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September 30, 2025

VIA ELECTRONIC FILING

Matt Homsher, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street, 2nd Floor
Harrisburg, PA 17120

RE: Final Annual Report to the Pennsylvania Public Utility Commission and Act 129 Statewide Evaluator; Phase IV Program year Period June 1, 2024 – May 31, 2025, for FirstEnergy Pennsylvania Electric Company;
Docket Nos. M-2020-3020820, M-2020-3020821, M-2020-3020822, and M-2020- 3020823

Dear Secretary Homsher:

Enclosed please find the Final Annual Report to the Pennsylvania Public Utility Commission in the above-captioned matter for FirstEnergy Pennsylvania Electric Company on behalf of Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company.

Should you have any questions regarding this matter, please do not hesitate to contact me.

Very truly yours,

Timothy K. McHugh

TKM/mlr
Enclosure

cc: Certificate of Service

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Final Annual Report to the Pennsylvania Public Utility Commission and Act 129 Statewide Evaluator; Phase IV Program Period June 1, 2024 – May 31, 2025 for Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company and West PennPower Company	:	**Docket No. M-2020-3020820** **M-2020-3020821** **M-2020-3020822** **M-2020-3020823**

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a true copy of the foregoing document upon the parties via listed below by e-mail.

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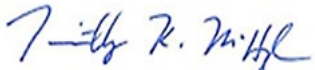
Dated: September 30, 2025



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Final Annual Report to the Pennsylvania Public Utility Commission

Phase IV of Act 129

Program Year 16

(June 1, 2024 – May 31, 2025)

For Pennsylvania Act 129 of 2008

Energy Efficiency and Conservation Plan

Prepared by ADM Associates, Tetra Tech, and Ecometric Consulting

For

Metropolitan Edison Company M-2020-3020820

Pennsylvania Electric Company M-2020-3020821

Pennsylvania Power Company M-2020-3020822

West Penn Power Company M-2020-3020823

September 30, 2025

Contents

Acronyms

ATI	Appliance Turn-In or Appliance Recycling
BOC	Building Operator Certification
C&I	Commercial and Industrial
CFL	Compact Fluorescent Lamp
CSP	Conservation Service Provider or Curtailment Service Provider
CV	Coefficient of Variation
DLC	Direct Load Control
DDR	Dispatchable Demand Response
EAP	Energy Association of Pennsylvania
EDC	Electric Distribution Company
EDT	Eastern Daylight Time
EE&C	Energy Efficiency and Conservation
EM&V	Evaluation, Measurement, and Verification
EMNC	Energy Management and New Construction
ER	Early Replacement
EUL	Effective Useful Life
FCM	Forward Capacity Market
GNI	Government, Non-Profit, Institutional
HER	Home Energy Report
HERS	Home Energy Rating System
HIM	High-Impact Measure
HPWP	Heat Pump Water Heater
HVAC	Heating, Ventilating, and Air Conditioning
ICSP	Implementation Conservation Service Provider
IDI	In-Depth Interview
IMP	Interim Measure Protocol
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light-Emitting Diode
LI	Low-Income
LIURP	Low-Income Usage Reduction Program
LLF	Line Loss Factor
M&V	Measurement and Verification
MW	Megawatt
MWh	Megawatt-hour
NPV	Net Present Value
NTG	Net-to-Gross
O&M	Operation and Maintenance
P4TD	Phase IV to Date
PA PUC	Pennsylvania Public Utility Commission
PDR	Peak Demand Reductions
PSA	Phase IV to Date Preliminary Savings Achieved; equal to VTD + PYRTD
PSA+CO	PSA savings plus Carryover from Phase III
PY	Program Year: e.g., PY16, from June 1, 2024, to May 31, 2025
PYRTD	Program Year Reported to Date

PYVTD	Program Year Verified to Date
RCT	Randomized Control Trial
ROB	Replace on Burnout
RTD	Phase IV to Date Reported Gross Savings
RTO	Regional Transmission Organization
SO	Spillover
SWE	Statewide Evaluator
TRC	Total Resource Cost
TRM	Technical Reference Manual
VTD	Phase IV to Date Verified Gross Savings
WACC	Weighted Average Cost of Capital

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 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 EDC or its program Implementation Conservation Service Providers (ICSP) 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 multi-year 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 TRM provides algorithms and assumptions to calculate annual savings, and Act 129 compliance targets for consumption reduction are based on the sum of the annual savings estimates of installed measures or behavior change.

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

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

> **Phase IV to Date Reported (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 (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 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.
>
> **Phase IV to Date Preliminary 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 is the best estimate of an EDC's progress toward the Phase IV compliance targets.

Phase IV to Date Verified + 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.

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 with the 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 in Program Year 16 (PY16) for Metropolitan Edison (Met-Ed), Pennsylvania Electric Company (Penelec), Pennsylvania Power Company (Penn Power), and West Penn Power Company (WPP), collectively referred to herein as the FirstEnergy PA Companies (Companies) or the four PA EDCs[1], 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 towards EDC savings compliance targets for Phase IV.

This report details the participation, spending, reported gross, verified gross, and verified net impacts of the energy efficiency programs in PY16. Compliance with Act 129 savings goals are ultimately based on verified gross savings. This report also includes estimates of cost-effectiveness according to the Pennsylvania Total Resource Cost test (TRC).[2] The Companies have retained ADM Associates, Tetra Tech, and Ecometric Consulting (the ADM team, or ADM) as an independent evaluation contractor for Phase IV of Act 129. The ADM team is responsible for the measurement, verification, and calculation of gross verified and net verified savings.

The ADM team also performed process evaluations 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.

[1] In Docket Nos. A-2023-3038771, et. al., The Commission approved FirstEnergy Corp.'s Pennsylvania distribution operating companies' (i.e., Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company) request to merge into FirstEnergy Pennsylvania Electric Company, and be known as "Rate Districts". For purposes of this report and continuance of Act 129 Phase IV reporting norms, EDC is used in this report to distinguish compliance targets.

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

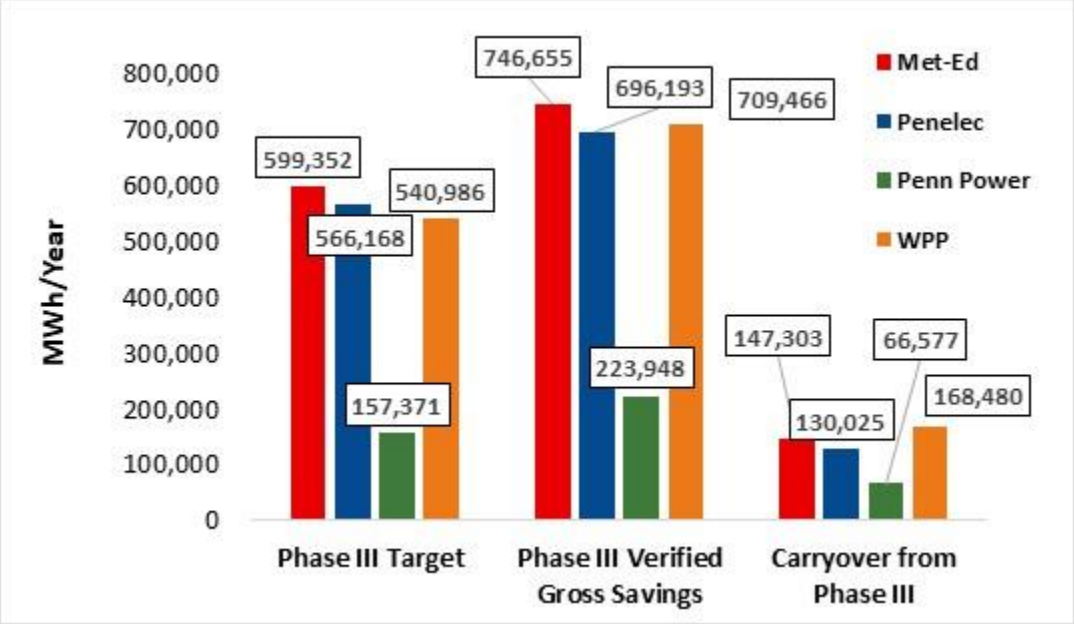
2.1 Carryover Savings from Phase III of Act 129

Table 1 shows total MWh/year carryover savings from Phase III for each of the FirstEnergy EDCs. Figure 1 compares Phase III verified gross savings total to the Phase III compliance target to illustrate the carryover calculation.

Table 1: Carryover Savings from Phase III

FirstEnergy EDC	Phase IV Carryover Savings (MWh/Year)	Phase IV Low-Income Carryover Savings (MWh/Year)
Met-Ed	147,303	9,782
Penelec	130,025	10,466
Penn Power	66,577	3,504
West Penn Power	168,480	8,270

Figure 1: Carryover Savings from Phase III of Act 129



The Commission's Phase IV Implementation Order[3] also allowed EDCs to carry over savings in excess of the Phase III Low-Income (LI) savings goal.[4] Figure 2 shows the calculation of carryover savings for the low-income customer segment.

Figure 2: Low-Income Carryover from Phase III

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 Program Year 16 on June 1, 2024, the four FirstEnergy PA EDCs reported and verified gross electric energy savings and gross peak demand savings are shown in Table 2 below.

[3] 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.
[4] Proportionate to those savings achieved by dedicated low-income programs in Phase III.

Table 2: Gross Reported and Verified Electric and Demand Savings for PY16

EDC	PYRTD MWh	PYRTD MW	PYVTD MWh	PYVTD MW
Met-Ed	169,065	32.0	163,063	27.3
Penelec	120,057	26.4	110,670	20.9
Penn Power	34,093	7.6	32,615	5.6
West Penn Power	173,673	33.7	160,670	27.1

Since the beginning of Phase IV of Act 129 on June 1, 2021, the four FirstEnergy PA EDCs reported and verified gross electric energy savings and gross peak demand savings are shown in Table 3 below.

Table 3: Gross Reported and Verified Electric and Demand Savings since the beginning of Phase IV of Act 129

EDC	RTD MWh	RTD MW	VTD MWh	VTD MW
Met-Ed	384,767	67.4	379,912	60.4
Penelec	306,870	59.5	290,211	52.0
Penn Power	97,060	18.5	92,022	15.6
West Penn Power	383,631	70.6	368,007	59.3

Achievements toward Phase IV Energy Savings compliance, including carryover savings from Phase III, are shown in Table 4 below for the four PA EDCs.

Table 4: Phase IV Electric Savings including Phase III Carryover

EDC	VTD +CO MWh	MWh Compliance Target	Percent of Energy Target to Date	VTD MW	MW Compliance Target	Percent of Demand Target to Date
Met-Ed	527,215	463,215	114%	60.4	76	79%
Penelec	420,236	437,676	96%	52.0	80	65%
Penn Power	158,599	128,909	123%	15.6	20	78%
West Penn Power	536,486	504,951	106%	59.3	86	69%

Figure 3 and Figure 4 summarize progress towards the Phase IV MWh and MW portfolio compliance targets, respectively, for each of the four EDCs.

