
Appliance Recycling	8,480	8,988	4,775
In-Home Assessment	2,870	2,358	2,707
New Construction	2,070	2,097	1,929
Multifamily	2,267	2,238	1,955
Multifamily Income-Eligible	3,800	3,041	3,041
Residential Total	**42,009**	**40,788**	**27,821**
Single-Family	14,732	10,899	10,889
Appliance Recycling	1,095	1,047	1,047
Long-Term Savings	142	120	120
Income-Eligible Total	**15,969**	**12,066**	**12,066**
Residential HER	**23,789**	**23,781**	**23,781**
Income-Eligible HER	**793**	**795**	**795**
Downstream	111,721	116,882	73,224
Midstream	34,977	40,573	27,995
Small Business Direct Install	4,077	3,750	3,313
New Construction	5,140	5,236	1,975
Non-Residential Total	**155,915**	**166,440**	**106,507**
Portfolio Total	**238,475**	**243,870**	**170,969**

Source: Guidehouse analysis

A summary of the peak demand impacts by energy efficiency program and component through the current reporting period are presented in Table D-2.

Table D-2. Peak Demand Savings by Energy Efficiency Program and Component (MW/Yr)

Program and Component	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)
Rebates and Marketplace	3.92	4.12	2.72
Appliance Recycling	1.71	1.77	0.91
In-Home Assessment	0.36	0.30	0.35
New Construction	0.88	0.59	0.54
Multifamily	0.35	0.33	0.29
Multifamily Income-Eligible	0.42	0.32	0.32
Residential Total	**7.64**	**7.43**	**5.13**

Program and Component	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)
Single-Family	1.55	1.12	1.12
Appliance Recycling	0.25	0.24	0.24
Long-Term Savings	0.01	0.01	0.01
Income-Eligible Total	**1.81**	**1.37**	**1.37**
Residential HER	**3.87**	**4.10**	**4.10**
Income-Eligible HER	**0.13**	**-0.12**	**-0.12**
Downstream	20.64	19.20	12.26
Midstream	7.43	8.46	5.83
Small Business Direct Install	0.68	0.67	0.59
New Construction	1.04	1.11	0.40
Non-Residential Total	**29.78**	**29.43**	**19.09**
Portfolio Total	**43.24**	**42.22**	**29.57**

Source: Guidehouse analysis

D.2 Program-Level Cost-Effectiveness Summary

Table D-3. shows the TRC ratios by program and for the portfolio. The benefits in Table D-3 were calculated using gross verified impacts. Costs and benefits are expressed in 2021 dollars.

Table D-3. PY13 Gross TRC Ratios by Program ($1,000)[1]

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Residential	$40,166	$38,217	1.05	$1,950
Income-Eligible	$21,895	$5,731	3.82	$16,164
HER	$2,409	$1,418	1.70	$991
Income-Eligible HER	$0.89	$60	0.01	($59)
Residential Subtotal	**$64,472**	**$45,425**	**1.42**	**$19,047**
Non-Residential Subtotal	**$79,092**	**$90,252**	**0.88**	**($11,159)**
Common Portfolio Costs	**N/A**	**$10,473**	**N/A**	**($10,473)**
Portfolio Total	**$143,564**	**$146,150**	**0.98**	**($2,585)**

[1] Costs and benefits are expressed as follows PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025.

Source: PECO and CSP tracking data

Table D-4. presents PY13 cost-effectiveness using net verified savings to calculate benefits.

Table D-4. PY13 Net TRC Ratios by Program ($1,000)[1]

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Residential	$29,322	$29,238	1.00	$83
Income-Eligible	$21,895	$5,731	3.82	$16,164
HER	$2,409	$1,418	1.70	$991
Income-Eligible HER	$0.89	$60	0.01	($59)
Residential Subtotal	**$53,627**	**$36,447**	**1.47**	**$17,180**
Non-Residential Subtotal	**$50,619**	**$61,409**	**0.82**	**($10,790)**

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Common Portfolio Costs	**N/A**	**$10,473**	**N/A**	**($10,473)**
Portfolio Total	**$104,246**	**$108,329**	**0.96**	**($4,083)**

[1] Costs and benefits are expressed as follows PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025

Source: PECO and CSP tracking data

D.3 High Impact Measure Net-to-Gross

Findings from NTG research are not used to adjust compliance savings in Pennsylvania. Instead, NTG research provides directional information for program planning purposes. Guidehouse did not conduct NTG research for the downstream components of PECO's portfolio of programs in PY13 and therefore did not estimate NTG results for HIMs.[47]

D.4 Program-Level Comparison of Performance to Approved EE&C Plan

Table D-5 presents PY13 expenditures, by program, compared with the budget estimates set forth in the EE&C plan[48] for PY13. All the dollars in Table D-5 are presented in 2021 dollars.

Table D-5. Comparison of PY13 Expenditures to Phase IV EE&C Plan ($1,000)

Program	PY13 Budget from EE&C Plan	PY13 Actual Expenditures	Ratio
Residential	$14,450	$10,689	0.74
Income-Eligible	$8,490	$5,731	0.68
Residential HER	$1,850	$1,418	0.77
Income-Eligible HER	$80	$60	0.75
Non-Residential	$39,590	$26,451	0.67
Portfolio Total	**$64,460**	**$44,348**	**0.69**

Sources: Guidehouse analysis, PECO EE&C Plan

Table D-6 compares PY13 verified gross program savings to the energy savings projections set forth in the EE&C plan.

Table D-6. Comparison of Actual Program Savings to EE&C Plan Projections for PY13

Program	EE&C Plan Projections for PY13 (MWh)	PY13 VTD Gross MWh Savings	Ratio (Actual/Plan)
Residential	44,174	40,788	0.92
Income-Eligible	17,138	12,066	0.70

[47] The Phase IV Evaluation Framework provides guidance to EDCs to oversample measure categories (technologies) of high importance, called HIMs, to help program planners make decisions concerning those measures. The SWE suggests that for each program year, each EDC identify three to five HIMs for study based on energy impact, level of uncertainty, prospective value, funding, or other parameters. The intent is to prioritize measure-level NTGRs for HIMs, but the EDCs are encouraged to also provide program-level NTG information – that is, to oversample HIMs, but they may also include non-HIMs in the research, as appropriate, https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

[48] PECO, *PECO Program Years 2021-2026 Act 129 – Phase IV Energy Efficiency and Conservation Plan.* Filed June 18, 2020, https://www.puc.pa.gov/pcdocs/1666981.docx.

Program	EE&C Plan Projections for PY13 (MWh)	PY13 VTD Gross MWh Savings	Ratio (Actual/Plan)
Residential HER	21,507	23,781	1.11
Income-Eligible HER	938	795	0.85
Non-Residential	174,863	166,440	0.95
Portfolio Total	**258,620**	**243,870**	**0.94**

Sources: Guidehouse analysis, PECO EE&C Plan

Appendix E. Residential and Income-Eligible EE Programs

This appendix details the evaluation methods and activities Guidehouse deployed in program year 13 (PY13) for select Residential and Income-Eligible (IE) Energy Efficiency (EE) Program components (listed below). Refer to Sections 3.1 and 3.2 for key evaluation findings, results, and conclusions for these components:

- Rebates and Marketplace (market-rate)
- Appliance Recycling (market-rate and IE)
- In-Home Assessments (market-rate)
- New Construction (market-rate)
- Multifamily (market-rate and IE)
- Single-Family (IE)
- Long-Term Savings (IE)

E.1 Rebates and Marketplace (Market-Rate)

The Rebates and Marketplace component includes customer rebates for lighting, HVAC, appliances, and energy-saving devices. There are multiple delivery channels to receive product rebates: Downstream, Trade Ally and Distributor Network, Marketplace, and Point of Purchase. According to the Phase IV plan, this component is planned to account for 50% of Residential EE Program energy savings, 45% of Residential EE Program demand savings, 7% of total portfolio energy savings, and 5% of portfolio demand savings. The Phase IV Rebates and Marketplace component is implemented by CLEAResult.

E.1.1 Gross Impact Evaluation

Guidehouse conducted two activities to verify savings for this component: a tracking database analysis for all measures outlined in the PA TRM and latest interim measure protocols (IMPs) using a combination of TRM default values and EDC-provided data, and online surveys of sampled recipients for the downstream, marketplace, and trade ally channels. As part of the tracking database analysis, the team verified algorithms used to estimate reported gross savings at the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM measures were passed through this process with no adjustment and adjusted savings for these measures equaled the reported savings[49].

Table E-1. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Section 3.1.2.

[49] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Table E-1. Detailed Findings for Rebates and Marketplace

Measure	Percentage of Residential Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Lighting	39.3%	0.98	1.04	TRM default values were used in place of missing data
ECM Furnace Fan	2.0%	1.05	1.06	Tracking data is using a rounded TRM default value for delta kW
Ductless Heat Pump	1.4%	1.03	1.11	TRM default values were used in place of missing data
Variable Speed Pool Pump	0.9%	1.02	100.87	TRM default values were used in place of missing data
ENERGY STAR Refrigerator	0.2%	0.98	0.98	TRM default values were used in place of missing data

[1] Percentage of Residential Savings is the percent of total Residential Program energy savings that each of these measures represent.

Source: Guidehouse analysis

Guidehouse conducted online surveys of sampled recipients in PY13 for the downstream, marketplace, and trade ally channels, as described in Section 3.1.2. The surveys included specific questions the customer could answer based on common knowledge of the measures they received. The survey responses showed the frequency of measures being installed as well as any issues with installation. Savings were recalculated based on the customer responses in the surveys. Findings from the survey are detailed in Section 3.1.2. These results were combined with the results of the tracking database analysis to determine final verified gross savings.

As Table E-2. presents, Guidehouse stratified the sample by channel (and further by measure) to account for the different channels within the Rebates and Marketplace component, as described in the Sample Design Memo.[50] Overall, Guidehouse exceeded the sample response rate as a result of higher than expected survey participation for the Downstream channel. The Trade Ally channel underachieved slightly as a result of missing or incorrect contact information for customers.

Table E-2. Rebates and Marketplace Sample Project Count

Channel	Target Count	Achieved Count
Downstream	54	256
Marketplace	56	53
Trade Ally	24	17
Total Sampled Projects	**134**	**326**

Source: Guidehouse analysis

E.1.2 Net Impact Evaluation

Guidehouse did not conduct net-to-gross (NTG) research for this component in PY13.

[50] PECO, *PY13 Residential Impact Sample Design Memo 03-14-22,* dated March 14, 2022.

E.1.3 Process Evaluation

All process evaluation activities are discussed in Section 3.1.5.

E.2 Appliance Recycling (Market-Rate and Income-Eligible)

The Appliance Recycling component focuses on recycling refrigerators, freezers, and window air conditioning units responsibly. The component serves both market-rate and IE customers. According to the Phase IV plan, this component is planned to account for 18% of Residential EE Program energy savings, 17% of Residential EE Program demand savings, 10% of Income-Eligible EE Program energy savings, 14% of Income-Eligible EE Program demand savings, 3% of total portfolio energy savings, and 2% of total portfolio demand savings. The Appliance Recycling component is implemented by ARCA.

E.2.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data.

Table E-3. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Sections 3.1.2 and 3.2.2. These adjustments affected both MR and IE verification ratios and are outlined in Table E-3.

Table E-3. Detailed Findings for Appliance Recycling

Measure	Percentage of Residential or IE Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
Refrigerator Recycling	17.9%	1.12	1.12	TRM default values were used in place of missing data
Freezer Recycling	1.9%	1.02	1.02	TRM default values were used in place of missing data
Removal of Existing Refrigerator with Replacement	0.0%	0.88	0.88	TRM default values were used in place of missing data
Refrigerator Recycling (IE)	5.0%	1.14	1.14	TRM default values were used in place of missing data
Removal of Existing Refrigerator with Replacement (IE)	1.4%	0.93	0.93	TRM default values were used in place of missing data

[1] Percentage of Energy Savings is the percent of total Residential Program or IE Program energy savings that each of these measures represent within their respective programs.

Source: Guidehouse analysis

Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied the energy and demand verification ratios based on evaluation activities in PY12 to the result of the tracking database analysis to arrive at final PY13 gross impact results.

E.2.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.2.3 Process Evaluation

All process evaluation activities are discussed in Sections 3.1.5 and 3.2.5.

E.3 In-Home Assessments (Market-Rate)

The In-Home Assessment component provides in-home or virtual assessments and comprehensive audits to educate customers; install energy efficient measures; identify additional, potentially larger, energy efficiency opportunities (such as insulation and air sealing); and encourage greater participation in other Residential EE Program components. According to the Phase IV Evaluation Plan,[51] this component is planned to account for 15% of Residential EE Program energy savings, 12% of Residential EE Program demand savings, 2% of total portfolio energy savings, and 1% of portfolio demand savings. The In-Home Assessment component is implemented by CLEAResult.