Figure 3: EE&C Plan Performance toward Phase IV Portfolio Compliance Target

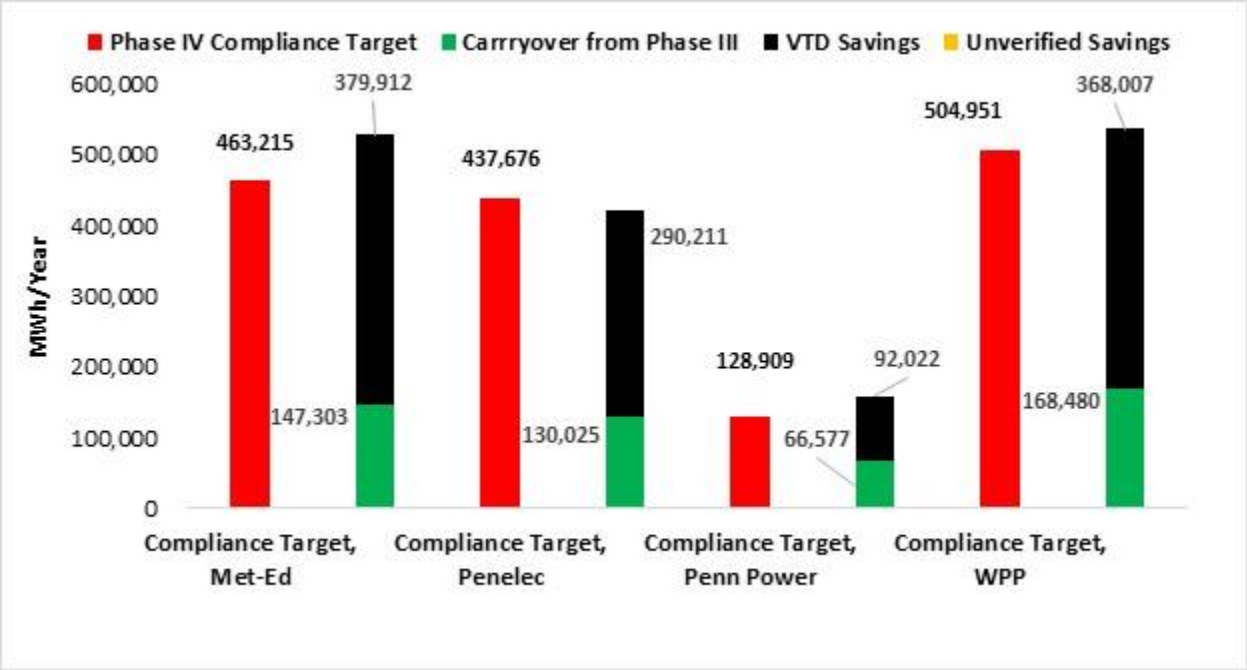
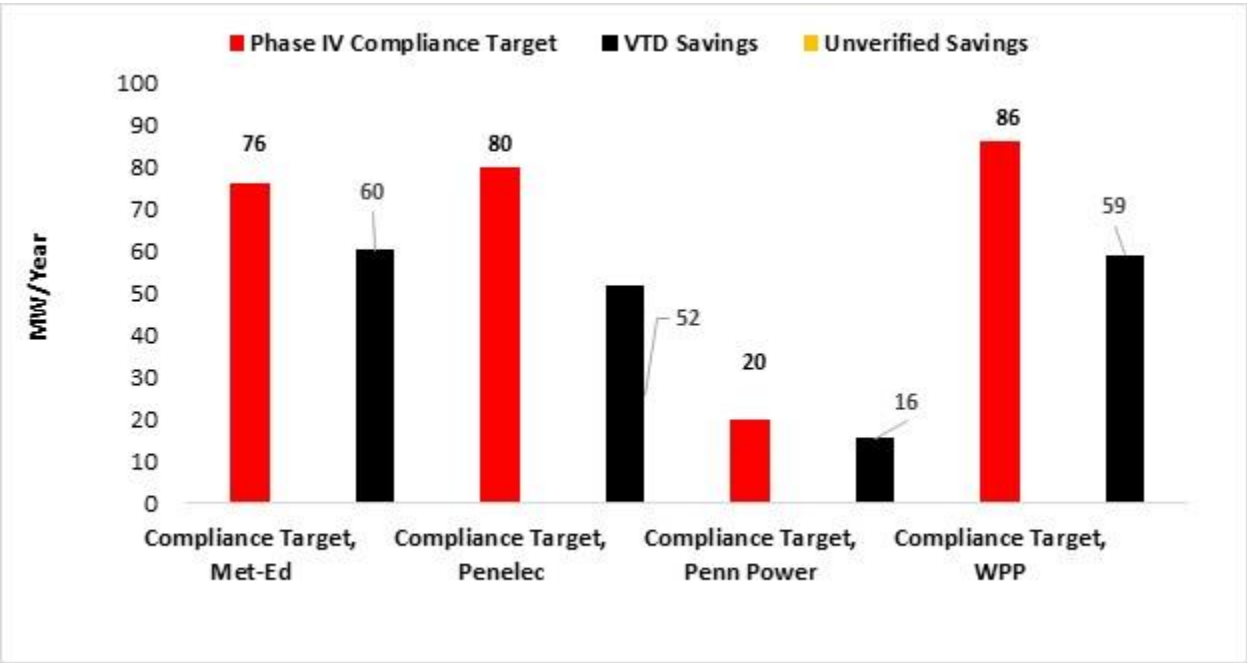


Figure 4: EE&C Plan Performance toward Phase IV Portfolio Compliance Target



2.2.1 Phase IV Prescription of Low-Income Measures and Carve-Out

The Phase IV Implementation Order directed EDCs to offer conservation measures to the low-income customer segment based on the proportion of electric sales attributable to low-income households. The proportionate number of measures targets for the EDCs are listed in the second column of Table 5. The total number of EE&C measures offered by each EDC to its residential and non-residential customer classes are shown in the third column. The fourth column shows the number of measures available to the low-income customer segment at no cost to the customer. The last column shows the percentages of total measures offered in the EE&C plan. These percentages exceed the proportionate number of measures targets for each EDC.

Table 5: Proportion of Measures Offered to Low-Income Customers

EDC	% Proportionate Number of Measures Target	Total Measures Offered	Number of Measures Available at No Cost	% Measures Offered
Met-Ed	9%	136	29	21%
Penelec	10%	136	29	21%
Penn Power	11%	136	29	21%
West Penn Power	9%	136	29	21%

The PA PUC also established a low-income energy savings target of 5.8% of the portfolio savings goal. The second column of Table 6 shows the low-income savings targets, based on verified gross savings, for each EDC. The third column of the table shows the verified low-income impacts, inclusive of Phase III carryover. The percentages of the Phase IV low-income energy savings targets achieved to date are shown in the last column of the table.

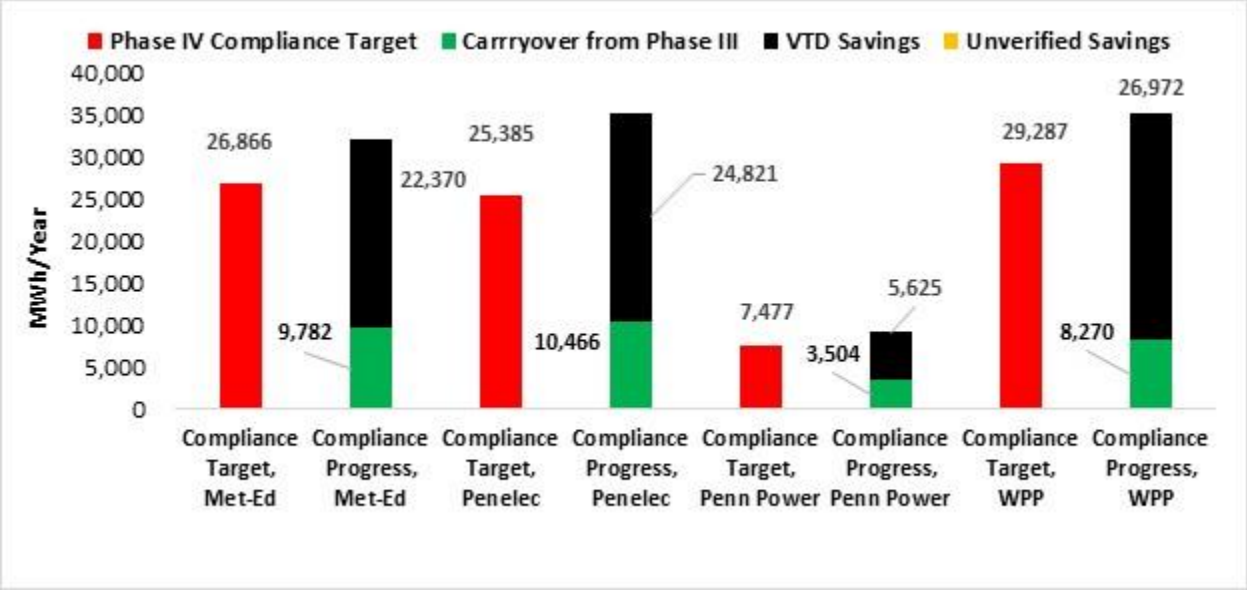
Table 6: Low-Income Program Energy Savings and Targets[5]

EDC	Compliance Target	LI VTD +CO MWh	Percent of Target to Date
Met-Ed	26,866	32,152	120%
Penelec	25,385	35,287	139%
Penn Power	7,477	9,129	122%
West Penn Power	29,287	35,242	120%

Figure 5 compares the VTD performance for the low-income customer segment to the Phase IV savings target.

[5] The sum of the LI VTD + CO in this table may differ by ±1 MWh from the sum of the VTD and CO reported in Figure 2 due to rounding. The values in Table 6 result from adding unrounded elements, and then rounding to the nearest MWh.

Figure 5: EE&C Plan Performance toward Phase IV Low-Income Compliance Target



2.2.2 Phase IV Performance, Multifamily Housing

The first and second column of Table 7 respectively show verified gross electric energy savings (PYVTD) in the multifamily sector and for low-income customers within that sector. based on verified gross savings, for each EDC. The third and fourth columns of the table show Phase IV verified gross electric energy savings (VTD) in the multifamily sector and for low-income customers within that sector.

Table 7: Energy Savings in the Multifamily Sector

EDC	PYVTD MF MWh	PYVTD MF LI MWh	VTD MF MWh	VTD MF LI MWh
Met-Ed	1,007	971	3,116	2,555
Penelec	1,604	1,475	4,281	3,987
Penn Power	676	424	917	658
West Penn Power	1,387	787	4,541	3,789

2.3 PHASE IV PERFORMANCE BY CUSTOMER SEGMENT

Table 8 presents the participation[6], savings, and spending by customer sector for PY16. The residential, small C&I, and large C&I sectors are defined by EDC tariff and the residential low-income and governmental/educational/non-profit sector were defined by statute (66 Pa. C.S. §

[6] The definition of participant is discussed in Section 2.4 below.

2806.1). The residential low-income 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 Large C&I rate classes. The savings, spending, and participation values for the LI and GNI segments have been removed from the parent sectors in Table 8.

Table 8: Program Year 16 Summary Statistics by Customer Segment

EDC	Parameter	Residential (Non-LI)	Low Income	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI	Total
Met-Ed	# participants	149,592	35,720	3,546	558	29	189,445
	PYVTD MWh/yr	36,301	5,952	32,250	87,470	1,090	163,063
	PYVTD MW/yr	5.29	0.71	7.27	13.87	0.21	27.35
	Incentives ($1000)	$3,630	$2,265	$5,193	$4,754	$307	$16,150
Penelec	# participants	221,351	34,513	4,686	493	76	261,119
	PYVTD MWh/yr	21,360	5,216	51,325	30,813	1,957	110,670
	PYVTD MW/yr	3.68	0.33	11.18	5.33	0.38	20.90
	Incentives ($1000)	$2,766	$3,089	$7,004	$3,173	$598	$16,630
Penn Power	# participants	76,146	8,056	488	123	25	84,838
	PYVTD MWh/yr	11,417	1,020	11,145	8,483	550	32,615
	PYVTD MW/yr	1.33	0.17	2.59	1.44	0.08	5.60
	Incentives ($1000)	$1,301	$912	$1,236	$826	$200	$4,475
West Penn Power	# participants	257,218	31,613	2,032	523	71	291,457
	PYVTD MWh/yr	27,980	5,083	42,090	40,779	44,737	160,670
	PYVTD MW/yr	5.58	0.76	8.30	7.26	5.23	27.13
	Incentives ($1000)	$3,767	$2,782	$5,605	$3,764	$1,213	$17,132

Table 9 summarizes plan performance by sector since the beginning of Phase IV.

Table 9: Phase IV Summary Statistics by Customer Segment

EDC	Parameter	Residential (Non-LI)	Low Income	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI	Total
Met-Ed	# participants	476,129	97,103	5,385	1,015	97	579,729
	VTD MWh/yr	109,024	20,449	85,819	161,318	3,301	379,912
	VTD MW	17.1	2.8	16	24	1	60.4
	Incentives ($1000)	$15,543	$6,688	$16,365	$8,025	$783	$47,403
Penelec	# participants	547,686	86,303	7,060	832	134	642,015
	VTD MWh/yr	80,516	22,258	111,166	72,700	3,571	290,211
	VTD MW	13.1	2.3	24	12	1	52.0
	Incentives ($1000)	$10,984	$9,210	$20,071	$5,948	$897	$47,110
Penn Power	# participants	174,268	22,798	1,030	256	52	198,404
	VTD MWh/yr	33,673	5,427	23,844	27,211	1,867	92,022
	VTD MW	5.3	0.8	5	4	0	15.6
	Incentives ($1000)	$4,986	$2,501	$4,733	$2,351	$390	$14,960
West Penn Power	# participants	629,777	86,446	4,531	946	113	721,813
	VTD MWh/yr	94,198	24,890	106,461	95,860	46,598	368,007
	VTD MW	16.2	3.1	19	15	6	59.3
	Incentives ($1000)	$14,335	$9,432	$19,399	$8,238	$1,703	$53,108

2.4 Summary of Participation by Program

Participation is defined differently for certain programs 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 bullets below. Table 10 provides the current participation totals for PY16 and Phase IV.

- For the Appliance Recycling components of the Energy Efficient Products, Low-Income Energy Efficiency Program, and Energy Solutions for Business – Small Program, participation is the count of rebate applications, which corresponds to appliance pick-up events. If a homeowner recycles two refrigerators on one occasion, that counts as one participant.
- For the Home Energy Reports and Online Audit components of the Energy Efficient Homes and Low-Income Energy Efficiency Programs, the number of participants is taken as the maximum number of participants in the treatment group during the year. This definition of participant is selected because it aligns with the gross impact evaluation protocol for Home Energy Reports.
- For the Conservation Kits components of the Energy Efficient Homes Program and Low-Income Energy Efficiency Programs, the participant counts are equal to the overall count of kits distributed by each program. In nearly all cases, one kit is sent to a household.
- For the Residential New Construction components of the Energy Efficient Homes Program and Low-Income Energy Efficiency Programs, the participant count is equal to the number of houses (or in the case of multifamily housing, the number of dwelling units).

- For the Direct Install component of the Energy Efficient Homes Program, the participant count is equal to the number of rebate homes treated in the program.
- For Midstream Appliances component of the Energy Efficient Products Program, the participant count is equal to the number of appliances sold.
- For the Upstream Electronics component of the Energy Efficient Products Program, the participant count is equal to the number of electronics equipment sold.
- For the HVAC component of the Energy Efficient Products Program, the participant count is equal to the sum of HVAC units and HVAC tune-ups rebated by the program. If a customer purchases multiple HVAC units or tune-ups, then the customer counts as two participants. The majority of rebate applications, however, are for a single HVAC system or service.
- For the Appliances components of the Energy Efficient Products Program and the Low-Income Energy Efficiency Program, the participant count is equal to the sum of rebate applications. If a customer purchases multiple appliances and submits one application for them all, then the customer counts as one participant. If a customer submits multiple rebate applications, then they count as multiple participants.
- For the Direct Install component of the Low-Income Energy Efficiency Program, the participant count is equal to the number of homes treated in the program.
- For the downstream and midstream rebates in all nonresidential energy efficiency programs, the participant count is equal to the number of unique account numbers associated with rebate applications for the program year.

Table 10: EE&C Portfolio Participation by Program

Utility	Program	PY16 Participation	P4TD Participation
Met-Ed	Energy Efficient Homes	134,205	385,092
	Energy Efficient Products	15,387	91,037
	Low Income Energy Efficiency	35,720	97,103
	C&I Energy Solutions for Business - Small	3,565	5,454
	C&I Energy Solutions for Business - Large	568	1,043
	Portfolio Total	**189,445**	**579,729**
Penelec	Energy Efficient Homes	203,983	466,757
	Energy Efficient Products	17,368	80,929
	Low Income Energy Efficiency	34,513	86,303
	C&I Energy Solutions for Business - Small	4,740	7,167
	C&I Energy Solutions for Business - Large	515	859
	Portfolio Total	**261,119**	**642,015**
Penn Power	Energy Efficient Homes	69,284	142,148
	Energy Efficient Products	6,862	32,120
	Low Income Energy Efficiency	8,056	22,798
	C&I Energy Solutions for Business - Small	510	1,072
	C&I Energy Solutions for Business - Large	126	266
	Portfolio Total	**84,838**	**198,404**
West Penn Power	Energy Efficient Homes	238,775	542,771
	Energy Efficient Products	18,443	87,006
	Low Income Energy Efficiency	31,613	86,446
	C&I Energy Solutions for Business - Small	2,095	4,632
	C&I Energy Solutions for Business - Large	531	958
	Portfolio Total	**291,457**	**721,813**

2.5 Summary of Impact Evaluation Results

During PY16 the ADM team completed gross impact evaluations for all the energy efficiency programs in the portfolio, and all program components except for Appliance Recycling, Residential and Commercial New Construction and Multifamily, Residential Direct Install (both Low-Income and non-Low-Income), and Nonresidential Prescriptive Downstream Appliances. The ADM team completed net impact evaluation for the Residential and Commercial Multifamily, School Education and Energy Efficiency Kits (both low-income and non-low-income), Residential Comprehensive Audits, and Residential HVAC initiatives. Table 11 and Table 12 summarize the realization rates and net-to-gross ratios by program. Initiative-level evaluation detail is available in the Appendices to this report. Note that net-to-gross studies for some initiatives are scheduled for subsequent program years. The net-to-gross ratios shown in the tables, other than for the initiatives evaluated for net-to-gross in PY13 through PY16, derive from comparable programs and initiatives offered by the Companies in Phase III of Act 129.

Table 11: Impact Evaluation Results Summary for Met-Ed and Penelec

Program Component	Program	Met-Ed			Penelec		
		Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio
EE Kits	Energy Efficient Homes	90.1%	91.4%	81.6%	90.0%	93.3%	106.1%
Home Energy Reports	Energy Efficient Homes	104.0%	29.3%	100.0%	50.7%	32.8%	100.0%
Direct Install	Energy Efficient Homes	97.2%	73.0%	86.7%	108.3%	76.0%	99.1%
New Homes	Energy Efficient Homes	100.8%	85.0%	72.0%	96.4%	85.0%	72.0%
Multifamily	Energy Efficient Homes	101.2%	90.6%	99.5%	101.3%	75.1%	99.5%
Online Audits	Energy Efficient Homes	29.4%	48.6%	100.0%	41.8%	62.6%	100.0%
Appliance Recycling	Energy Efficient Products	108.5%	113.7%	62.0%	103.4%	103.4%	60.0%
HVAC	Energy Efficient Products	159.0%	138.8%	50.6%	109.6%	117.7%	69.7%
Appliances	Energy Efficient Products	110.6%	111.5%	67.9%	104.4%	102.5%	49.4%
Midstream Appliances	Energy Efficient Products	107.5%	103.6%	57.6%	103.4%	100.7%	47.8%
Appliances	Low Income Program	110.6%	111.5%	100.0%	104.4%	102.5%	100.0%
Appliance Turn-In	Low Income Program	116.5%	123.0%	100.0%	126.1%	117.6%	100.0%
Direct Install	Low Income Program	103.4%	103.2%	100.0%	100.2%	102.1%	100.0%
Home Energy Reports	Low Income Program	102.2%	46.9%	100.0%	191.8%	1625.0%	100.0%
Kits	Low Income Program	102.8%	108.3%	100.0%	104.5%	105.3%	100.0%
New Homes	Low Income Program	100.8%	85.0%	100.0%	96.4%	85.0%	100.0%
Online Audits	Low Income Program	169.8%	234.4%	100.0%	211.5%	295.0%	100.0%
CI Prescriptive	C&I Solutions for Business Programs - Small and Large	93.8%	96.4%	64.0%	95.2%	79.1%	65.9%
CI Custom	C&I Solutions for Business Programs - Small and Large	100.4%	108.4%	55.7%	100.2%	118.0%	47.6%
CI EMNC	C&I Solutions for Business Programs - Small and Large	82.1%	77.3%	67.9%	88.5%	87.8%	78.3%
CI Multifamily	C&I Solutions for Business Program - Small	104.2%	112.3%	99.5%	92.8%	102.7%	99.5%
Appliance Recycling	C&I Solutions for Business Program - Small	108.5%	113.7%	62.0%	103.4%	103.4%	60.0%