E.3.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data.

Table E-4. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Section 3.1.2.

Table E-4. Detailed Findings for In-Home Assessments

Measure	Percentage of Residential Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Lighting (Specialty)*	4.1%	0.76	0.80	TRM default values were used in place of missing data
ENERGY STAR Lighting (Standard)	1.9%	0.93	0.98	Unable to recreate reported savings from the information provided
Insulation	0.1%	1.01	1.01	TRM default values were used in place of missing data
Air Sealing/Weatherization	0.0%	0.92	0.92	Unable to recreate reported savings from the information provided

[1] Percentage of Residential Savings is the percent of total Residential Program energy savings that each of these measures represent.
Note: Realization Rate for ENERGY STAR Lighting (Specialty) is a weighted average of the affected bulbs.
Source: Guidehouse analysis

[51] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied energy and demand verification ratios based on the Whole Home evaluation activities conducted in PY11 to the result of the tracking database analysis to arrive at final PY13 gross impact results.

E.3.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.3.3 Process Evaluation

All process evaluation activities are discussed in Section 3.1.5.

E.4 New Construction (Market-Rate)

The Residential New Construction component supports the construction of more comfortable, durable, and energy efficient homes compared with those simply built to code. This component works with Home Energy Rating System (HERS) raters and builders to create more energy efficient homes during the design and construction phases. According to the Phase IV Evaluation Plan,[52] this component is planned to account for 7% of Residential EE Program energy savings, 20% of Residential EE Program demand savings, 1% of total portfolio energy savings, and 2% of total portfolio demand savings. The New Construction component is implemented by PSD.

E.4.1 Gross Impact Evaluation

In PY13 Guidehouse conducted file reviews, performed building simulation modeling using REM/Rate software, and utilized TRM algorithms to determine gross impact results. The evaluation team reviewed the energy models for each sampled site for quality assurance and performed supplemental TRM-based calculations outside of the energy models to generate the total peak demand savings, as required by the Phase IV TRM. Refer to Section 3.1.2 for key evaluation findings, results, and conclusions for these components.

Methodology
Guidehouse independently recalculated energy and demand savings by running the REM/Rate building simulation models for each of the sites selected within the sample. Each REM/Rate file was run against the PECO reference home based on TRM specifications. The annual energy and demand savings are defined in the TRM as the difference between the baseline (PECO reference home) and the as-built simulation results. Unlike previous evaluations where REM/Rate was used to calculate savings exclusively associated with weather-sensitive measures, the current version of the TRM allows for the total energy savings to be calculated within the REM/Rate software.

The cooling demand savings generated from the REM/Rate models are assumed to coincide with the peak period and subsequently reflect peak cooling demand savings. The TRM allows for additional demand savings for other end uses to be calculated using algorithms from the applicable measures elsewhere in the TRM. The evaluation team utilized the REM/Rate model

[52] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

inputs to apply TRM-deemed savings, TRM algorithms, and engineering best practices to calculate demand savings associated with ENERGY STAR lighting and appliances such as refrigerators, clothes dryers, clothes washers, dishwashers, and low flow fixtures. The evaluation team calculated the total verified demand savings by applying the coincidence factor (CF) defined in the TRM Volume 1 (0.424 for Philadelphia) to the REM/Rate-generated peak cooling demand savings and adding the demand savings from qualifying lighting, appliances, and low flow fixtures, to generate the total verified demand savings. The total verified energy and demand savings were compared with the reported savings to determine the realization rates.

The evaluation review revealed that the tracked demand savings were generated by applying the phase III HVAC coincidence factor to the whole building demand savings output by the energy model. As discussed above the TRM only allows cooling demand savings to be claimed from the model and requires additional demand savings to be claimed using the algorithms defined in the TRM. Additionally, the coincidence factor was reduced from 0.647 in phase II to 0.424 in phase IV. Overall, the methodology described above results in a reduction in verified demand savings compared to the tracking data.

Sampling

Using tracking data from Q1-Q4 of PY13, 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 PY13 to bin projects into measures/strata shown below, as outlined in the PY13 Sample Design Memo.[53] Projects with reported energy savings of less than 265 kWh, which represent less than 1% of total component energy and demand savings, were excluded from the evaluation due to their minimal impact. In total 38 sites were selected for evaluation. As presented in Table E-5., a random sample was generated ensuring the measure and strata selection was representative of the participating population.

Table E-5. New Construction Sample Project Count

Measure/Stratum	Target Site Count	Achieved Site Count
Code Plus Home/Multifamily	1	1
Code Plus Home/Single-Family	10	10
Code Plus Home/Townhouse and Duplex	9	9
ENERGY STAR Home/Multifamily	9	9
ENERGY STAR Home/Townhouse and Duplex	1	1
Smart Thermostat	8	8
Total Sampled Projects	**38**	**38**

Source: Guidehouse analysis

E.4.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

[53] PECO, *PY13 Residential Impact Sample Design Memo 03-14-22,* dated March 14, 2022.

E.4.3 Process Evaluation

All process evaluation activities are discussed in Section 3.1.5.

E.5 Multifamily (Market-Rate and Income-Eligible)

The Multifamily component provides analysis, direct install measures, and larger, investment-level upgrades to improve the energy efficiency of multifamily buildings, both in units and in common areas. The component serves buildings with market-rate customers, IE customers, and a mix of residential and commercial customer types. According to the Phase IV Evaluation Plan,[54] this component is planned to account for 10% of Residential EE Program energy savings, 6% of Residential EE Program demand savings, 15% of Income-Eligible EE Program energy savings, 11% of Income-Eligible EE Program demand savings, 2% of total portfolio energy savings, and 1% of total portfolio demand savings. The Multifamily (for both the Residential and Income-Eligible Programs) component is implemented by CMC.

E.5.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data.

Table E-6. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Section 3.1.2.

Table E-6. Detailed Findings for Multifamily

Measure	Percentage of Residential Energy Savings [1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Lighting (Specialty)	2.3%	0.25	0.24	Baseline wattage was not using TRM deemed 45 lumens per watt
ENERGY STAR Lighting (Standard)	0.9%	0.94	0.99	Unable to recreate reported savings from the information provided
LED Nightlight	0.0%	4.90	NA	Unable to recreate reported savings from the information provided

[1] Percentage of Energy Savings is the percent of total Residential Program energy savings that each of these measures represent due to Multifamily IE being reported as part of the Residential Program in the tracking database.
Note: Realization Rate for ENERGY STAR Lighting (Specialty) and ENERGY STAR Lighting (Standard) are weighted averages of the affected bulbs.

Source: Guidehouse analysis

Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied energy and demand verification ratios based on evaluation activities in PY10 to the result of the tracking database analysis to arrive at final PY13 gross impact results.

[54] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

E.5.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.5.3 Process Evaluation

All process evaluation activities are discussed in Section 3.1.5.

E.6 Single-Family (Income-Eligible)

This Single-Family component improves the energy efficiency of single-family homes for IE customers to help reduce their electric bills and make their homes more comfortable. There are multiple channels to receive program services. The Free Home Energy Check-Ups program and Low-Income Usage Reduction Program (LIURP) offer consistent program services for IE households but are differentiated by funding sources. Giveaways are unique to the Single-Family component. According to the Phase IV Evaluation Plan,[55] this component is planned to account for 70% of Income-Eligible EE Program energy savings, 74% of Income-Eligible EE Program demand savings, 4% of total portfolio energy savings, and 3% of portfolio demand savings. The Single-Family component is implemented by CMC.

E.6.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data.

Table E-7. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Section 3.2.2.

Table E-7. Detailed Findings for Single-Family (Income-Eligible)

Measure	Percentage of IE Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Lighting (Specialty)	25.0%	0.24	0.25	Baseline wattage was not using TRM-deemed 45 lumens per watt
ENERGY STAR Lighting (Standard)	9.3%	0.94	1.03	Unable to recreate reported savings from the information provided
Ductless Heat Pump	9.3%	0.94	1.03	Unable to recreate reported savings from the information provided.
Air Source Heat Pump	0.1%	1.42	1.51	TRM dictates that when baseline cooling system is nonexistent it should be set to air source heat pump with early replacement.
Insulation	1.2%	1.41	5.6	Unable to recreate reported savings from the information provided
Air Sealing	0.1%	0.96	0.48	Tracking data was using incorrect TRM values for baseline efficiency

[55] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Measure	Percentage of IE Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Room Air Conditioner	0.0%	0.96	0.96	Tracking data was using incorrect TRM value for CEERee

[1] Percentage of IE Savings is the percent of total IE Program energy savings that each of these measures represent.

Source: Guidehouse analysis

Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied energy and demand verification ratios based on evaluation activities in PY12 to the result of the tracking database analysis to arrive at final PY13 gross impact results.

E.6.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.6.3 Process Evaluation

All process evaluation activities are discussed in Section 3.2.5.

E.7 Long-Term Savings (Income-Eligible)

The Long-Term Savings component is implemented as an overlay service through the Single-Family component to encourage the installation of long-term, comprehensive measures. The Long-Term Savings component measures include insulation, air sealing, duct sealing, heat pumps, air conditioners, thermostats, window repairs, and residential heat pump water heaters and solar water heaters. According to the Phase IV Evaluation Plan,[56] this component is planned to account for 5% of Income-Eligible EE Program energy savings, 1% of Income-Eligible EE Program demand savings, 0.3% of total portfolio energy savings, and 0.004% of total portfolio demand savings. The Long-Term Savings component is implemented by CMC.

E.7.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data. Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied energy and demand verification ratios based on IE Whole Home evaluation activities in PY12 to the result of the tracking database analysis to arrive at final PY13 gross impact results.[57]

Table E-8. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Section 3.2.2.

[56] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.
[57] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Table E-8. Detailed Findings for Long-Term Savings (Income-Eligible)

Measure	Percentage of IE Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
Ductless Heat Pump	0.1%	1.76	0.85	TRM dictates that when baseline cooling system is nonexistent it should be set to ductless heat pump with early replacement
Attic/Ceiling/Roof Insulation - IE Direct Install with Heat Pump	0.1%	1.03	4.83	Unable to recreate reported savings from the information provided
Air Source Heat Pump	0.0%	1.49	NA[2]	TRM dictates that when baseline cooling system is nonexistent it should be set to air source heat pump with early replacement

[1] Percentage of IE Savings is the percent of total IE Program energy savings that each of these measures represent.
[2] Reported demand savings for this measure were zero.

Source: Guidehouse analysis

E.7.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.7.3 Process Evaluation

All process evaluation activities are discussed in Section 3.2.5.

Appendix F. Residential and Income-Eligible Home Energy Report Programs

This appendix details the evaluation methods and activities Guidehouse deployed in PY13 for select Residential and Income-Eligible Home Energy Report (HER) Programs. According to the Phase IV Evaluation Plan,[58] these programs are planned to account for 7% of total portfolio energy savings and 14% of total portfolio demand savings. Refer to Sections 3.3 and 3.4 for key evaluation findings, results, and conclusions for these components.

F.1 Gross Impact Evaluation

The HER Gross Impact Evaluation details are discussed in Sections 3.3 and 3.4 and Appendix B.

F.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for these programs in PY13.

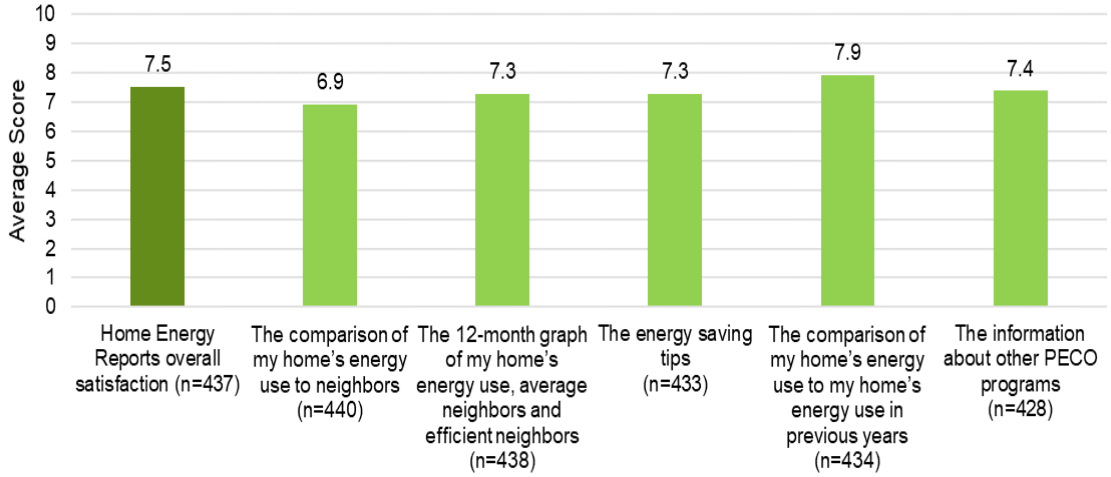
F.3 Process Evaluation

Guidehouse conducted a survey of sampled recipients of HERs in PY13, as described in Sections 3.3.5 and 3.4.5. The survey assessed customer satisfaction, perceived accuracy of various report components, and awareness of energy-saving tips provided in the report. This appendix presents results from the entire survey population, including both market-rate and IE waves. Key insights from the survey include the following:

Overall satisfaction with the HER program is 7.5 out of 10 and respondents indicated the prior year comparison component is the most useful report component. Figure F-1. shows the mean value for each question.