Table 12: Impact Evaluation Results Summary for Penn Power and WPP

Program Component	Program	Penn Power			West Penn Power		
		Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio
EE Kits	Energy Efficient Homes	91.9%	92.6%	85.0%	89.5%	91.7%	95.7%
Home Energy Reports	Energy Efficient Homes	99.0%	14.4%	100.0%	29.3%	29.5%	100.0%
Direct Install	Energy Efficient Homes	107.4%	75.5%	94.1%	102.9%	78.3%	91.3%
New Homes	Energy Efficient Homes	102.5%	78.5%	72.0%	95.8%	83.2%	72.0%
Multifamily	Energy Efficient Homes	99.7%	77.8%	99.5%	100.6%	91.8%	99.5%
Online Audits	Energy Efficient Homes	27.4%	46.0%	100.0%	31.2%	49.6%	100.0%
Appliance Recycling	Energy Efficient Products	108.4%	108.7%	61.0%	109.2%	108.7%	66.0%
HVAC	Energy Efficient Products	94.8%	99.0%	54.7%	108.2%	105.1%	54.8%
Appliances	Energy Efficient Products	106.5%	112.9%	52.3%	103.2%	106.2%	52.2%
Midstream Appliances	Energy Efficient Products	101.7%	100.7%	50.2%	103.5%	100.9%	50.0%
Appliances	Low Income Program	106.5%	112.9%	100.0%	103.2%	106.2%	100.0%
Appliance Turn-In	Low Income Program	127.9%	113.9%	100.0%	123.7%	114.3%	100.0%
Direct Install	Low Income Program	105.0%	104.7%	100.0%	98.0%	99.1%	100.0%
Home Energy Reports	Low Income Program	50.1%	16.8%	100.0%	16.8%	116.0%	100.0%
Kits	Low Income Program	91.9%	92.6%	100.0%	89.5%	91.7%	100.0%
New Homes	Low Income Program	102.5%	78.5%	100.0%	95.8%	83.2%	100.0%
Online Audits	Low Income Program	206.3%	312.0%	100.0%	176.4%	266.6%	100.0%
CI Prescriptive	C&I Solutions for Business Programs - Small and Large	93.7%	88.5%	77.4%	97.2%	88.6%	68.0%
CI Custom	C&I Solutions for Business Programs - Small and Large	101.6%	115.9%	56.0%	102.0%	102.1%	56.3%
CI EMNC	C&I Solutions for Business Programs - Small and Large	85.2%	96.3%	74.8%	113.1%	88.8%	71.6%
CI Multifamily	C&I Solutions for Business Program - Small	102.4%	103.1%	99.5%	101.1%	105.3%	99.5%
Appliance Recycling	C&I Solutions for Business Program - Small	108.4%	108.7%	61.0%	109.2%	108.7%	66.0%

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 13, Table 14, Table 15, and Table 16 present a summary of the Program Year 16 and Phase IV to date incremental annual energy savings by program for Met-Ed, Penelec, Penn Power, and WPP respectively. As discussed earlier, the energy impacts in this report are

presented at the meter level and do not reflect adjustments for transmission and distribution losses, while the demand impacts do reflect those losses. The verified gross savings are adjusted by the energy recent realization rate and the verified net savings are adjusted by both the realization rate and the net-to-gross ratio.

Table 13: Incremental Annual Energy Savings by Program - Met-Ed

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	30,072	28,795	25,728	82,126	70,870	61,378
Energy Efficient Products	6,256	7,506	4,365	34,144	38,154	18,567
Low Income Program	5,750	5,952	5,952	19,421	20,449	20,449
C&I Solutions for Business Program - Small	35,901	32,555	21,082	88,101	87,983	62,598
C&I Solutions for Business Program - Large	91,086	88,255	51,570	160,975	162,455	97,061
Portfolio Total	**169,065**	**163,063**	**108,697**	**384,767**	**379,912**	**260,053**

Table 14: Incremental Annual Energy Savings by Program - Penelec

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	21,685	16,463	17,086	68,179	56,415	54,001
Energy Efficient Products	4,694	4,897	2,740	23,118	24,101	13,846
Low Income Program	4,481	5,216	5,216	20,535	22,258	22,258
C&I Solutions for Business Program - Small	55,680	52,293	35,326	118,904	113,374	81,283
C&I Solutions for Business Program - Large	33,516	31,801	20,780	76,133	74,062	48,927
Portfolio Total	**120,057**	**110,670**	**81,147**	**306,870**	**290,211**	**220,316**

Table 15: Incremental Annual Energy Savings by Program – Penn Power

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	9,876	9,489	8,468	25,659	24,220	20,885
Energy Efficient Products	1,859	1,929	1,056	9,054	9,453	4,370
Low Income Program	1,228	1,020	1,020	6,055	5,427	5,427
C&I Solutions for Business Program - Small	12,249	11,490	8,576	27,085	24,833	20,414
C&I Solutions for Business Program - Large	8,881	8,688	5,597	29,208	28,089	21,073
Portfolio Total	**34,093**	**32,615**	**24,717**	**97,060**	**92,022**	**72,169**

Table 16: Incremental Annual Energy Savings by Program - WPP

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	36,825	21,992	20,571	88,231	64,107	62,547
Energy Efficient Products	5,609	5,988	3,473	27,997	30,091	17,728
Low Income Program	5,708	5,083	5,083	24,168	24,890	24,890
C&I Solutions for Business Program - Small	43,683	44,174	30,081	108,104	110,175	83,205
C&I Solutions for Business Program - Large	81,848	83,433	50,929	135,131	138,743	89,926
Portfolio Total	**173,673**	**160,670**	**110,136**	**383,631**	**368,007**	**278,295**

The previously reported VTD savings from prior years have not changed.

2.6.2 Lifetime Energy Savings by Program

Table 17, Table 18, Table 19, and Table 20 present the PYTD and P4TD lifetime energy savings by program for Met-Ed, Penelec, Penn Power, and WPP respectively. Lifetime savings are calculated by using expected useful lives (EULs) listed in the PA TRM for each measure, subject to a 15-year cap. For commercial and industrial projects, the measure lives are first determined for each sampled project during gross impact evaluation. The measure lives are then weighted by sampling initiative and EDC as the ratio between verified lifetime energy savings and program-year verified savings. This step is conducted in part because measure lives, as determined post-verification, may differ from ex-ante measure lives in the tracking database[7], and in part to maintain consistency between verified impacts, measure lives, and incremental costs for all sampled projects. For cases that involve early replacement, the measure life is adjusted to replicate the effect of a dual-baseline benefits stream. This involves calculating a discounted lifetime savings for the measure with the first period corresponding to the remaining useful life (RUL) of the supplanted equipment (taken to be 1/3 of the measure life) and using the supplanted equipment as the baseline, and with the second period using the prevailing code or standard at the end of the RUL as the baseline. The adjustment factor for measure life is the ratio of the discounted lifetime savings with the dual-baseline approach compared to the discounted lifetime savings as calculated by using the first-year savings for the duration of the nominal measure life.

Table 17: Lifetime Energy Savings by Program for Met-Ed

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Energy Efficient Homes	223,936	183,547	675,013	548,400
Energy Efficient Products	70,199	39,506	353,314	175,579
Low Income Energy Efficiency	38,416	38,416	154,227	154,227
C&I Energy Solutions for Business - Small	470,208	301,825	1,256,005	884,759
C&I Energy Solutions for Business - Large	1,304,976	761,367	2,390,359	1,424,417
Portfolio Total	**2,107,734**	**1,324,662**	**4,828,919**	**3,187,382**

[7] For example, a project may consist of various measures with different lifetimes can have different realization rates by measure.

Table 18: Lifetime Energy Savings by Program for Penelec

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Energy Efficient Homes	167,397	175,420	608,148	576,590
Energy Efficient Products	44,362	24,595	217,873	121,778
Low Income Energy Efficiency	32,270	32,270	175,794	175,794
C&I Energy Solutions for Business - Small	757,456	507,179	1,633,712	1,162,317
C&I Energy Solutions for Business - Large	462,631	301,906	1,072,604	707,137
Portfolio Total	**1,464,116**	**1,041,369**	**3,708,131**	**2,743,615**

Table 19: Lifetime Energy Savings by Program for Penn Power

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Energy Efficient Homes	76,670	62,423	250,270	204,236
Energy Efficient Products	17,460	9,271	89,174	41,941
Low Income Energy Efficiency	4,637	4,637	37,649	37,649
C&I Energy Solutions for Business - Small	167,961	125,219	357,493	292,970
C&I Energy Solutions for Business - Large	129,556	83,375	408,032	303,574
Portfolio Total	**396,285**	**284,925**	**1,142,618**	**880,369**

Table 20: Lifetime Energy Savings by Program for WPP

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Energy Efficient Homes	221,950	202,210	684,436	659,970
Energy Efficient Products	53,514	29,597	268,788	149,676
Low Income Energy Efficiency	40,404	40,404	199,896	199,896
C&I Energy Solutions for Business - Small	639,963	435,025	1,588,296	1,189,355
C&I Energy Solutions for Business - Large	1,225,411	745,503	2,040,368	1,318,444
Portfolio Total	**2,181,241**	**1,452,738**	**4,781,783**	**3,517,341**

The previously reported VTD lifetime savings from prior years have not changed.

2.7 Summary of Demand 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. The 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. Table 21 lists the line loss multipliers by EDC and by sector.