[58] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Figure F-1. Satisfaction and Usefulness

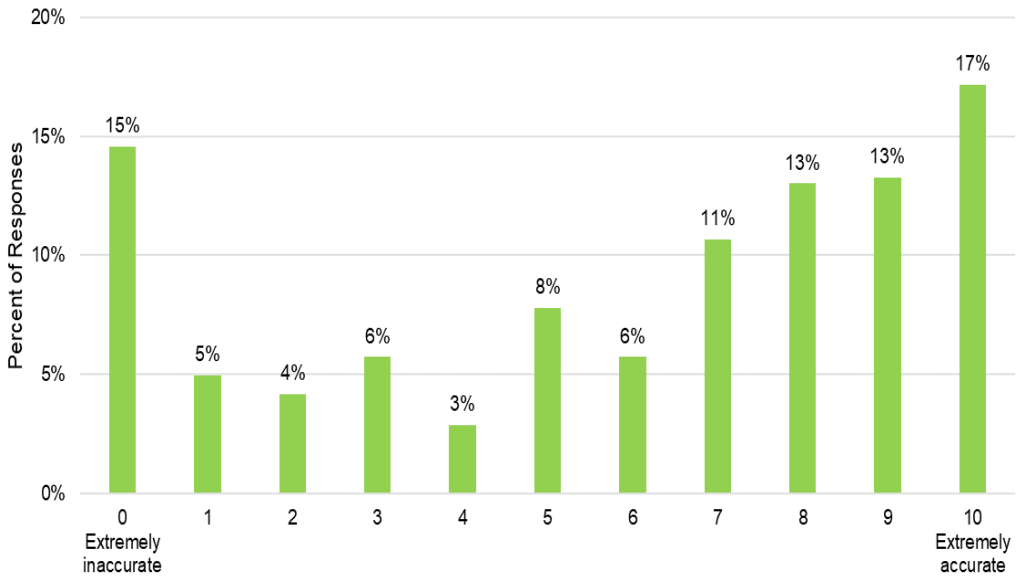


Respondents received the following questions: "Using a scale of 0 to 10, with 0 meaning 'Extremely Dissatisfied' and 10 meaning 'Extremely Satisfied,' how would you rate your satisfaction with the Home Energy Reports overall?" and "On a scale of 0 to 10, where 0 means 'not useful at all' and 10 means 'very useful,' please indicate how useful each of the following elements of the Home Energy Reports are to you."

Source: Guidehouse analysis

Survey respondents reported the lowest relative satisfaction with the neighbor comparison component. Figure F-2. shows the overall sample's rating of the accuracy of the neighbor comparison, with a mean score of 5.9 out of 10. When asked how the report could be improved, customers frequently mentioned the neighbor comparison, citing differences in household needs as a source of inaccuracy.

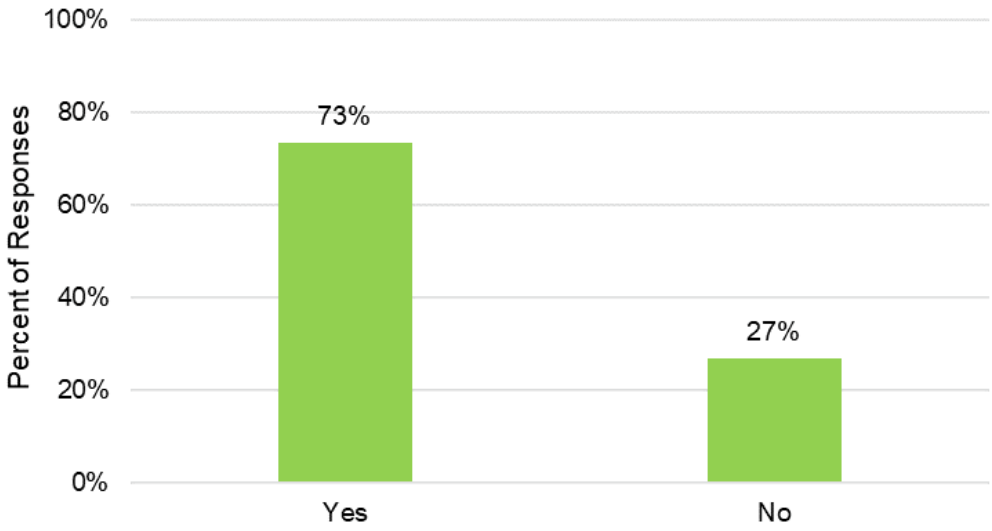
Figure F-2. Accuracy of Neighbor Comparison (n=384)



Respondents received the following question: "A prominent feature of the Home Energy Reports is its ability to show you how your energy use compares to neighbors. Please indicate how accurate you think these comparisons are:"
Source: Guidehouse analysis

HER recipients view PECO as a source for energy savings tips, and the majority of customers who recall tips from the reports find the suggestions relevant to their household, as Figure F-3. shows.

Figure F-3. Relevancy of Suggestions (n=165)



Respondents received the following question: "On average, do you find the suggestions relevant to your household?"
Source: Guidehouse analysis

Appendix G. Non-Residential EE Program

This appendix details the evaluation sample design, methods, and activities deployed in PY13 for select Non-Residential EE Program components. Refer to Section 3.5 for evaluation findings, results, and conclusions for these components.

G.1 Downstream

The Downstream component includes incentives for existing building retrofit projects with either deemed, partially deemed, or custom measures. Typical measures include lighting, variable frequency drives (VFDs), HVAC systems, motors, refrigeration, and controls. According to the Phase IV Evaluation Plan,[59] this component is planned to account for 45% of Non-Residential EE Program energy savings, 48% of Non-Residential EE Program demand savings, 33% of total portfolio energy savings, and 34% of total portfolio demand savings. The Phase IV Downstream Rebate component is implemented by DNV.

G.1.1 Gross Impact Evaluation

Methodology

In the first step of the gross impact evaluation, Guidehouse conducted a tracking database analysis for all 771 projects from all 698 participants in the component. This analysis used a combination of TRM default values and EDC-provided data for open variables. The team verified approaches, algorithms, and assumptions used to estimate reported gross savings at the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM based measures passed through this step with no adjustments, and the adjusted database savings for these measures equaled the reported savings.

In the second step, Guidehouse sampled projects for further data collection and analysis. Guidehouse conducted engineering desk reviews for all projects in the evaluation sample. The engineering 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. In the engineering desk review, the team reviewed all available project documentation to ensure all assumptions used in measure savings calculations were supported by the project documentation and to ensure the calculation methodology was correct.

The evaluation team supplemented engineering desk reviews with phone verifications, which the team assigned to projects per the Sample Design Memo[60] that was submitted to and approved by the SWE. Phone verifications consisted of interviews with customers about their projects. Common discussion points included the quantities and type of each measure installed,

[59] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.
[60] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

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. The team made updates to the measure savings calculations based on customer responses during the phone verifications as warranted.

Guidehouse conducted onsite verification for sampled projects per the Sample Design Memo.[61] Projects assigned an onsite visit first received an engineering desk review to create the Site-Specific Measurement and Verification Plan (SSMVP). The primary objective of site visits was to collect the data required by the TRM and the Phase IV Evaluation Framework. This data included verifying the quantities and type of each measure, equipment nameplate data, and operating schedules, and carefully describing the site conditions. Guidehouse verified this information through visual inspection of the measures and by interviewing the customers, and updated measure savings calculations as warranted based on verified information obtained onsite.

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 assigned a phone verification, the team converted the project to an engineering desk review only after making at least five attempts to call or email the customer in alignment with the Evaluation Plan.[62] Six projects were converted to engineering desk review after the team exhausted all customer contact attempts.

Table G-1. shows the number of Downstream projects by evaluation method. Of the 771 completed projects, the team sampled 33 projects for additional data collection and analysis.

Table G-1. Non-Residential Downstream Rebate Project Count by Evaluation Method

Verification Level	Evaluation Target	Number of Projects Evaluated
Tracking Database Analysis	771	771
Engineering Desk Review Only	0	6
Phone Verification	29	25
Onsite Verification	2	2
Total Sampled Projects	31	33

Source: Guidehouse analysis

Five projects surpassed the energy (kilowatt-hour) savings thresholds set in Table 1-2 of the TRM,[63] which requires site-specific data collection for enhanced evaluation rigor. For these five projects, Guidehouse used site-specific information to verify the project savings, including metering data, end use trend data, and trend data from building management systems.

Sampling

Using tracking data from PY13, 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

[61] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

[62] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

[63] PA PUC, *Technical Reference Manual; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program*, dated February 2021, https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/.

at the project level for the impact evaluation activities in PY13 to bin projects into six strata, as outlined in the PY13 Sample Design Memo.[64]

Guidehouse first separated CHP projects into their own separate stratum. The sampling team then created a census stratum (Stratum 1 – Very Large Projects) for projects reporting more than 1,000 MWh of energy savings. Next, the evaluation team sorted all remaining projects by size and excluded all of the smallest projects, which combine to make up the lowest 2% of total energy savings. Finally, the team divided the remaining population into three additional strata: those projects make up the top, middle, and lowest third of the total remaining energy savings.

For Downstream Rebate projects, of the 33 projects evaluated:

- 27 included lighting or lighting control retrofits
- Three included custom measures
- One was an AC custom motor and drive
- One was a VFD retrofit
- One was a CHP project

The SWE sampled nine total projects for its review. It conducted site visits for one of the projects and conducted engineering desk reviews for all nine projects.

G.1.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

G.1.3 Process Evaluation

All process evaluation activities are discussed in Section 3.5.5.

G.2 Midstream

The Midstream component includes incentives at the distributor and manufacturer levels to encourage the purchase and installation of high efficiency lighting, HVAC, refrigeration and food service, compressed air, and other measures. PECO has several pathways to receive Midstream rebates, including the Point of Sale (POS) for all measures, and LED Aggregation and Lookback pathways (for lighting measures).

The LED aggregation pathway 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.

The Midstream Lookback pathway issues midstream incentives and savings attribution letters to program-qualifying lighting projects that are not captured through the POS pathway (the

[64] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

customer does not receive an instant discount during purchase at the distributor). The Lookback pathway reviews distributor transaction data, identifies program-qualifying projects that did not receive an incentive, and issues incentives to both the purchaser and the distributor.

In 2022, PECO and DNV expanded the Midstream component to begin offering incentives for non-lighting measures including HVAC, refrigeration and food service, and compressed air. According to the Phase IV Evaluation Plan,[65] this component is expected to account for 28% of Non-Residential EE Program energy savings, 26% of Non-Residential EE Program demand savings, 20% of total portfolio energy savings, and 19% of total portfolio demand savings. The Phase IV Midstream component is implemented by DNV.

G.2.1 Gross Impact Evaluation

Methodology

In the first step of the gross impact evaluation, Guidehouse conducted a tracking database analysis for all 3,373 projects from all 2,153 participants in the Midstream component. This analysis used a combination of TRM default values and EDC-provided data for open variables. The team verified approaches, algorithms, and assumptions used to estimate reported gross savings at the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM-based measures passed through this step with no adjustments, and the adjusted database savings for these measures equaled the reported savings.

In the second step, Guidehouse sampled projects for further data collection and analysis. Guidehouse conducted engineering desk reviews for all projects in the evaluation sample. The engineering desk reviews used project measure invoices and documents provided by PECO, as well as customized TRM Appendix C calculation sheets, specification sheets and DLC reports based on model numbers, and other information as it was available. PECO-provided documentation often included only invoices from the distributors. In the engineering desk review, the team reviewed all available project documentation to ensure all assumptions used in measure savings calculations were supported by the project documentation and to ensure the calculation methodology was correct.

The evaluation team supplemented engineering desk reviews with phone verifications, which the team assigned to projects per the Sample Design Memo[66] that was submitted to and approved by the SWE. 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 model numbers, operating schedules, a careful description of site conditions, and overall verification of the information contained in the project files. The team made updates to the measure savings calculations based on customer responses during the phone verifications as warranted.

Guidehouse conducted onsite verification for sampled projects per the Sample Design Memo.[66] Projects assigned an onsite visit first received an engineering desk review to create the SSMVP.

[65] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.
[66] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

The primary objective of site visits was to collect the data required by the TRM and the Phase IV Evaluation Framework. This data included verifying the quantities and type of each measure, equipment nameplate data, and operating schedules, and carefully describing the site conditions. Guidehouse verified this information through visual inspection of the measures and by interviewing the customers, and updated measure savings calculations as warranted based on verified information obtained onsite.

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 assigned a phone verification, the team converted the project to an engineering desk review only after making at least five attempts to call or email the customer in alignment with the Evaluation Plan.[67] Thirty-three projects were converted to a 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.

Table G-2. shows the number of Midstream projects by evaluation method. Of the 3,373 completed projects through 2,153 participants, the team sampled 78 projects for increased evaluation rigor.

Table G-2. Non-Residential Midstream Project Count of Evaluation Rigor

Verification Level	Evaluation Target	Number of Projects
Tracking Database Analysis	3,373	3,373
Engineering Desk Review Only	0	33
Phone Verification	64	43
Onsite Verification	2	2
Total Sampled Projects	66	78

Source: Guidehouse analysis

One project surpassed the energy (kilowatt-hour) savings thresholds set in Table 1-2 of the TRM,[68] which requires site-specific data collection for enhanced evaluation rigor. For this project, Guidehouse completed a site visit and installed metering equipment to obtain site-specific hours of use and operation data.

Sampling

Using tracking data from PY13, 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 PY13 to bin projects within five strata, as outlined in the PY13 Sample Design Memo.[69]

Guidehouse first created a census stratum (Stratum 1 – Very Large Projects) for projects exceeding 1,000 MWh of energy savings. Next, the evaluation team sorted the remaining projects by size and excluded all projects making up the lowest 2% of total Midstream energy

[67] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

[68] PA PUC, *Technical Reference Manual; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program*, dated February 2021, https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/.

[69] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

savings. Finally, the team divided the population into three additional strata: those projects making up the top, middle, and lowest third of the total remaining Midstream energy savings.

For Midstream projects, all 78 sampled projects included lighting or lighting control retrofits. The SWE sampled five total projects for its review and conducted engineering desk reviews for all five sites.

G.2.2 Net Impact Evaluation

Guidehouse conducted NTG research for the Point of Purchase pathway of the Non-Residential Midstream component, known to customers as the Instant Discounts Pathway program.[70] The evaluation team did not evaluate NTG for the LED Aggregation or Lookback pathways due to differences in customer participation and decision-making.

Methodology

Guidehouse followed the Statewide Evaluator (SWE) framework[71] and the Illinois Technical Reference Manual (IL TRM)[72] for calculating free ridership and estimating NTG for the Midstream component in PY13. The team collected feedback from participating distributors for estimating NTG but did not survey end use customers due to the lack of contact information collected by the program at the time of purchase.

Data Collection

Guidehouse attempted to interview a census of distributors operating in the PECO service territory and participating in Instant Discounts. The implementer provided a list of current distributors and contact information for the individuals responsible for the decision to participate in the program. The team developed the NTG interview instrument according to SWE requirements and had the SWE review and approve the instrument in advance of fielding.

Guidehouse contacted distributors from participating businesses via phone to complete a 20-minute to 30-minute interview on their experience. Interviewers contacted 22 businesses, using phone numbers provided by PECO, at least three times or until completing a full interview. Interviewers called distributors over 7 weeks, with call attempts made at varied times of day and days of the week to account for interviewees' schedules. Of the 69 call attempts made, 19 were sent to voicemail where the interviewer left a message explaining the purpose of the interview and a phone number where distributors could call back. Additionally, distributors asked to be called back at another time or suggested someone else at their company to contact on 18 of the call attempts. The evaluation team followed up on all call-back requests, but several interviewees either did not answer or were busy during the call-back time. Several numbers did

[70] Guidehouse did not conduct NTG research for the LED Aggregation and Lookback pathways of the Midstream component due to differences in implementation structure and decision-making processes from the point-of-sale pathway.

[71] PA PUC SWE, *Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs,* July 16, 2021, https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

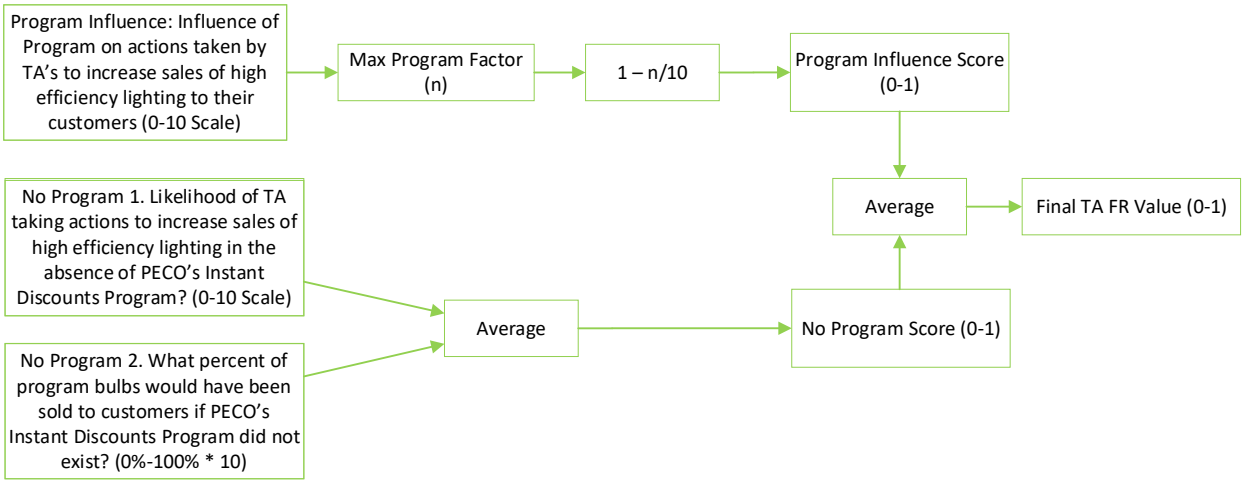
[72] *Illinois Statewide Technical Reference Manual version 10.0,* August 1, 2022, https://www.ilsag.info/technical-reference-manual/il-statewide-technical-reference-manual-version-10-0/. Guidehouse has not conducted NTG research for PECO's Midstream programs in past program years, nor is there supporting documentation from the SWE that includes algorithms for quantifying NTG results in Pennsylvania. Therefore, Guidehouse looked outside of Pennsylvania for detailed methods on estimating NTG for Midstream programs.

not have voicemail set up or were disconnected, and one of the companies contacted does not participate in the program.

NTG Algorithm

PY13 is the first year the evaluation team conducted NTG research for the Midstream offering. The team relied on research conducted in other utility jurisdictions for examples of how to estimate NTG for a Midstream program. The IL TRM provided detailed discussions on the type of feedback to collect and the algorithm to use for calculating free ridership from distributors and free ridership and spillover from participating end use customers.[73] Figure G-1. shows the algorithm for estimating free ridership from distributors participating in the Midstream component.[74]

Figure G-1. Distributor Free Ridership Algorithm



Source: ComEd-Business Instant Discounts NTG Memo appending the IL TRM v.10.0

Guidehouse developed the distributor interview guide to gather the feedback necessary to establish the inputs to the NTG algorithm and estimate free ridership for Instant Discounts.[75] The team used this data to establish a picture of the effects Instant Discounts had on the overall lighting market through the distributor-reported percentage change in bulb sales prior to and after program participation. These results are shown in the next section.

[73] Guidehouse did not conduct free ridership and spillover research with end use customers due to the lack of contact information collected by the distributors at the time of purchase.

[74] The Distributor Free Ridership Algorithm used is an update to the recently published IL TRM v.10.0. Guidehouse followed the guidance for estimating NTG for Midstream programs detailed in the IL TRM v.10.0 and plans to officially publish this version of the free ridership algorithm in the IL TRM v.11.0 later this year.

[75] The team did not collect data on spillover since the IL TRM requires end use customer spillover estimates to avoid double counting of spillover savings.

NTG Results

Guidehouse collected feedback from five distributors participating in Instant Discounts within PECO's service territory. Table G-3. shows the NTG results as well as the reported change in bulb sales due to program participation.

Table G-3. Non-Residential Midstream NTG Results

Participant	Free Ridership	Spillover	NTG	Percentage Change in Sales[1]
Distributor A	0.29	0.00	0.71	20% Increase
Distributor B	0.35	0.00	0.65	10% Increase
Distributor C	0.40	0.00	0.60	10% Increase
Distributor D	0.28	0.00	0.72	40% Increase
Distributor E	0.55	0.00	0.45	30% Increase
Total[2]	**0.31**	**0.00**	**0.69**	**35% Increase**

[1] Percentage Change in Sales compares the distributor-reported percentage of sales prior to and after program participation as well as the reported percentage of sales that would have occurred in absence of the program.
[2] Guidehouse used the claimed kWh savings to weight the individual NTG and percentage change in sales results to the total population.

Source: Guidehouse analysis

Guidehouse also asked distributors to identify any changes to stocking and selling practices due to their participation in Instant Discounts. These results show to what extent the program is influencing distributors to market program-qualified equipment to customers. Table G-4. shows the number of "Yes" responses for each practice.

Table G-4. Non-Residential Midstream Stocking and Selling Practices

Stocking/Selling Practice	"Yes" Responses
Increase marketing of program-qualified units	4 of 5
Increase the stocking or assortment of program-qualified units	4 of 5
Reduce the prices of program-qualified units	2 of 5
Discuss the benefits of program-qualified units with design professionals	1 of 5
Conduct training workshops for contractors	0 of 5
Conduct training workshops for customers	0 of 5

Respondents received the following question: "Since participating in the PECO Instant Discounts Pathway program, has your organization taken any of the following actions?"

Source: Guidehouse analysis

G.2.3 Process Evaluation

All process evaluation activities are discussed in Section 3.5.5.

G.3 Small Business Direct Install

The Small Business Direct Install component offers rebates to small businesses for the direct installation of energy efficiency measures to improve overall energy performance. Typical measure offerings include efficient lighting and lighting controls, refrigeration lighting, door

gaskets, and efficient motors on refrigerators and freezers. According to the Phase IV Evaluation Plan,[76] this component is predicted to account for 17% of Non-Residential EE Program energy savings, 17% of Non-Residential Program demand savings, 12% of total portfolio energy savings, and 12% of total portfolio demand savings. The Phase IV Small Business Direct Install component was implemented by SmartWatt from June 2021 through January 2022 (the same CSP as Phase III). DNV began implementing the component in February 2022 using an open contractor network.

G.3.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for all 89 projects across all 87 participants in the component. This analysis used a combination of TRM default values and EDC-provided data for open variables. The team verified approaches, algorithms, and assumptions used to estimate reported gross savings at the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM-based measures passed through this step with no adjustments, and the adjusted database savings for these measures equaled the reported savings. Guidehouse applied the verification ratios from the PY11 evaluation of the Small Business Direct Install program to the PY13 adjusted database savings for energy and demand to arrive at PY13 gross impact results.

G.3.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

G.3.3 Process Evaluation

All process evaluation activities are discussed in Section 3.5.5.

G.4 New Construction

The New Construction component 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 Non-Residential New Construction component involve efficient lighting, heating and cooling technologies, controls, and other measures. According to the Phase IV Evaluation Plan,[77] this component is expected to account for 10% of Non-Residential EE Program energy savings, 9% of Non-Residential EE Program demand savings, 7% of total portfolio energy savings, and 6% of total portfolio demand savings. The Phase IV New Construction component is implemented by DNV.

[76] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.
[77] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

G.4.1 Gross Impact Evaluation

Methodology

In the first step of the gross impact evaluation, Guidehouse conducted a tracking database analysis for all 35 projects at all 35 participating sites in the component. This analysis used a combination of TRM default values and EDC-provided data for open variables. The team verified approaches, algorithms, and assumptions used to estimate reported gross savings at the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM-based measures passed through this step with no adjustments, and the adjusted database savings for these measures equaled the reported savings.

In the second step, Guidehouse sampled projects for further data collection and analysis. Guidehouse conducted engineering desk reviews for all projects in the evaluation sample. The engineering 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. In the engineering desk review, the team reviewed all available project documentation to ensure all assumptions used in measure savings calculations were supported by the project documentation and to ensure the calculation methodology was correct.

The evaluation team supplemented engineering desk reviews with phone verifications, which the team assigned to projects per the Sample Design Memo[78] that was submitted to and approved by the SWE. 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. The team made updates to the measure savings calculations based on customer responses during the phone verifications as warranted.

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 assigned a phone verification, the team converted the project to an engineering desk review only after making at least five attempts to call or email the customer in alignment with the Evaluation Plan.[79] Four projects were converted to file review after the team exhausted all customer contact attempts.