Table 21: Line Loss Multipliers by EDC and Customer Sector

Sector	Met-Ed	Penelec	Penn Power	WPP
Residential	1.0945	1.0945	1.0949	1.0943
Small C&I	1.0720	1.0720	1.0545	1.0790
Large C&I	1.0720	1.0720	1.0545	1.0790

Summaries of the peak demand impacts by energy efficiency program through the current reporting period are presented in Table 22, Table 23, Table 24, and Table 25 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 22: Peak Demand Savings by Energy Efficiency Program for Met-Ed

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	7.97	3.62	3.23	15.52	9.29	7.93
Energy Efficient Products	1.44	1.67	0.99	7.48	7.80	3.76
Low Income Energy Efficiency	0.88	0.71	0.71	2.96	2.82	2.82
C&I Energy Solutions for Business - Small	7.88	7.33	4.64	17.60	16.63	11.43
C&I Energy Solutions for Business - Large	13.80	14.02	8.22	23.88	23.85	14.36
Portfolio Total	**31.97**	**27.35**	**17.78**	**67.44**	**60.39**	**40.31**

Table 23: Peak Demand Savings by Energy Efficiency Program for Penelec

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	5.05	2.53	2.59	10.37	7.61	7.32
Energy Efficient Products	1.11	1.15	0.64	5.46	5.51	3.17
Low Income Energy Efficiency	0.49	0.33	0.33	2.51	2.30	2.30
C&I Energy Solutions for Business - Small	13.20	11.37	7.51	26.78	23.92	16.96
C&I Energy Solutions for Business - Large	6.56	5.52	3.59	14.39	12.67	8.29
Portfolio Total	**26.41**	**20.90**	**14.65**	**59.51**	**52.01**	**38.03**

Table 24: Peak Demand Savings by Energy Efficiency Program for Penn Power

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	2.46	0.93	0.79	5.29	3.31	2.78
Energy Efficient Products	0.38	0.40	0.22	1.98	2.00	0.92
Low Income Energy Efficiency	0.49	0.17	0.17	1.07	0.78	0.78
C&I Energy Solutions for Business - Small	2.84	2.64	1.94	5.68	5.17	4.16
C&I Energy Solutions for Business - Large	1.43	1.46	0.96	4.47	4.35	3.30
Portfolio Total	**7.60**	**5.60**	**4.08**	**18.49**	**15.61**	**11.94**

Table 25: Peak Demand Savings by Energy Efficiency Program for WPP

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	9.47	4.23	4.01	17.76	9.79	9.35
Energy Efficient Products	1.27	1.34	0.80	6.37	6.46	3.87
Low Income Energy Efficiency	0.71	0.76	0.76	3.26	3.14	3.14
C&I Energy Solutions for Business - Small	9.58	8.64	5.80	21.97	19.94	14.56
C&I Energy Solutions for Business - Large	12.71	12.15	7.54	21.23	19.95	13.21
Portfolio Total	**33.74**	**27.13**	**18.91**	**70.60**	**59.28**	**44.12**

The previously reported VTD savings have not changed since the PY15 final annual report was submitted.

2.7.1 Peak Demand Savings Nominated to PJM Forward Capacity Market (FCM)

Table 26, Table 27, Table 28, and Table 29 summarize the potential PJM Phase IV peak demand savings by Act 129 program year and PJM delivery year for Met-Ed, Penelec, Penn Power, and West Penn Power. All values shown below represent installed capacity as defined in PJM Manual 18. Note that the only PY16 contributions reflected below are those that have been verified in time for the 2025/26 Post-Install report, which was due in early May 2025.

Table 26: Met-Ed Potential FCM Nominations by PY & 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	3.7	3.8	3.7	0.0				
PY14	3.2	2.5	3.2	0.0	0			
PY15	2.2		2.2	3.2	0	0		
PY16	2.4 to 4.2			0.6	0	0	0	
PY17	0				0	0	0	0
Phase IV Total	**12.0 to 21.0**	**6.3**	**9.2**	**3.8**	**0 to 0**	**0 to 0**	**0 to 0**	**0 to 0**

Table 27: Penelec Potential FCM Nominations by PY & 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	3.1	2.5	3.1	0.0				
PY14	3.9	1.8	3.9	0.0	0			
PY15	2.1		2.1	2.4	0	0		
PY16	2.8 to 4.2			0.7	0	0	0	
PY17	0				0	0	0	0
Phase IV Total	**14.0 to 21.0**	**4.2**	**9.2**	**3.1**	**0 to 0**	**0 to 0**	**0 to 0**	**0 to 0**

Table 28: Penn Power Potential FCM Nominations by PY & 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	0.6	0.8	0.6	0.0				
PY14	0.7	0.4	0.7	0.0	0			
PY15	0.5		0.5	1.1	0	0		
PY16	0.8 to 1.2			0.6	0	0	0	
PY17	0				0	0	0	0
Phase IV Total	**4.0 to 6.0**	**1.2**	**1.8**	**1.7**	**0 to 0**	**0 to 0**	**0 to 0**	**0 to 0**

Table 29: WPP Potential FCM Nominations by PY & 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	2.5	3.3	2.5	0.0				
PY14	3.8	2.6	3.8	0.0	0			
PY15	2.9		2.9	5.6	0	0		
PY16	2.3 to 4.1			0.9	0	0	0	
PY17	0				0	0	0	0
Phase IV Total	**11.5 to 20.5**	**6**	**9.2**	**6.6**	**0 to 0**	**0 to 0**	**0 to 0**	**0 to 0**

The values in the tables above remain consistent with the original estimated ranges of the PJM Summer and Winter MW EE potential for each PJM delivery year as shown in Appendix C, Table C-3 based on the MWh savings as projected in the EE&C Plan, based on the following assumptions and modifications:

- Identified and removed energy savings of all measures not eligible for PJM including:
  - appliance recycling;
  - building lighting controls and occupancy sensors;
  - smart thermostats, energy management systems or smart homes;
  - behavioral and educational programs;
- Excluded some low-volume measures for which PJM-required M&V activities would likely cost more than the associated PJM revenues.

- The EDCs retain all Phase IV Plan program Capacity Rights to support their offered EE resources and to ensure no double counting of EE resources by third parties;
- Assigned an initial savings load shape to each PJM eligible EE measure; Estimated the potential kW savings values for each measure for the PJM defined Summer and Winter periods using the appropriate load shape curve; and
- Included T & D line losses to adjust retail kW values to wholesale kW values.

Offers associated with PY13 through PY16 reflect measurement and verification results from the DY 23/24 through DY 25/26 Post-Install Measurement and Verification reports.

DY 25/26 was the final year for which PJM accepted energy efficiency offers in the FCM. Additional offers are not anticipated beyond DY 25/26.

Revenues from PJM's FCM will be used to offset cost recovery on a per customer class basis. PJM revenues will be treated as program cost reductions, and market participation costs or deficiency charges (if any), will be treated as program cost increases.

2.8 Summary of Fuel Switching Impacts

Act 129 allows EDCs to achieve electric savings by converting electric equipment to non-electric equipment. Table 30 summarizes for each EDC, key fuel switching metrics to date in Phase IV. Combined Heat and Power (CHP), fuel cells, and solar water heating are the only fuel switching measures offered by the Companies in Phase IV. In PY16, West Penn Power provided incentives for one CHP project and Met-Ed provided incentives for one fuel cell project.

Table 30: Phase IV to Date Fuel Switching Summary

	Met-Ed	Penelec	Penn Power	WPP
Fuel Switching Measures Offered	CHP, Solar Water Heaters			
Fuel Switching Measures Implemented in PY16	Fuel Cell	None	None	CHP
Fuel Switching Measures Implemented in Phase IV	CHP, Fuel Cell	CHP	None	CHP
PY16 Energy Savings Achieved via Fuel Switching (MWh/yr)	59,195	0	0	0
PY16 Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	310,740	0	0	209,750
PY16 Incentive Payments for Fuel Switching Measures ($1000)	500	0	0	500
VTD Energy Savings Achieved via Fuel Switching (MWh/yr)	78,339	2,878	0	0
P4TD Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	425,106	92,381	0	209,750
P4TD Incentive Payments for Fuel Switching Measures ($1000)	1,170	399	0	500

2.9 Summary of Renewable Energy Impacts

Act 129 allows EDCs to incentivize behind-the-meter solar photovoltaics and other renewable energy generation measures that offset the need for electricity from the grid. Table 31 summarizes the energy savings, peak demand reduction, and incentive totals for renewable energy measures in PY16 and Phase IV to date.

Table 31: Renewables Summary

Metric	Met-Ed		Penelec		Penn Power		WPP	
	PY16	P4TD	PY16	P4TD	PY16	P4TD	PY16	P4TD
Renewable Energy Measures Implemented	Solar Power	Solar Power	Solar Power	Solar Power	Solar Power	Solar Power	Solar Power	Solar Power
VTD Residential Energy Savings Achieved via Renewables (MWh/yr)	88.08	88.08	99.10	99.10	0.00	0.00	50.74	50.74
VTD Residential Peak Demand Savings Achieved via Renewables (MW/yr)	0.02	0.02	0.02	0.02	0.00	0.00	0.01	0.01
Incentive Payments for Residential Renewable Energy Measures ($1000)	3.00	3.00	2.50	2.50	0.00	0.00	2.00	2.00
VTD Non-Residential Energy Savings Achieved via Renewables (MWh/yr)	7,402	11,333	5,241	9,245	976	976	2,623	2,671
VTD Non-Residential Peak Demand Savings Achieved via Renewables (MW/yr)	1.88	2.80	1.71	2.88	0.35	0.35	0.71	0.72
Incentive Payments for Non-Residential Renewable Energy Measures ($1000)	728.18	1,116.25	403.79	834.41	61.92	61.92	244.32	247.13