Table G-5. shows the number of New Construction Rebate projects by evaluation method. Of the 35 completed projects, the team sampled 14 projects for increased evaluation rigor.

[78] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.
[79] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Table G-5. Non-Residential New Construction Project Count of Evaluation Rigor

Verification Level	Evaluation Target	Number of Projects
Tracking Database Analysis	35	35
Engineering Desk Review Only	0	4
Phone Verification	14	10
Total Sampled Projects	14	14

Source: Guidehouse analysis

Two projects surpassed the energy (kilowatt-hour) savings thresholds set in Table 1-2 of the TRM,[80] which requires site-specific data collection for enhanced evaluation rigor. For one of these projects, Guidehouse made use of site-specific information to verify the project savings. Site-specific information included metering data, end use trend data, and trend data from building management systems. The other project refused to allow our staff onsite to conduct additional verification and metering. As the facility was a part of the New Construction component, the team could not collect any historical trend data. Also, the site did not have a building automation system, so collecting site-specific information required an onsite visit, which was not possible. Therefore, the team used a phone verification to confirm the quantity of fixtures and operating schedule, which were used in the evaluation.

Sampling

Using tracking data from PY13, 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 PY13 to bin projects within four strata, as outlined in the PY13 Sample Design Memo.[81]

Guidehouse first created a census stratum (Stratum 1 – Very Large Projects) for new construction projects exceeding 500 MWh of energy savings. Next, the evaluation team sorted the remaining projects by size and excluded all projects making up the lowest 2% of total new construction energy savings. Finally, the team divided the population into two additional strata: those projects making up the top and bottom halves of the total remaining new construction energy savings.

For the New Construction component, of the 14 projects evaluated:

- Seven included only lighting or lighting controls
- Six included lighting and HVAC measures
- One included custom refrigeration measures

The SWE sampled two total projects for its review, of which both received an engineering desk review by the SWE.

[80] PA PUC, *Technical Reference Manual; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program*, dated February 2021, https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/.

[81] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

G.4.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

G.4.3 Process Evaluation

All process evaluation activities are discussed in Section 3.5.5.

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Appendix E: Residential and Income-Eligible EE Program

Appendix F: Residential and Income-Eligible HER Program

Appendix G: Non-Residential EE Program

Program Year 13
(June 1, 2021–May 31, 2022)

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Appendix E. Residential and Income-Eligible EE Programs

This appendix details the evaluation methods and activities Guidehouse deployed in program year 13 (PY13) for select Residential and Income-Eligible (IE) Energy Efficiency (EE) Program components (listed below). Refer to Section 3.1 and 3.2 of the main body report for key evaluation findings, results, and conclusions for these components:

- Rebates and Marketplace (market-rate)
- Appliance Recycling (market-rate and IE)
- In-Home Assessments (market-rate)
- New Construction (market-rate)
- Multifamily (market-rate and IE)
- Single-Family (IE)
- Long-Term Savings (IE)

E.1 Rebates and Marketplace (Market-Rate)

The Rebates and Marketplace component includes customer rebates for lighting, HVAC, appliances, and energy-saving devices. There are multiple delivery channels to receive product rebates: Downstream, Trade Ally and Distributor Network, Marketplace, and Point of Purchase. According to the Phase IV plan, this component is planned to account for 50% of Residential EE Program energy savings, 45% of Residential EE Program demand savings, 7% of total portfolio energy savings, and 5% of portfolio demand savings. The Phase IV Rebates and Marketplace component is implemented by CLEAResult.

E.1.1 Gross Impact Evaluation

Guidehouse conducted two activities to verify savings for this component: a tracking database analysis for all measures outlined in the PA TRM and latest interim measure protocols (IMPs) using a combination of TRM default values and EDC-provided data, and online surveys of sampled recipients for the downstream, marketplace, and trade ally channels. As part of the tracking database analysis, the team verified algorithms used to estimate reported gross savings at the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM measures were passed through this process with no adjustment and adjusted savings for these measures equaled the reported savings[1].

Table E-1. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Section 3.1.2 of the main body.

[1] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Table E-1. Detailed Findings for Rebates and Marketplace

Measure	Percentage of Residential Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Lighting	39.3%	0.98	1.04	TRM default values were used in place of missing data
ECM Furnace Fan	2.0%	1.05	1.06	Tracking data is using a rounded TRM default value for delta kW
Ductless Heat Pump	1.4%	1.03	1.11	TRM default values were used in place of missing data
Variable Speed Pool Pump	0.9%	1.02	100.87	TRM default values were used in place of missing data
ENERGY STAR Refrigerator	0.2%	0.98	0.98	TRM default values were used in place of missing data

[1] Percentage of Residential Savings is the percent of total Residential Program energy savings that each of these measures represent.

Source: Guidehouse analysis

Guidehouse conducted online surveys of sampled recipients in PY13 for the downstream, marketplace, and trade ally channels, as described in Section 3.1.2 of the main body of the report. The surveys included specific questions the customer could answer based on common knowledge of the measures they received. The survey responses showed the frequency of measures being installed as well as any issues with installation. Savings were recalculated based on the customer responses in the surveys. Findings from the survey are detailed in Section 3.1.2 of the main body of the report. These results were combined with the results of the tracking database analysis to determine final verified gross savings.

As Table E-2. presents, Guidehouse stratified the sample by channel (and further by measure) to account for the different channels within the Rebates and Marketplace component, as described in the Sample Design Memo.[2] Overall, Guidehouse exceeded the sample response rate as a result of higher than expected survey participation for the Downstream channel. The Trade Ally channel underachieved slightly as a result of missing or incorrect contact information for customers.

Table E-2. Rebates and Marketplace Sample Project Count

Channel	Target Count	Achieved Count
Downstream	54	256
Marketplace	56	53
Trade Ally	24	17
Total Sampled Projects	**134**	**326**

Source: Guidehouse analysis

E.1.2 Net Impact Evaluation

Guidehouse did not conduct net-to-gross (NTG) research for this component in PY13.

[2] PECO, *PY13 Residential Impact Sample Design Memo 03-14-22,* dated March 14, 2022.

E.1.3 Process Evaluation

All process evaluation activities are discussed in Section 3.1.5 of the main body.

E.2 Appliance Recycling (Market-Rate and Income-Eligible)

The Appliance Recycling component focuses on recycling refrigerators, freezers, and window air conditioning units responsibly. The component serves both market-rate and IE customers. According to the Phase IV plan, this component is planned to account for 18% of Residential EE Program energy savings, 17% of Residential EE Program demand savings, 10% of Income-Eligible EE Program energy savings, 14% of Income-Eligible EE Program demand savings, 3% of total portfolio energy savings, and 2% of total portfolio demand savings. The Appliance Recycling component is implemented by ARCA.

E.2.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data.

Table E-3. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Sections 3.1.2 and 3.2.2 of the main body. These adjustments affected both MR and IE verification ratios and are outlined in Table E-3.

Table E-3. Detailed Findings for Appliance Recycling

Measure	Percentage of Residential or IE Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
Refrigerator Recycling	17.9%	1.12	1.12	TRM default values were used in place of missing data
Freezer Recycling	1.9%	1.02	1.02	TRM default values were used in place of missing data
Removal of Existing Refrigerator with Replacement	0.0%	0.88	0.88	TRM default values were used in place of missing data
Refrigerator Recycling (IE)	5.0%	1.14	1.14	TRM default values were used in place of missing data
Removal of Existing Refrigerator with Replacement (IE)	1.4%	0.93	0.93	TRM default values were used in place of missing data

[1] Percentage of Energy Savings is the percent of total Residential Program or IE Program energy savings that each of these measures represent within their respective programs.

Source: Guidehouse analysis

Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied the energy and demand verification ratios based on evaluation activities in PY12 to the result of the tracking database analysis to arrive at final PY13 gross impact results.

E.2.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.2.3 Process Evaluation

All process evaluation activities are discussed in Sections 3.1.5 and 3.2.5 of the main body.

E.3 In-Home Assessments (Market-Rate)

The In-Home Assessment component provides in-home or virtual assessments and comprehensive audits to educate customers; install energy efficient measures; identify additional, potentially larger, energy efficiency opportunities (such as insulation and air sealing); and encourage greater participation in other Residential EE Program components. According to the Phase IV Evaluation Plan,[3] this component is planned to account for 15% of Residential EE Program energy savings, 12% of Residential EE Program demand savings, 2% of total portfolio energy savings, and 1% of portfolio demand savings. The In-Home Assessment component is implemented by CLEAResult.

E.3.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data.

Table E-4. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Section 3.1.2 of the main body.

Table E-4. Detailed Findings for In-Home Assessments

Measure	Percentage of Residential Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Lighting (Specialty)*	4.1%	0.76	0.80	TRM default values were used in place of missing data
ENERGY STAR Lighting (Standard)	1.9%	0.93	0.98	Unable to recreate reported savings from the information provided
Insulation	0.1%	1.01	1.01	TRM default values were used in place of missing data
Air Sealing/Weatherization	0.0%	0.92	0.92	Unable to recreate reported savings from the information provided

[1] Percentage of Residential Savings is the percent of total Residential Program energy savings that each of these measures represent.
Note: Realization Rate for ENERGY STAR Lighting (Specialty) is a weighted average of the affected bulbs.
Source: Guidehouse analysis

[3] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied energy and demand verification ratios based on the Whole Home evaluation activities conducted in PY11 to the result of the tracking database analysis to arrive at final PY13 gross impact results.

E.3.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.3.3 Process Evaluation

All process evaluation activities are discussed in Section 3.1.5 of the main body.

E.4 New Construction (Market-Rate)

The Residential New Construction component supports the construction of more comfortable, durable, and energy efficient homes compared with those simply built to code. This component works with Home Energy Rating System (HERS) raters and builders to create more energy efficient homes during the design and construction phases. According to the Phase IV Evaluation Plan,[4] this component is planned to account for 7% of Residential EE Program energy savings, 20% of Residential EE Program demand savings, 1% of total portfolio energy savings, and 2% of total portfolio demand savings. The New Construction component is implemented by PSD.

E.4.1 Gross Impact Evaluation

In PY13 Guidehouse conducted file reviews, performed building simulation modeling using REM/Rate software, and utilized TRM algorithms to determine gross impact results. The evaluation team reviewed the energy models for each sampled site for quality assurance and performed supplemental TRM-based calculations outside of the energy models to generate the total peak demand savings, as required by the Phase IV TRM. Refer to Section 3.1 of the main body report for key evaluation findings, results, and conclusions for these components.

Methodology
Guidehouse independently recalculated energy and demand savings by running the REM/Rate building simulation models for each of the sites selected within the sample. Each REM/Rate file was run against the PECO reference home based on TRM specifications. The annual energy and demand savings are defined in the TRM as the difference between the baseline (PECO reference home) and the as-built simulation results. Unlike previous evaluations where REM/Rate was used to calculate savings exclusively associated with weather-sensitive measures, the current version of the TRM allows for the total energy savings to be calculated within the REM/Rate software.

The cooling demand savings generated from the REM/Rate models are assumed to coincide with the peak period and subsequently reflect peak cooling demand savings. The TRM allows for additional demand savings for other end uses to be calculated using algorithms from the applicable measures elsewhere in the TRM. The evaluation team utilized the REM/Rate model inputs to apply TRM-deemed savings, TRM algorithms, and engineering best practices to

[4] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

calculate demand savings associated with ENERGY STAR lighting and appliances such as refrigerators, clothes dryers, clothes washers, dishwashers, and low flow fixtures. The evaluation team calculated the total verified demand savings by applying the coincidence factor (CF) defined in the TRM Volume 1 (0.424 for Philadelphia) to the REM/Rate-generated peak cooling demand savings and adding the demand savings from qualifying lighting, appliances, and low flow fixtures, to generate the total verified demand savings. The total verified energy and demand savings were compared with the reported savings to determine the realization rates.

The evaluation review revealed that the tracked demand savings were generated by applying the phase III HVAC coincidence factor to the whole building demand savings output by the energy model. As discussed above the TRM only allows cooling demand savings to be claimed from the model and requires additional demand savings to be claimed using the algorithms defined in the TRM. Additionally, the coincidence factor was reduced from 0.647 in phase II to 0.424 in phase IV. Overall, the methodology described above results in a reduction in verified demand savings compared to the tracking data.

Sampling

Using tracking data from Q1-Q4 of PY13, 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 PY13 to bin projects into measures/strata shown below, as outlined in the PY13 Sample Design Memo.[5] Projects with reported energy savings of less than 265 kWh, which represent less than 1% of total component energy and demand savings, were excluded from the evaluation due to their minimal impact. In total 38 sites were selected for evaluation. As presented in Table E-5., a random sample was generated ensuring the measure and strata selection was representative of the participating population.

Table E-5. New Construction Sample Project Count

Measure/Stratum	Target Site Count	Achieved Site Count
Code Plus Home/Multifamily	1	1
Code Plus Home/Single-Family	10	10
Code Plus Home/Townhouse and Duplex	9	9
ENERGY STAR Home/Multifamily	9	9
ENERGY STAR Home/Townhouse and Duplex	1	1
Smart Thermostat	8	8
Total Sampled Projects	**38**	**38**

Source: Guidehouse analysis

E.4.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

[5] PECO, *PY13 Residential Impact Sample Design Memo 03-14-22,* dated March 14, 2022.

E.4.3 Process Evaluation

All process evaluation activities are discussed in Section 3.1.5 of the main body.

E.5 Multifamily (Market-Rate and Income-Eligible)

The Multifamily component provides analysis, direct install measures, and larger, investment-level upgrades to improve the energy efficiency of multifamily buildings, both in units and in common areas. The component serves buildings with market-rate customers, IE customers, and a mix of residential and commercial customer types. According to the Phase IV Evaluation Plan,[6] this component is planned to account for 10% of Residential EE Program energy savings, 6% of Residential EE Program demand savings, 15% of Income-Eligible EE Program energy savings, 11% of Income-Eligible EE Program demand savings, 2% of total portfolio energy savings, and 1% of total portfolio demand savings. The Multifamily (for both the Residential and Income-Eligible Programs) component is implemented by CMC.

E.5.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data.

Table E-6. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Sections 3.1.2 and 3.2.2 of the main body.

Table E-6. Detailed Findings for Multifamily

Measure	Percentage of Residential Energy Savings [1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Lighting (Specialty)	2.3%	0.25	0.24	Baseline wattage was not using TRM deemed 45 lumens per watt
ENERGY STAR Lighting (Standard)	0.9%	0.94	0.99	Unable to recreate reported savings from the information provided
LED Nightlight	0.0%	4.90	NA	Unable to recreate reported savings from the information provided

[1] Percentage of Energy Savings is the percent of total Residential Program energy savings that each of these measures represent due to Multifamily IE being reported as part of the Residential Program in the tracking database.
Note: Realization Rate for ENERGY STAR Lighting (Specialty) and ENERGY STAR Lighting (Standard) are weighted averages of the affected bulbs.

Source: Guidehouse analysis

Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied energy and demand verification ratios based on evaluation activities in PY10 to the result of the tracking database analysis to arrive at final PY13 gross impact results.

[6] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

E.5.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.5.3 Process Evaluation

All process evaluation activities are discussed in Sections 3.1.5 and 3.2.5 of the main body.

E.6 Single-Family (Income-Eligible)

This Single-Family component improves the energy efficiency of single-family homes for IE customers to help reduce their electric bills and make their homes more comfortable. There are multiple channels to receive program services. The Free Home Energy Check-Ups program and Low-Income Usage Reduction Program (LIURP) offer consistent program services for IE households but are differentiated by funding sources. Giveaways are unique to the Single-Family component. According to the Phase IV Evaluation Plan,[7] this component is planned to account for 70% of Income-Eligible EE Program energy savings, 74% of Income-Eligible EE Program demand savings, 4% of total portfolio energy savings, and 3% of portfolio demand savings. The Single-Family component is implemented by CMC.

E.6.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data.

Table E-7. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Section 3.2.2 of the main body.

Table E-7. Detailed Findings for Single-Family (Income-Eligible)

Measure	Percentage of IE Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Lighting (Specialty)	25.0%	0.24	0.25	Baseline wattage was not using TRM-deemed 45 lumens per watt
ENERGY STAR Lighting (Standard)	9.3%	0.94	1.03	Unable to recreate reported savings from the information provided
Ductless Heat Pump	9.3%	0.94	1.03	Unable to recreate reported savings from the information provided.
Air Source Heat Pump	0.1%	1.42	1.51	TRM dictates that when baseline cooling system is nonexistent it should be set to air source heat pump with early replacement.
Insulation	1.2%	1.41	5.6	Unable to recreate reported savings from the information provided
Air Sealing	0.1%	0.96	0.48	Tracking data was using incorrect TRM values for baseline efficiency

[7] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Measure	Percentage of IE Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
ENERGY STAR Room Air Conditioner	0.0%	0.96	0.96	Tracking data was using incorrect TRM value for CEERee

[1] Percentage of IE Savings is the percent of total IE Program energy savings that each of these measures represent.

Source: Guidehouse analysis

Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied energy and demand verification ratios based on evaluation activities in PY12 to the result of the tracking database analysis to arrive at final PY13 gross impact results.

E.6.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.6.3 Process Evaluation

All process evaluation activities are discussed in Section 3.2.5 of the main body.

E.7 Long-Term Savings (Income-Eligible)

The Long-Term Savings component is implemented as an overlay service through the Single-Family component to encourage the installation of long-term, comprehensive measures. The Long-Term Savings component measures include insulation, air sealing, duct sealing, heat pumps, air conditioners, thermostats, window repairs, and residential heat pump water heaters and solar water heaters. According to the Phase IV Evaluation Plan,[8] this component is planned to account for 5% of Income-Eligible EE Program energy savings, 1% of Income-Eligible EE Program demand savings, 0.3% of total portfolio energy savings, and 0.004% of total portfolio demand savings. The Long-Term Savings component is implemented by CMC.

E.7.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for this component for all measures outlined in the PA TRM and latest IMPs using a combination of TRM default values and EDC-provided data. Guidehouse did not conduct additional component-specific verification activities in PY13, and instead applied energy and demand verification ratios based on IE Whole Home evaluation activities in PY12 to the result of the tracking database analysis to arrive at final PY13 gross impact results.[9]

Table E-8. illustrates the factors that led to variation between the reported and adjusted database savings and impacted the observed realization rates reported in Section 3.2.2 of the main body.

[8] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

[9] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Table E-8. Detailed Findings for Long-Term Savings (Income-Eligible)

Measure	Percentage of IE Energy Savings[1]	Tracking Database Energy Ratio	Tracking Database Demand Ratio	Reason for Adjustment
Ductless Heat Pump	0.1%	1.76	0.85	TRM dictates that when baseline cooling system is nonexistent it should be set to ductless heat pump with early replacement
Attic/Ceiling/Roof Insulation - IE Direct Install with Heat Pump	0.1%	1.03	4.83	Unable to recreate reported savings from the information provided
Air Source Heat Pump	0.0%	1.49	NA[2]	TRM dictates that when baseline cooling system is nonexistent it should be set to air source heat pump with early replacement

[1] Percentage of IE Savings is the percent of total IE Program energy savings that each of these measures represent.
[2] Reported demand savings for this measure were zero.

Source: Guidehouse analysis

E.7.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

E.7.3 Process Evaluation

All process evaluation activities are discussed in Section 3.2.5 of the main body.

Appendix F. Residential and Income-Eligible Home Energy Report Programs

This appendix details the evaluation methods and activities Guidehouse deployed in PY13 for select Residential and Income-Eligible Home Energy Report (HER) Programs. According to the Phase IV Evaluation Plan,[10] these programs are planned to account for 7% of total portfolio energy savings and 14% of total portfolio demand savings. Refer to Sections 3.3 and 3.4 of the main body report for key evaluation findings, results, and conclusions for these components.

F.1 Gross Impact Evaluation

The HER Gross Impact Evaluation details are discussed in Sections 3.3 and 3.4 and Appendix B of the main body of the report.

F.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for these programs in PY13.

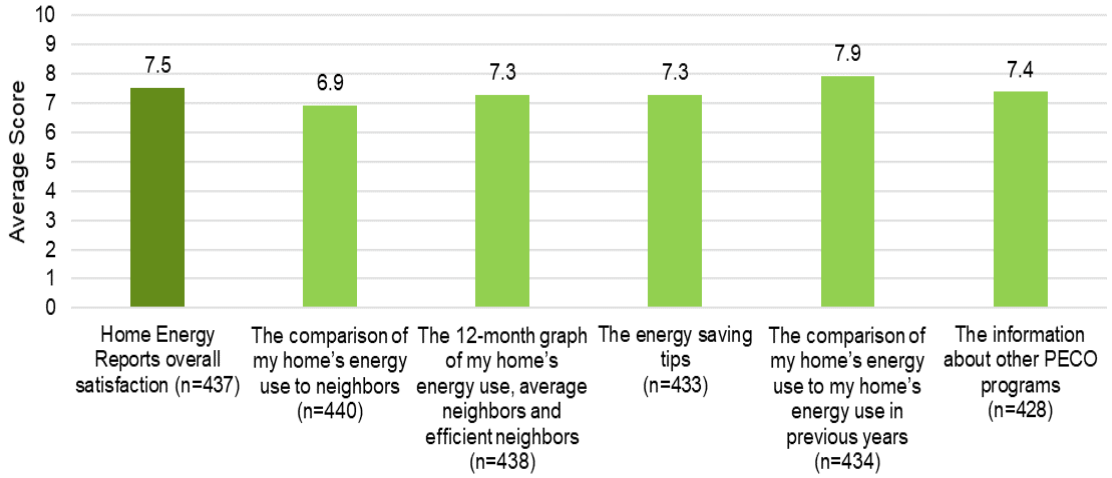
F.3 Process Evaluation

Guidehouse conducted a survey of sampled recipients of HERs in PY13, as described in Sections 3.3.5 and 3.4.5 of the main body of the report. The survey assessed customer satisfaction, perceived accuracy of various report components, and awareness of energy-saving tips provided in the report. This appendix presents results from the entire survey population, including both market-rate and IE waves. Key insights from the survey include the following:

Overall satisfaction with the HER program is 7.5 out of 10 and respondents indicated the prior year comparison component is the most useful report component. Figure F-1. shows the mean value for each question.

[10] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Figure F-1. Satisfaction and Usefulness

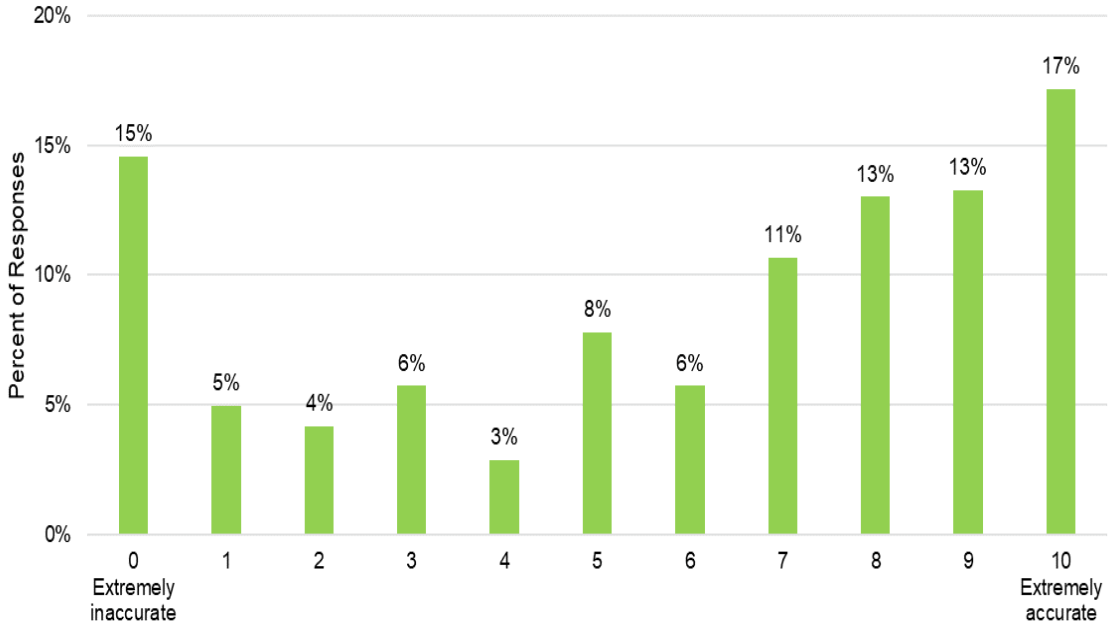


Respondents received the following questions: "Using a scale of 0 to 10, with 0 meaning 'Extremely Dissatisfied' and 10 meaning 'Extremely Satisfied,' how would you rate your satisfaction with the Home Energy Reports overall?" and "On a scale of 0 to 10, where 0 means 'not useful at all' and 10 means 'very useful,' please indicate how useful each of the following elements of the Home Energy Reports are to you."

Source: Guidehouse analysis

Survey respondents reported the lowest relative satisfaction with the neighbor comparison component. Figure F-2. shows the overall sample's rating of the accuracy of the neighbor comparison, with a mean score of 5.9 out of 10. When asked how the report could be improved, customers frequently mentioned the neighbor comparison, citing differences in household needs as a source of inaccuracy.