2.10 Summary of Cost-Effectiveness Results

A detailed breakdown of portfolio finances and cost-effectiveness is presented for Met-Ed, Penelec, Penn Power, and West Penn Power in Table 32, Table 33, Table 34, and Table 35. TRC benefits in these tables were calculated using gross verified impacts. Net present value (NPV) PY16 costs and benefits are expressed in 2024 dollars. Net present value costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 32: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)	
1	**IMCs**	59,222		117,307	
2	Rebates to Participants and Trade Allies	12,684		28,553	
3	Upstream / Midstream Incentives	979		4,540	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,698		8,673	
5	Direct Installation Program Materials and Labor	2,335		5,632	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	40,527		69,909	
		EDC	CSP	EDC	CSP
7	Program Design	28	14	29	51
8	Administration and Management	637	8,240	3,082	13,082
9	Marketing	54	1,732	130	2,767
10	Program Delivery	55	353	225	4,207
11	EDC Evaluation Costs	736		3,006	
12	SWE Audit Costs	253		1,020	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	12,102		27,600	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**71,324**		**144,907**	
15	Total NPV Lifetime Electric Energy Benefits	66,166		133,368	
16	Total NPV Lifetime Electric Capacity Benefits	33,889		69,900	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	-2,318		-2,160	
18	Total NPV Lifetime Fossil Fuel Impacts	-8,525		-12,610	
19	Total NPV Lifetime Water Impacts	6,036		17,131	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**95,249**		**205,629**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.34**		**1.42**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 33: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)	
1	**IMCs**	37,565		84,152	
2	Rebates to Participants and Trade Allies	11,066		25,016	
3	Upstream / Midstream Incentives	2,426		5,100	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,437		8,392	
5	Direct Installation Program Materials and Labor	3,322		8,600	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	18,314		37,043	
		EDC	CSP	EDC	CSP
7	Program Design	26	13	27	47
8	Administration and Management	602	6,812	2,955	11,368
9	Marketing	51	1,394	125	2,464
10	Program Delivery	51	250	205	3,719
11	EDC Evaluation Costs	671		2,758	
12	SWE Audit Costs	230		925	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	10,099		24,593	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**47,664**		**108,744**	
15	Total NPV Lifetime Electric Energy Benefits	46,848		103,498	
16	Total NPV Lifetime Electric Capacity Benefits	28,260		60,973	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,641		5,051	
18	Total NPV Lifetime Fossil Fuel Impacts	-1,781		-6,556	
19	Total NPV Lifetime Water Impacts	4,163		17,681	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**79,131**		**180,647**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.66**		**1.66**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 34: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)	
1	**IMCs**	11,653		35,182	
2	Rebates to Participants and Trade Allies	2,835		8,675	
3	Upstream / Midstream Incentives	704		1,631	
4	Material Cost for Self-Install Programs (EE&C Kits)	564		2,153	
5	Direct Installation Program Materials and Labor	1,077		2,501	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	6,472		20,223	
		EDC	CSP	EDC	CSP
7	Program Design	8	4	8	14
8	Administration and Management	241	1,781	1,096	3,630
9	Marketing	16	403	38	751
10	Program Delivery	18	85	75	1,353
11	EDC Evaluation Costs	180		784	
12	SWE Audit Costs	71		287	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	2,805		8,035	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**14,458**		**43,217**	
15	Total NPV Lifetime Electric Energy Benefits	13,119		33,335	
16	Total NPV Lifetime Electric Capacity Benefits	5,066		12,035	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	648		5,636	
18	Total NPV Lifetime Fossil Fuel Impacts	251		-50	
19	Total NPV Lifetime Water Impacts	1,243		4,240	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**20,328**		**55,196**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.41**		**1.28**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 35: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)	
1	**IMCs**	41,406		98,846	
2	Rebates to Participants and Trade Allies	12,296		30,251	
3	Upstream / Midstream Incentives	1,916		4,628	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,776		8,860	
5	Direct Installation Program Materials and Labor	2,844		9,367	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	21,574		45,741	
		EDC	CSP	EDC	CSP
7	Program Design	27	13	28	49
8	Administration and Management	660	8,303	3,076	13,548
9	Marketing	63	1,345	150	2,368
10	Program Delivery	47	289	199	4,535
11	EDC Evaluation Costs	664		2,826	
12	SWE Audit Costs	238		956	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	11,648		27,734	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**53,054**		**126,580**	
15	Total NPV Lifetime Electric Energy Benefits	72,418		139,491	
16	Total NPV Lifetime Electric Capacity Benefits	19,660		39,617	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	-2,359		1,955	
18	Total NPV Lifetime Fossil Fuel Impacts	-10,618		-11,136	
19	Total NPV Lifetime Water Impacts	5,341		16,899	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**84,441**		**186,825**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.59**		**1.48**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

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 incremental cost incurred by program participants to install efficient equipment, not just the portion covered by the EDC rebate. Appendix D shows the TRC ratios by program and for the portfolio.

2.11 Comparison of Performance to Approved EE&C Plan

Table 36 presents PY16 expenditures compared to the budget estimates set forth in the EE&C plan for PY16 and P4TD. PY16 values are presented in 2024 dollars and P4TD values are presented in 2021 dollars. Program-level comparisons of expenditures to plans are presented in Appendix D.

Table 36: Comparison of Expenditures to Phase IV EE&C Plan ($1,000)

EDC	Expenditures	Budget from EE&C Plan	Actual Expenditures	Ratio (Actual/Plan)
Met-Ed	PY16 Portfolio	$ 25,066.00	$ 30,797.40	1.23
Met-Ed	P4TD	$ 99,169.00	$ 82,153.25	0.83
Penelec	PY16 Portfolio	$ 23,189.00	$ 29,350.19	1.27
Penelec	P4TD	$ 91,620.00	$ 78,585.79	0.86
Penn Power	PY16 Portfolio	$ 6,695.00	$ 7,985.95	1.19
Penn Power	P4TD	$ 26,586.00	$ 25,050.49	0.94
West Penn Power	PY16 Portfolio	$ 23,714.00	$ 31,480.02	1.33
West Penn Power	P4TD	$ 94,038.00	$ 88,449.48	0.94

Table 37 and Table 38 compare PY16 and P4TD verified gross program savings and demand reductions compared to the energy savings projections set forth in the EE&C plan. Program-level comparisons of expenditures to plans are presented in Appendix D.

Table 37: Comparison of Actual Portfolio Savings to Plan Projections

EDC	Savings	EE&C Plan Projections	Gross MWh Savings	Ratio (Actual/Plan)
Met-Ed	PY16 Portfolio MWh	94,135	163,063	1.73
Met-Ed	P4TD MWh	370,589	379,912	1.03
Penelec	PY16 Portfolio MWh	90,954	110,670	1.22
Penelec	P4TD MWh	357,015	290,211	0.81
Penn Power	PY16 Portfolio MWh	26,367	32,615	1.24
Penn Power	P4TD MWh	103,278	92,022	0.89
West Penn Power	PY16 Portfolio MWh	95,185	160,670	1.69
West Penn Power	P4TD MWh	374,271	368,007	0.98

Table 38: Comparison of Actual Portfolio Demand Reductions to Plan Projections

EDC	Savings	EE&C Plan Projections	Gross MW Savings	Ratio (Actual/Plan)
Met-Ed	PY16 Portfolio MW	17.0	27.3	1.61
Met-Ed	P4TD MW	67.1	60.4	0.90
Penelec	PY16 Portfolio MW	16.5	20.9	1.27
Penelec	P4TD MW	65.0	52.0	0.80
Penn Power	PY16 Portfolio MW	5.0	5.6	1.11
Penn Power	P4TD MW	19.8	15.6	0.79
West Penn Power	PY16 Portfolio MW	18.0	27.1	1.51
West Penn Power	P4TD MW	71.0	59.3	0.84

PY13 included significant challenges related to program startup and launch. The Companies rolled out many new offerings and program elements and onboarded new ICSPs. The transition

to new programs and ICSPs, though started as soon as plans and contracts were approved, necessarily required more time than continuing with the same programs and ICSPs as Phase III. Supply chain and labor shortages persisted into PY14 and impeded program implementation and participation rates. The interruption of the Appliance Recycling program component in PY15 adversely affected peak demand reductions in the residential sector, as that program component consistently delivered high demand reductions per dollar of program spend. However, the Companies have worked with a new vendor to revive that program. The Companies have expended considerable resources in developing new strategies and initiatives to increase demand reductions for the remaining duration of Phase IV, and made significant progress toward their compliance targets in PY16. Overall, both energy and demand savings were much higher in PY16 than in previous years and demand reductions were, on average, 43% higher than corresponding values in the EE&C plan. This is also reflected in the increased spending in PY16. As of this writing, the Companies are closely managing progress toward compliance targets as well as remaining budgets. Portfolio budgets are under increased pressure due to an inflationary spike in PY13-PY15, which included the highest inflation rate in over four decades.

2.12 FINDINGS AND RECOMMENDATIONS

The impact and process evaluation activities completed by the ADM team provided recommendations for program improvement. Table 39 lists the overarching recommendations that affect more than one program, the evaluation activity(ies) that uncovered the finding, and the ADM team's recommendation(s) to the Companies to address the finding. All the overarching recommendations are intended to reduce noncompliance risks for Phase IV.

Table 39: Summary of Evaluation Recommendations

Evaluation Activity	Finding	Recommendation
General Evaluation	Projects involving solar power have helped to increase compliance likelihood due to their high kW to kWh ratios. However, the C/I sector has far outstripped the residential sector in solar rebates.	Increase customer outreach efforts and reduce procedural barriers to participation for solar power projects in the residential sector.
General Evaluation	All four EDCs are on track to comply with Phase IV energy savings and low-income energy-savings targets. Penelec and West-Penn Power are still struggling to meet demand-reduction targets, despite a successful PY16.	Consider reallocating funding from measures and programs that mainly provide energy savings, to those that can provide significant demand reductions (e.g., solar power, dehumidifiers, appliance recycling).
Cost-Effectiveness Evaluation	Midstream lighting, despite having slightly more variable realization rates than downstream lighting, is the most cost-effective program in the Companies' Act 129 compliance efforts.	Continue to scale the midstream program, especially in Penelec and West Penn Power. Consider a within-sector funding reallocation from less cost-effective programs.
Impact Evaluation	A number of factors cause significant evaluation uncertainty in the Home Energy Reports program. These include relatively small treatment/control cohorts, the lack of AMI data for older cohorts, and FYSTATE corrections.	For Phase V, the Companies will be treated as a single EDC, and can thus combine cohorts to achieve better signal-to-noise. Consider starting completely "from scratch" and employ a relatively small number of cohorts to keep the treatment/control groups as large as possible. Also consider a more detailed integration of the HER program into the tracking system, along with quarterly or semi-annual impact evaluations of the program.

3 Evaluation Results by Program

This section documents the gross impact, net impact, and process evaluation activities conducted in PY16 along with the outcomes of those activities. Not every program receives an evaluation every year. Planned evaluation activities for Phase IV are shown in Figure 6. Each row shows how savings from the initiative will be presented in that year's final annual report, where:

- V = verified using the results of the impact evaluation completed that year.
- H = verified using the results of a historic impact evaluation.
- U = unverified until the results of the impact evaluation are available.
- NA = the initiative is not offered in that program year.

The evaluation team plans on single-year sampling and data collection for any given evaluation effort denoted by the letter "V" in the table below.