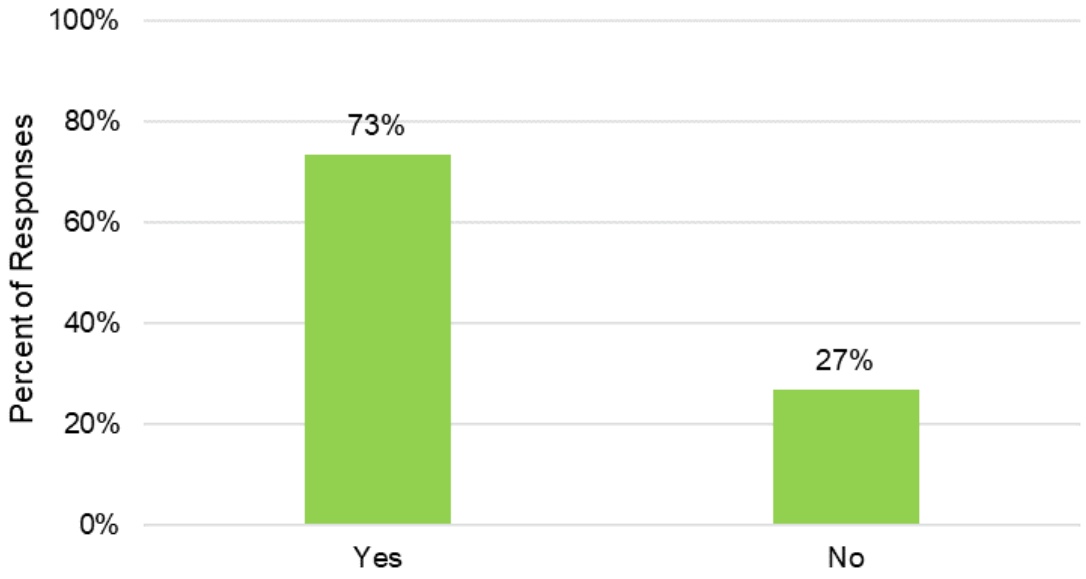
Figure F-2. Accuracy of Neighbor Comparison (n=384)



Respondents received the following question: "A prominent feature of the Home Energy Reports is its ability to show you how your energy use compares to neighbors. Please indicate how accurate you think these comparisons are:"
Source: Guidehouse analysis

HER recipients view PECO as a source for energy savings tips, and the majority of customers who recall tips from the reports find the suggestions relevant to their household, as Figure F-3. shows.

Figure F-3. Relevancy of Suggestions (n=165)



Respondents received the following question: "On average, do you find the suggestions relevant to your household?"
Source: Guidehouse analysis

Appendix G. Non-Residential EE Program

This appendix details the evaluation sample design, methods, and activities deployed in PY13 for select Non-Residential EE Program components. Refer to Section 3.5 of the main body report for evaluation findings, results, and conclusions for these components.

G.1 Downstream

The Downstream component includes incentives for existing building retrofit projects with either deemed, partially deemed, or custom measures. Typical measures include lighting, variable frequency drives (VFDs), HVAC systems, motors, refrigeration, and controls. According to the Phase IV Evaluation Plan,[11] this component is planned to account for 45% of Non-Residential EE Program energy savings, 48% of Non-Residential EE Program demand savings, 33% of total portfolio energy savings, and 34% of total portfolio demand savings. The Phase IV Downstream Rebate component is implemented by DNV.

G.1.1 Gross Impact Evaluation

Methodology

In the first step of the gross impact evaluation, Guidehouse conducted a tracking database analysis for all 771 projects from all 698 participants in the component. This analysis used a combination of TRM default values and EDC-provided data for open variables. The team verified approaches, algorithms, and assumptions used to estimate reported gross savings at the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM based measures passed through this step with no adjustments, and the adjusted database savings for these measures equaled the reported savings.

In the second step, Guidehouse sampled projects for further data collection and analysis. Guidehouse conducted engineering desk reviews for all projects in the evaluation sample. The engineering 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. In the engineering desk review, the team reviewed all available project documentation to ensure all assumptions used in measure savings calculations were supported by the project documentation and to ensure the calculation methodology was correct.

The evaluation team supplemented engineering desk reviews with phone verifications, which the team assigned to projects per the Sample Design Memo[12] that was submitted to and approved by the SWE. 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

[11] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.
[12] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

description of site conditions, and overall verification of the information contained in the project files. The team made updates to the measure savings calculations based on customer responses during the phone verifications as warranted.

Guidehouse conducted onsite verification for sampled projects per the Sample Design Memo.[13] Projects assigned an onsite visit first received an engineering desk review to create the Site-Specific Measurement and Verification Plan (SSMVP). The primary objective of site visits was to collect the data required by the TRM and the Phase IV Evaluation Framework. This data included verifying the quantities and type of each measure, equipment nameplate data, and operating schedules, and carefully describing the site conditions. Guidehouse verified this information through visual inspection of the measures and by interviewing the customers, and updated measure savings calculations as warranted based on verified information obtained onsite.

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 assigned a phone verification, the team converted the project to an engineering desk review only after making at least five attempts to call or email the customer in alignment with the Evaluation Plan.[14] Six projects were converted to engineering desk review after the team exhausted all customer contact attempts.

Table G-1. shows the number of Downstream projects by evaluation method. Of the 771 completed projects, the team sampled 33 projects for additional data collection and analysis.

Table G-1. Non-Residential Downstream Rebate Project Count by Evaluation Method

Verification Level	Evaluation Target	Number of Projects Evaluated
Tracking Database Analysis	771	771
Engineering Desk Review Only	0	6
Phone Verification	29	25
Onsite Verification	2	2
Total Sampled Projects	31	33

Source: Guidehouse analysis

Five projects surpassed the energy (kilowatt-hour) savings thresholds set in Table 1-2 of the TRM,[15] which requires site-specific data collection for enhanced evaluation rigor. For these five projects, Guidehouse used site-specific information to verify the project savings, including metering data, end use trend data, and trend data from building management systems.

Sampling

Using tracking data from PY13, 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

[13] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

[14] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

[15] PA PUC, *Technical Reference Manual; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program*, dated February 2021, https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/.

at the project level for the impact evaluation activities in PY13 to bin projects into six strata, as outlined in the PY13 Sample Design Memo.[16]

Guidehouse first separated CHP projects into their own separate stratum. The sampling team then created a census stratum (Stratum 1 – Very Large Projects) for projects reporting more than 1,000 MWh of energy savings. Next, the evaluation team sorted all remaining projects by size and excluded all of the smallest projects, which combine to make up the lowest 2% of total energy savings. Finally, the team divided the remaining population into three additional strata: those projects make up the top, middle, and lowest third of the total remaining energy savings.

For Downstream Rebate projects, of the 33 projects evaluated:

- 27 included lighting or lighting control retrofits
- Three included custom measures
- One was an AC custom motor and drive
- One was a VFD retrofit
- One was a CHP project

The SWE sampled nine total projects for its review. It conducted site visits for one of the projects and conducted engineering desk reviews for all nine projects.

G.1.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

G.1.3 Process Evaluation

All process evaluation activities are discussed in Section 3.5.5 of the main body.

G.2 Midstream

The Midstream component includes incentives at the distributor and manufacturer levels to encourage the purchase and installation of high efficiency lighting, HVAC, refrigeration and food service, compressed air, and other measures. PECO has several pathways to receive Midstream rebates, including the Point of Sale (POS) for all measures, and LED Aggregation and Lookback pathways (for lighting measures).

The LED aggregation pathway 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.

The Midstream Lookback pathway issues midstream incentives and savings attribution letters to program-qualifying lighting projects that are not captured through the POS pathway (the customer does not receive an instant discount during purchase at the distributor). The Lookback

[16] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

pathway reviews distributor transaction data, identifies program-qualifying projects that did not receive an incentive, and issues incentives to both the purchaser and the distributor.

In 2022, PECO and DNV expanded the Midstream component to begin offering incentives for non-lighting measures including HVAC, refrigeration and food service, and compressed air. According to the Phase IV Evaluation Plan,[17] this component is expected to account for 28% of Non-Residential EE Program energy savings, 26% of Non-Residential EE Program demand savings, 20% of total portfolio energy savings, and 19% of total portfolio demand savings. The Phase IV Midstream component is implemented by DNV.

G.2.1 Gross Impact Evaluation

Methodology

In the first step of the gross impact evaluation, Guidehouse conducted a tracking database analysis for all 3,373 projects from all 2,153 participants in the Midstream component. This analysis used a combination of TRM default values and EDC-provided data for open variables. The team verified approaches, algorithms, and assumptions used to estimate reported gross savings at the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM-based measures passed through this step with no adjustments, and the adjusted database savings for these measures equaled the reported savings.

In the second step, Guidehouse sampled projects for further data collection and analysis. Guidehouse conducted engineering desk reviews for all projects in the evaluation sample. The engineering desk reviews used project measure invoices and documents provided by PECO, as well as customized TRM Appendix C calculation sheets, specification sheets and DLC reports based on model numbers, and other information as it was available. PECO-provided documentation often included only invoices from the distributors. In the engineering desk review, the team reviewed all available project documentation to ensure all assumptions used in measure savings calculations were supported by the project documentation and to ensure the calculation methodology was correct.

The evaluation team supplemented engineering desk reviews with phone verifications, which the team assigned to projects per the Sample Design Memo[18] that was submitted to and approved by the SWE. 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 model numbers, operating schedules, a careful description of site conditions, and overall verification of the information contained in the project files. The team made updates to the measure savings calculations based on customer responses during the phone verifications as warranted.

Guidehouse conducted onsite verification for sampled projects per the Sample Design Memo.[18] Projects assigned an onsite visit first received an engineering desk review to create the SSMVP. The primary objective of site visits was to collect the data required by the TRM and the Phase IV Evaluation Framework. This data included verifying the quantities and type of each measure,

[17] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.
[18] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

equipment nameplate data, and operating schedules, and carefully describing the site conditions. Guidehouse verified this information through visual inspection of the measures and by interviewing the customers, and updated measure savings calculations as warranted based on verified information obtained onsite.

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 assigned a phone verification, the team converted the project to an engineering desk review only after making at least five attempts to call or email the customer in alignment with the Evaluation Plan.[19] Thirty-three projects were converted to a 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.

Table G-2. shows the number of Midstream projects by evaluation method. Of the 3,373 completed projects through 2,153 participants, the team sampled 78 projects for increased evaluation rigor.

Table G-2. Non-Residential Midstream Project Count of Evaluation Rigor

Verification Level	Evaluation Target	Number of Projects
Tracking Database Analysis	3,373	3,373
Engineering Desk Review Only	0	33
Phone Verification	64	43
Onsite Verification	2	2
Total Sampled Projects	66	78

Source: Guidehouse analysis

One project surpassed the energy (kilowatt-hour) savings thresholds set in Table 1-2 of the TRM,[20] which requires site-specific data collection for enhanced evaluation rigor. For this project, Guidehouse completed a site visit and installed metering equipment to obtain site-specific hours of use and operation data.

Sampling

Using tracking data from PY13, 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 PY13 to bin projects within five strata, as outlined in the PY13 Sample Design Memo.[21]

Guidehouse first created a census stratum (Stratum 1 – Very Large Projects) for projects exceeding 1,000 MWh of energy savings. Next, the evaluation team sorted the remaining projects by size and excluded all projects making up the lowest 2% of total Midstream energy savings. Finally, the team divided the population into three additional strata: those projects making up the top, middle, and lowest third of the total remaining Midstream energy savings.

[19] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

[20] PA PUC, *Technical Reference Manual; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program*, dated February 2021, https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/.

[21] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

For Midstream projects, all 78 sampled projects included lighting or lighting control retrofits. The SWE sampled five total projects for its review and conducted engineering desk reviews for all five sites.

G.2.2 Net Impact Evaluation

Guidehouse conducted NTG research for the Point of Purchase pathway of the Non-Residential Midstream component, known to customers as the Instant Discounts Pathway program.[22] The evaluation team did not evaluate NTG for the LED Aggregation or Lookback pathways due to differences in customer participation and decision-making.

Methodology

Guidehouse followed the Statewide Evaluator (SWE) framework[23] and the Illinois Technical Reference Manual (IL TRM)[24] for calculating free ridership and estimating NTG for the Midstream component in PY13. The team collected feedback from participating distributors for estimating NTG but did not survey end use customers due to the lack of contact information collected by the program at the time of purchase.

Data Collection

Guidehouse attempted to interview a census of distributors operating in the PECO service territory and participating in Instant Discounts. The implementer provided a list of current distributors and contact information for the individuals responsible for the decision to participate in the program. The team developed the NTG interview instrument according to SWE requirements and had the SWE review and approve the instrument in advance of fielding.

Guidehouse contacted distributors from participating businesses via phone to complete a 20-minute to 30-minute interview on their experience. Interviewers contacted 22 businesses, using phone numbers provided by PECO, at least three times or until completing a full interview. Interviewers called distributors over 7 weeks, with call attempts made at varied times of day and days of the week to account for interviewees' schedules. Of the 69 call attempts made, 19 were sent to voicemail where the interviewer left a message explaining the purpose of the interview and a phone number where distributors could call back. Additionally, distributors asked to be called back at another time or suggested someone else at their company to contact on 18 of the call attempts. The evaluation team followed up on all call-back requests, but several interviewees either did not answer or were busy during the call-back time. Several numbers did not have voicemail set up or were disconnected, and one of the companies contacted does not participate in the program.

[22] Guidehouse did not conduct NTG research for the LED Aggregation and Lookback pathways of the Midstream component due to differences in implementation structure and decision-making processes from the point-of-sale pathway.

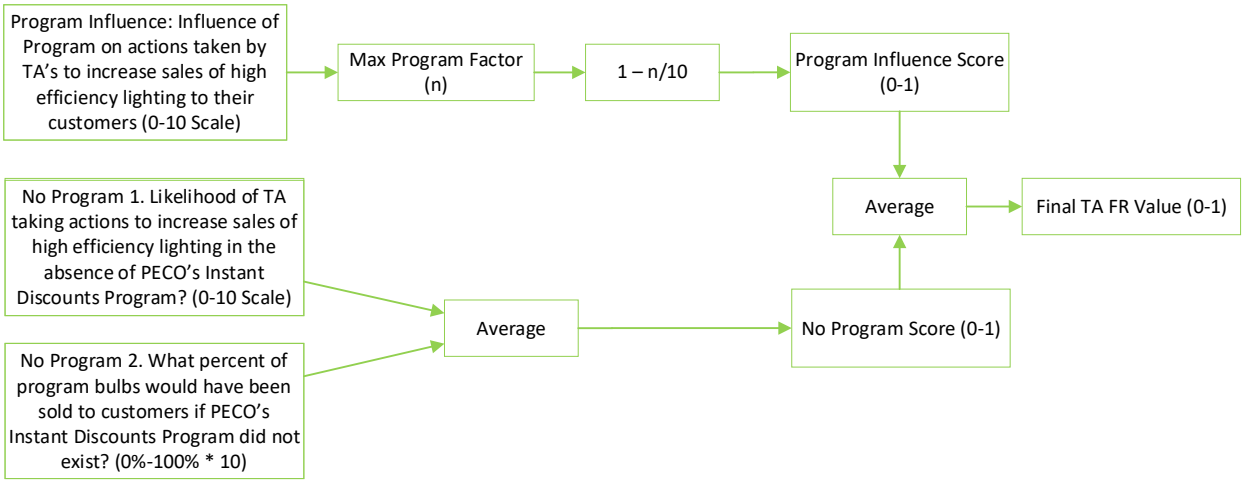
[23] PA PUC SWE, *Evaluation Framework for Pennsylvania Act 129 Phase IV Energy Efficiency and Conservation Programs,* July 16, 2021, https://www.puc.pa.gov/media/1584/swe-phaseiv_evaluation_framework071621.pdf.

[24] *Illinois Statewide Technical Reference Manual version 10.0,* August 1, 2022, https://www.ilsag.info/technical-reference-manual/il-statewide-technical-reference-manual-version-10-0/. Guidehouse has not conducted NTG research for PECO's Midstream programs in past program years, nor is there supporting documentation from the SWE that includes algorithms for quantifying NTG results in Pennsylvania. Therefore, Guidehouse looked outside of Pennsylvania for detailed methods on estimating NTG for Midstream programs.

NTG Algorithm

PY13 is the first year the evaluation team conducted NTG research for the Midstream offering. The team relied on research conducted in other utility jurisdictions for examples of how to estimate NTG for a Midstream program. The IL TRM provided detailed discussions on the type of feedback to collect and the algorithm to use for calculating free ridership from distributors and free ridership and spillover from participating end use customers.[25] Figure G-1. shows the algorithm for estimating free ridership from distributors participating in the Midstream component.[26]

Figure G-1. Distributor Free Ridership Algorithm



Source: ComEd-Business Instant Discounts NTG Memo appending the IL TRM v.10.0

Guidehouse developed the distributor interview guide to gather the feedback necessary to establish the inputs to the NTG algorithm and estimate free ridership for Instant Discounts.[27] The team used this data to establish a picture of the effects Instant Discounts had on the overall lighting market through the distributor-reported percentage change in bulb sales prior to and after program participation. These results are shown in the next section.

NTG Results

Guidehouse collected feedback from five distributors participating in Instant Discounts within PECO's service territory. Table G-3. shows the NTG results as well as the reported change in bulb sales due to program participation.

[25] Guidehouse did not conduct free ridership and spillover research with end use customers due to the lack of contact information collected by the distributors at the time of purchase.

[26] The Distributor Free Ridership Algorithm used is an update to the recently published IL TRM v.10.0. Guidehouse followed the guidance for estimating NTG for Midstream programs detailed in the IL TRM v.10.0 and plans to officially publish this version of the free ridership algorithm in the IL TRM v.11.0 later this year.

[27] The team did not collect data on spillover since the IL TRM requires end use customer spillover estimates to avoid double counting of spillover savings.

Table G-3. Non-Residential Midstream NTG Results

Participant	Free Ridership	Spillover	NTG	Percentage Change in Sales[1]
Distributor A	0.29	0.00	0.71	20% Increase
Distributor B	0.35	0.00	0.65	10% Increase
Distributor C	0.40	0.00	0.60	10% Increase
Distributor D	0.28	0.00	0.72	40% Increase
Distributor E	0.55	0.00	0.45	30% Increase
Total[2]	**0.31**	**0.00**	**0.69**	**35% Increase**

[1] Percentage Change in Sales compares the distributor-reported percentage of sales prior to and after program participation as well as the reported percentage of sales that would have occurred in absence of the program.
[2] Guidehouse used the claimed kWh savings to weight the individual NTG and percentage change in sales results to the total population.

Source: Guidehouse analysis

Guidehouse also asked distributors to identify any changes to stocking and selling practices due to their participation in Instant Discounts. These results show to what extent the program is influencing distributors to market program-qualified equipment to customers. Table G-4. shows the number of "Yes" responses for each practice.

Table G-4. Non-Residential Midstream Stocking and Selling Practices

Stocking/Selling Practice	"Yes" Responses
Increase marketing of program-qualified units	4 of 5
Increase the stocking or assortment of program-qualified units	4 of 5
Reduce the prices of program-qualified units	2 of 5
Discuss the benefits of program-qualified units with design professionals	1 of 5
Conduct training workshops for contractors	0 of 5
Conduct training workshops for customers	0 of 5

Respondents received the following question: "Since participating in the PECO Instant Discounts Pathway program, has your organization taken any of the following actions?"

Source: Guidehouse analysis

G.2.3 Process Evaluation

All process evaluation activities are discussed in Section 3.5.5 of the main body.

G.3 Small Business Direct Install

The Small Business Direct Install component offers rebates to small businesses for the direct installation of energy efficiency measures to improve overall energy performance. Typical measure offerings include efficient lighting and lighting controls, refrigeration lighting, door gaskets, and efficient motors on refrigerators and freezers. According to the Phase IV Evaluation Plan,[28] this component is predicted to account for 17% of Non-Residential EE Program energy savings, 17% of Non-Residential Program demand savings, 12% of total portfolio energy savings, and 12% of total portfolio demand savings. The Phase IV Small Business Direct Install component was implemented by SmartWatt from June 2021 through

[28] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

January 2022 (the same CSP as Phase III). DNV began implementing the component in February 2022 using an open contractor network.

G.3.1 Gross Impact Evaluation

Guidehouse conducted a tracking database analysis for all 89 projects across all 87 participants in the component. This analysis used a combination of TRM default values and EDC-provided data for open variables. The team verified approaches, algorithms, and assumptions used to estimate reported gross savings at the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM-based measures passed through this step with no adjustments, and the adjusted database savings for these measures equaled the reported savings. Guidehouse applied the verification ratios from the PY11 evaluation of the Small Business Direct Install program to the PY13 adjusted database savings for energy and demand to arrive at PY13 gross impact results.

G.3.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

G.3.3 Process Evaluation

All process evaluation activities are discussed in Section 3.5.5 of the main body.

G.4 New Construction

The New Construction component 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 Non-Residential New Construction component involve efficient lighting, heating and cooling technologies, controls, and other measures. According to the Phase IV Evaluation Plan,[29] this component is expected to account for 10% of Non-Residential EE Program energy savings, 9% of Non-Residential EE Program demand savings, 7% of total portfolio energy savings, and 6% of total portfolio demand savings. The Phase IV New Construction component is implemented by DNV.

G.4.1 Gross Impact Evaluation

Methodology

In the first step of the gross impact evaluation, Guidehouse conducted a tracking database analysis for all 35 projects at all 35 participating sites in the component. This analysis used a combination of TRM default values and EDC-provided data for open variables. The team verified approaches, algorithms, and assumptions used to estimate reported gross savings at

[29] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

the measure level and recalculated gross energy and demand savings estimates to confirm whether the tracking database was accurate as reported. Guidehouse used a programmatic approach in this step based solely on inputs provided in the tracking database and the relevant TRM and IMP sections. Non-TRM-based measures passed through this step with no adjustments, and the adjusted database savings for these measures equaled the reported savings.

In the second step, Guidehouse sampled projects for further data collection and analysis. Guidehouse conducted engineering desk reviews for all projects in the evaluation sample. The engineering 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. In the engineering desk review, the team reviewed all available project documentation to ensure all assumptions used in measure savings calculations were supported by the project documentation and to ensure the calculation methodology was correct.

The evaluation team supplemented engineering desk reviews with phone verifications, which the team assigned to projects per the Sample Design Memo[30] that was submitted to and approved by the SWE. 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. The team made updates to the measure savings calculations based on customer responses during the phone verifications as warranted.

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 assigned a phone verification, the team converted the project to an engineering desk review only after making at least five attempts to call or email the customer in alignment with the Evaluation Plan.[31] Four projects were converted to file review after the team exhausted all customer contact attempts.

Table G-5. shows the number of New Construction Rebate projects by evaluation method. Of the 35 completed projects, the team sampled 14 projects for increased evaluation rigor.

Table G-5. Non-Residential New Construction Project Count of Evaluation Rigor

Verification Level	Evaluation Target	Number of Projects
Tracking Database Analysis	35	35
Engineering Desk Review Only	0	4
Phone Verification	14	10
Total Sampled Projects	14	14

Source: Guidehouse analysis

[30] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.
[31] PECO, *Phase IV Evaluation Plan, Energy Efficiency and Conservation Portfolio,* January 14, 2022.

Two projects surpassed the energy (kilowatt-hour) savings thresholds set in Table 1-2 of the TRM,[32] which requires site-specific data collection for enhanced evaluation rigor. For one of these projects, Guidehouse made use of site-specific information to verify the project savings. Site-specific information included metering data, end use trend data, and trend data from building management systems. The other project refused to allow our staff onsite to conduct additional verification and metering. As the facility was a part of the New Construction component, the team could not collect any historical trend data. Also, the site did not have a building automation system, so collecting site-specific information required an onsite visit, which was not possible. Therefore, the team used a phone verification to confirm the quantity of fixtures and operating schedule, which were used in the evaluation.

Sampling

Using tracking data from PY13, 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 PY13 to bin projects within four strata, as outlined in the PY13 Sample Design Memo.[33]

Guidehouse first created a census stratum (Stratum 1 – Very Large Projects) for new construction projects exceeding 500 MWh of energy savings. Next, the evaluation team sorted the remaining projects by size and excluded all projects making up the lowest 2% of total new construction energy savings. Finally, the team divided the population into two additional strata: those projects making up the top and bottom halves of the total remaining new construction energy savings.

For the New Construction component, of the 14 projects evaluated:

- Seven included only lighting or lighting controls
- Six included lighting and HVAC measures
- One included custom refrigeration measures

The SWE sampled two total projects for its review, of which both received an engineering desk review by the SWE.

G.4.2 Net Impact Evaluation

Guidehouse did not conduct NTG research for this component in PY13.

G.4.3 Process Evaluation

All process evaluation activities are discussed in Section 3.5.5 of the main body.

[32] PA PUC, *Technical Reference Manual; State of Pennsylvania Act 129 Energy Efficiency and Conservation Program*, dated February 2021, https://www.puc.pa.gov/filing-resources/issues-laws-regulations/act-129/technical-reference-manual/.

[33] PECO, *PY13 Nonresidential Impact Sample Design Memo 06-06-22,* dated June 6, 2022.

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