Figure 6: Evaluation Activity Matrix

Sector	Initiative	Sub-Initiative	PY13	PY14	PY15	PY16	PY17
Residential	EE Kits	EE Kits	V	V	V	V	V
Residential	Home Energy Reports	Home Energy Reports	V	V	V	V	V
Residential	Home Energy Reports	LI - Home Energy Reports	V	V	V	V	V
Residential	LI Direct Install	LI Direct Install	V	V	H	V	V
Residential	Multifamily - Res	Multifamily - Res	V	V	H	V	V
Residential	New Homes	New Homes	V	V	H	V	V
Residential	Online Audits	LI - Online Audit	V	V	V	V	V
Residential	Online Audits	On-Line Audit	V	V	V	V	V
Residential	Residential Audit and DI	Residential Audit and DI	V	V	H	V	V
Residential	Residential Downstream Appliances	Downstream Appliances	V	V	V	V	V
Residential	Residential Downstream HVAC	Downstream HVAC	V	V	V	V	V
Residential	Residential Midstream Appliances	Midstream Appliances	V	V	V	V	V
Nonresidential	CI Custom	CI Custom	V	V	V	V	V
Nonresidential	CI EMNC	Building Improvements	V	V	V	V	V
Nonresidential	CI EMNC	Building Operations Training	V	V	V	V	V
Nonresidential	CI EMNC	Building Tune-Ups	V	V	V	V	V
Nonresidential	CI EMNC	Commissioning	NA	V	V	V	V
Nonresidential	CI EMNC	New Construction	V	V	H	V	V
Nonresidential	CI Multifamily	CI Multifamily	V	V	H	V	V
Nonresidential	CI Prescriptve	Downstream Lighting	V	V	V	V	V
Nonresidential	CI Prescriptve	Midstream Lighting	V	V	V	V	V
Nonresidential	CI Prescriptve	Downstream Nonlighting	V	V	V	V	V
Nonresidential	CI Prescriptve	Midstream Nonlighting	V	V	H	V	H
Cross-Cutting	Appliance Recycling	Appliance Recycling	V	V	V	V	V
Cross-Cutting	Appliance Recycling	Midstream Appliance Recycling	NA	V	V	V	V

3.1 ENERGY EFFICIENT HOMES PROGRAM

Energy Efficiency Homes Program has seven distinct components: Energy Efficiency Kits, School Education (with kits), Online Audits, Home Energy Reports, Residential Energy Audits and Direct Install, Multifamily Direct Install, and New Homes. ADM evaluates the program through six initiatives by combining the similar (from an impact evaluation perspective) Energy Efficiency Kit and School Education program components into one initiative.

AM Conservation Group (AMCG) administers the School Education and Energy Efficiency Kits program components. In the Energy Efficiency Kits program component, participants receive energy conservation kits which include energy efficiency measures As with Phase III, there are two kits aimed at homes with electric water heating and non-electric water heating. This program allows customers to receive one EE Kit per new account number at the time of move-in or eligible customers can request a kit for their home. The water heating fuel source is reported by the customer. In the School Education program component, students participate in a classroom-based presentation around energy conservation. Teachers also use a corresponding curriculum to continue to teach about energy conservation topics. New in Phase IV, all students receive a kit filled with energy-savings measures to install in their homes and are encouraged to continue discussions regarding energy conservation in the home.

The Home Energy Reports program component is administered by Oracle (formerly Opower). Home energy reports provide customers with comparative electric energy usage data and offer tips and advice on behavioral and low-cost energy saving measures. The number of participants for this program component is taken as the maximum number of participants in the treatment group during the year.

The Online Audit program component is also administered by Oracle and provides a web portal where customers can enter information about their home's envelope, HVAC systems, and plug loads to receive customized advice regarding their energy usage and ways to increase energy efficiency.

The Companies have retained CLEAResult to administer the Direct Install (branded as the Residential Energy Audit Program) component in Phase IV. Through this program component, customers receive free diagnostic assessments, followed by the direct installation of low-cost measures or incentivized installation of capital cost measures. In PY16, the program also provided incentives for solar panel installations. The participant count for this program component is equal to the number of homes treated in the program.

CLEAResult also administers the Multifamily Audit program, which provides measures like those offered in the Residential Energy Audit Program to participants in individually metered multifamily dwellings.

The New Homes component is again administered by Performance System Development (PSD). The New Homes program component provides incentives to builders that choose to build new homes to higher efficiency standards through the installation of efficient building shell measures, HVAC systems, appliances, lighting, smart thermostats, and other features. The

participant count for the New Homes program component is equal to the number of houses (or in the case of multifamily housing, the number of dwelling units).

3.1.1 Participation and Reported Savings by Customer Segment

Table 40 presents the participation counts, reported energy and demand savings, and incentive payments for the Energy Efficient Homes Program in PY16 by EDC. This program serves only the residential customer segment. The EE&C portfolios include separate and corresponding program components, administered by the same ICSPs, to serve the low-income residential customer segment.

Table 40: EEH Program Participation and Reported Impacts

Parameter	Met-Ed Residential (Non-LI)	Penelec Residential (Non-LI)	Penn Power Residential (Non-LI)	WPP Residential (Non-LI)
PYTD # Participants	134,205	203,983	69,284	238,775
PYRTD MWh/yr	30,072	21,685	9,876	36,825
PYRTD MW/yr	7.97	5.05	2.46	9.47
PYTD Incentives ($1000)	2,774	2,160	1,028	2,971

3.1.2 Gross Impact Evaluation

Each program component is treated as a separate evaluation initiative. The impact evaluation of the HER Initiative is described in Appendix B. The impact evaluation of the EE Kits Initiative is described in Appendix E. The impact evaluation of the Res DI Initiative is described in Appendix F. The impact evaluation of the Res NC Initiative is described in Appendix G. The impact evaluation of the Res MF initiative is described in Appendix H. The impact evaluation of the Online Audit initiative is described in Appendix I. Table 41 summarizes program verified impacts and realization rates for each EDC.

Table 41: EEH Program Gross Impact Evaluation Summary for PY16

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	EE Kits	12,811	1.40	90.1%	91.4%
Met-Ed	Home Energy Reports	13,030	1.69	104.0%	29.3%
Met-Ed	Direct Install	481	0.07	97.2%	73.0%
Met-Ed	New Homes	2,283	0.44	100.8%	85.0%
Met-Ed	Multifamily	37	0.00	101.2%	90.6%
Met-Ed	Online Audits	153	0.03	29.4%	48.6%
Met-Ed Total		**28,795**	**3.62**	**96%**	**45%**
Penelec	EE Kits	11,692	1.21	90.0%	93.3%
Penelec	Home Energy Reports	3,780	1.16	50.7%	32.8%
Penelec	Direct Install	402	0.06	108.3%	76.0%
Penelec	New Homes	328	0.06	96.4%	85.0%
Penelec	Multifamily	65	0.01	101.3%	75.1%
Penelec	Online Audits	196	0.03	41.8%	62.6%
Penelec Total		**16,463**	**2.53**	**76%**	**50%**
Penn Power	EE Kits	3,168	0.35	91.9%	92.6%
Penn Power	Home Energy Reports	4,214	0.24	99.0%	14.4%
Penn Power	Direct Install	99	0.01	107.4%	75.5%
Penn Power	New Homes	1,923	0.33	102.5%	78.5%
Penn Power	Multifamily	39	0.00	99.7%	77.8%
Penn Power	Online Audits	46	0.01	27.4%	46.0%
Penn Power Total		**9,489**	**0.93**	**96%**	**38%**
WPP	EE Kits	12,942	1.51	89.5%	91.7%
WPP	Home Energy Reports	5,294	2.07	29.3%	29.5%
WPP	Direct Install	474	0.07	102.9%	78.3%
WPP	New Homes	2,941	0.54	95.8%	83.2%
WPP	Multifamily	150	0.02	100.6%	91.8%
WPP	Online Audits	192	0.03	31.2%	49.6%
WPP Total		**21,992**	**4.23**	**60%**	**45%**

The gross realization rates for energy savings were driven primarily by the two largest components: Home Energy Reports and EE Kits. Realization rates for kits were lower than 100% due to lower in-service rates than planning estimates. Home Energy Reports energy savings varied from reported values primarily due to methodological differences in calculations of reported and verified demand reductions, as well as cross-participation corrections.

3.1.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

Evaluation, measurement, and verification of the Energy Efficient Homes Program was not impacted by the COVID-19 pandemic. The majority of energy savings were verified through participant surveys and billing analyses. On-site visits occurred in support of the New Homes program component, but the homes were not yet sold or occupied at the time of the site visits.

3.1.3 Net Impact Evaluation

The impact evaluation methods for the Home Energy Reports and Online Audits initiatives result in NTG values of 1.0, their impact evaluation methods are described in Appendix B and Appendix I respectively. The impact evaluation of the EE Kits Initiative is described in Appendix E. The impact evaluation of the Res DI Initiative is described in Appendix F. The impact evaluation of the Res NC Initiative is described in Appendix G. The impact evaluation of the Res MF initiative is described in Appendix H. Net impact analysis for the New Homes initiative was evaluated for NTG in PY14, while in PY15 NTG analyses were conducted for the EE Kits, Direct Install, and Multifamily initiatives. Table 42 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 42: EEH Program Net Impact Evaluation Summary for PY16

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	EE Kits	12,811	81.6%	10,448	1.14
Met-Ed	Home Energy Reports	13,030	100.0%	13,030	1.69
Met-Ed	Direct Install	481	86.7%	417	0.06
Met-Ed	New Homes	2,283	72.0%	1,644	0.32
Met-Ed	Multifamily	37	99.5%	36	0.00
Met-Ed	Online Audits	153	100.0%	153	0.03
Met-Ed Total		**28,795**	**89.3%**	**25,728**	**3.23**
Penelec	EE Kits	11,692	106.1%	12,410	1.28
Penelec	Home Energy Reports	3,780	100.0%	3,780	1.16
Penelec	Direct Install	402	99.1%	398	0.06
Penelec	New Homes	328	72.0%	236	0.04
Penelec	Multifamily	65	99.5%	65	0.01
Penelec	Online Audits	196	100.0%	196	0.03
Penelec Total		**16,463**	**103.8%**	**17,086**	**2.59**
Penn Power	EE Kits	3,168	85.0%	2,691	0.29
Penn Power	Home Energy Reports	4,214	100.0%	4,214	0.24
Penn Power	Direct Install	99	94.1%	93	0.01
Penn Power	New Homes	1,923	72.0%	1,384	0.23
Penn Power	Multifamily	39	99.5%	39	0.00
Penn Power	Online Audits	46	100.0%	46	0.01
Penn Power Total		**9,489**	**89.2%**	**8,468**	**0.79**
WPP	EE Kits	12,942	95.7%	12,386	1.45
WPP	Home Energy Reports	5,294	100.0%	5,294	2.07
WPP	Direct Install	474	91.3%	432	0.06
WPP	New Homes	2,941	72.0%	2,118	0.39
WPP	Multifamily	150	99.5%	149	0.02
WPP	Online Audits	192	100.0%	192	0.03
WPP Total		**21,992**	**93.5%**	**20,571**	**4.01**

3.1.3.1 High-Impact Measure Research

No Initiatives from this program have been designated as high-impact measures for PY16.

3.1.4 Verified Savings Estimates

In Table 43 the realization rates and net-to-gross ratios determined by the ADM and Tetra Tech team are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Energy Efficient Homes Program in PY16. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 43: PYTD and P4TD Savings Summary

	Met-Ed		Penelec		Penn Power		WPP	
Savings Type	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	30,072	7.97	21,685	5.05	9,876	2.46	36,825	9.47
PYVTD Gross	28,795	3.62	16,463	2.53	9,489	0.93	21,992	4.23
PYVTD Net	25,728	3.23	17,086	2.59	8,468	0.79	20,571	4.01
RTD	82,126	15.52	68,179	10.37	25,659	5.29	88,231	17.76
VTD Gross	70,870	9.29	56,415	7.61	24,220	3.31	64,107	9.79
VTD Net	61,378	7.93	54,001	7.32	20,885	2.78	62,547	9.35

The VTD demand reduction contribution from prior years has changed since the PY15 final annual report. In PY15 ADM applied incorrect historical realization rates to the New Homes program, which resulted in an overstatement of verified demand reductions of 0.028 MW, 0.001 MW,0.025 MW , and 0.020 MW for Met-Ed, Penelec, Penn Power, and West Penn Power respectively. The VTD values for gross and net demand reductions have been decremented in this report to reflect the necessary corrections.

3.1.5 Process Evaluation

Process evaluation activities were conducted for various components of this program in Phase IV, as summarized in in Table 44 below. PY15 process evaluation activities focused on the Residential Comprehensive Audits. Process evaluation was not scheduled for this program in PY16.

Table 44: EEH Program Process Evaluation Sample Design

EDC / Program Component	Latest Activity	Sample Target	Achieved Sample Size	Response Rate
ME - Home Energy Reports	Participant Surveys (PY13/14)	140	200	11%
PN - Home Energy Reports	Participant Surveys (PY13/14)	140	178	9%
PP - Home Energy Reports	Participant Surveys (PY13/14)	140	200	11%
WP - Home Energy Reports	Participant Surveys (PY13/14)	140	191	10%
ME - Comp Audits	Participant Surveys (PY15)	278	73	26%
PN - Comp Audits	Participant Surveys (PY15)	279	75	27%
PP - Comp Audits	Participant Surveys (PY15)	269	80	30%
WP - Comp Audits	Participant Surveys (PY15)	278	75	27%
All EDCs - Multifamily	Participant Surveys (PY15)	25	25	10%
All EDCs - Multifamily	Owner/Manager Surveys (PY15)	10	10	22%
ME - School Education	Participant Surveys (PY15)	276	24	9%
PN - School Education	Participant Surveys (PY15)	337	41	12%
PP - School Education	Participant Surveys (PY15)	41	3	7%
WP - School Education	Participant Surveys (PY15)	183	26	14%
All EDCs - School Education	School Coordinator Interviews (PY15)	31	8	26%
All EDCs - School Education	Teacher Surveys (PY15)	512	97	19%
ME - EE Kits	Participant Surveys (PY15)	310	47	15%
PN - EE Kits	Participant Surveys (PY15)	310	48	15%
PP - EE Kits	Participant Surveys (PY15)	310	53	17%
WP - EE Kits	Participant Surveys (PY15)	310	51	16%
ALL EDCs - In-Home Audits	Implementer and Subcontractor Interviews (PY14)	4	4	100%
All EDCs - New Homes	Builder Surveys (PY13/14)	15	14	41%
	Rater Surveys (PY13/14)	5	5	45%
Program Total		**4,343**	**1,528**	**13.1%**

3.1.5.1 Home Energy Reports (PY14)

The PY14 process evaluation included a quantitative survey of households that were randomly assigned to the treatment or control group. The survey design was informed by qualitative research completed in PY13; specifically, interviews with the FirstEnergy program manager (December 16, 2021, and May 26, 2022) and representatives from Oracle (January 19 and June 6, 2022). These interviews reviewed program design and any changes in Phase IV, discussed the details of program implementation, and captured evaluation priorities. The interview objectives and findings were reported in PY13 and guided the PY14 evaluation activities. The survey aimed to measure customers' awareness of energy efficiency programs and their own actions or efforts to reduce energy use. For control group customers, the survey effort sought to determine whether customers are aware of FirstEnergy/EDC-sponsored energy efficiency programs and actions they take to reduce their energy use. The survey was administered by web with telephone follow-up to maximize response. The survey was conducted from November 14, 2022, through January 10, 2023, at Tetra Tech's in-house Survey Research Center in its Madison, Wisconsin office, and hosted on a secure website. The target objective was to complete 70 interviews per stratum (participant type) and EDC for treatment and control groups.

3.1.5.2 School Education Program (PY15)

Process evaluation activities for PY15 focused on understanding the subprogram design, any changes in design or implementation in Phase IV, and participant utilization and satisfaction with the kit contents. Tetra Tech staff interviewed the FirstEnergy program implementation manager (PIM), representatives of the American Conservation Group (AM Conservation), the CSP, and staff at its subcontractor, the National Education Foundation (NEF). Tetra Tech staff also reviewed program tracking data and conducted surveys with participating school coordinators and teachers. Lastly, Tetra Tech deployed a survey to gather feedback from households that received an energy efficiency kit.

3.1.5.3 Energy Efficiency Kits (PY15)

Process evaluation activities for the PY15 program year focused on understanding the program design, any changes in design or implementation in Phase IV, and participant utilization and satisfaction with the kit contents. Tetra Tech staff interviewed the FirstEnergy program manager and representatives of AM Conservation, the program CSP. Tetra Tech also reviewed program tracking data and deployed a survey to gather feedback from customers who were sent an energy efficiency kit.

3.1.5.4 In-Home Audits (PY15)

In PY15, evaluation activities focused on a follow-up interview with the PIM in October 2023 and quantitative surveys with program participants. The interview with the PIM focused on understanding the program design and identifying any program changes between PY14 and PY15, along with any changes since the last program evaluation conducted for PY9 and PY10. The PIM felt the program was operating well, participation was good, and FirstEnergy was happy with the implementer interaction. Tetra Tech also sought to identify any concerns related to meeting program goals, discuss and prioritize research activities, and identify any other areas of interest to explore during the evaluation. The PIM did not have any specific concerns or researchable issues for the evaluation beyond what was already planned. Finally, Tetra Tech conducted a quantitative survey to assess the experience of customers who have participated in the program. The purpose of the survey was to capture customer perceptions of and experiences with the program, awareness of and attitudes toward energy efficiency and conservation, participation in other FirstEnergy programs, customer satisfaction, and possible areas for improvement. The survey also included questions to support the analysis of NTG.

3.1.5.5 New Homes (PY14)

Tetra Tech's combined process and net impact evaluation effort included both rater and builder interviews in early 2023. Tetra Tech developed a sample frame in December 2022 of the 34 most active builders who, together accounted for 95% of program impacts in the prior 12 months. Tetra Tech interviewed 14 of those 34 builders as well as six active HERS raters in the program. The outreach effort started in March 2023 and included notifications from the program implementer to homebuilders followed by emails and calls from Tetra Tech. Tetra Tech also conducted a benchmarking study for the program, which compared incentive structures, outreach methods, and eligibility requirements for ten other new construction programs.

3.1.5.6 Multifamily Program (PY14 and PY15)

In PY14 Tetra Tech conducted a benchmarking study for all four multifamily programs offered by the Companies:

- Energy Efficient Homes—Residential Multifamily (EE Homes Multifamily),
- Low-Income Energy Efficiency—Multifamily—Res (LI Res Multifamily),
- C&I Energy Solutions for Business—Multifamily—Small (C&I ESB Multifamily SCI), and
- C&I Energy Solutions for Business—Multifamily—Large (C&I ESB Multifamily LCI).

All four programs are implemented by CLEAResult, and together provide comprehensive coverage of both the low-income and market-rate multifamily sector, including common areas and master-metered and individually-metered dwelling units. The benchmarking reviewed various program aspects including overall program designs, incentive levels and structure, coordination with local community agencies, and marketing strategies.

In PY15, Tetra Tech continued process evaluation activities by interviewing program managers and CSP staff and conducting tenant and apartment owner/manager surveys. The interview with the program implementation manager (PIM) focused on understanding the program design and identifying any program changes between PY14 and PY15. The PIM indicated that FirstEnergy transitioned the delivery of the Multifamily subprograms to a one-stop-shop approach beginning in PY15. The one-stop-shop approach streamlines the participation experience by seamlessly connecting offerings available to multifamily properties across the residential and C&I multifamily subprograms. The interview with the CSP, CLEAResult, focused on understanding the redesign of the program, any barriers impacting the performance of the program, and their experiences with the program. CLEAResult indicated that building owners/managers have found the one-stop-shop approach of the program much easier to understand. Quantitative surveys of participating multifamily building tenants and building owners/managers investigated sources of awareness, preferred methods of communication, participation experiences, program satisfaction, and demographics. The surveys also gathered information on their decisions to participate, actions taken after the energy audit, and barriers to participating.

3.1.5.7 Behavioral Online Audits (PY14)

Tetra Tech completed a two-phase customer survey in PY14. Tetra Tech conducted an initial (Phase 1) survey soon after customers completed the audit to maximize recall of the online audit and any immediate energy-saving actions. A follow-up (Phase 2) survey, a few months later, assessed energy-saving actions since the online audit, awareness of energy-efficiency programs, and other program participation. Tetra Tech reached out to the census of PY14 participants to garner sufficient responses for the two-phase effort (there is attrition involved between the two phases due to response rates and selection criteria for eligibility in the second phase). The participation numbers shown in Table 44 reflect the first phase of the survey, since Phase 2 respondents are a subset of Phase 1 respondents.

3.1.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented Table 45, Table 46, Table 47, and Table 48 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2024 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 45: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	4,041		13,365		3,611		11,489	
2	Rebates to Participants and Trade Allies	697		2,348		697		2,348	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,283		7,234		2,283		7,234	
5	Direct Installation Program Materials and Labor	231		615		231		615	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	829		3,168		399		1,293	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	5	2	5	8	5	2	5	8
8	Administration and Management	83	838	493	1,870	83	838	493	1,870
9	Marketing	29	176	54	496	29	176	54	496
10	Program Delivery	8	152	39	1,011	8	152	39	1,011
11	EDC Evaluation Costs	71		493		71		493	
12	SWE Audit Costs	42		167		42		167	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,406		4,636		1,406		4,636	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**5,447**		**18,001**		**5,016**		**16,126**	
15	Total NPV Lifetime Electric Energy Benefits	7,250		19,248		5,947		15,648	
16	Total NPV Lifetime Electric Capacity Benefits	3,684		10,882		3,001		8,698	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-59		-39		-46		-31	
19	Total NPV Lifetime Water Impacts	4,866		13,631		3,970		11,163	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**15,740**		**43,720**		**12,872**		**35,478**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**2.89**		**2.43**		**2.57**		**2.20**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 46: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	2,775		8,308		2,715		7,879	
2	Rebates to Participants and Trade Allies	107		294		107		294	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,202		6,990		2,202		6,990	
5	Direct Installation Program Materials and Labor	192		479		192		479	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	274		545		215		116	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	4	2	4	7	4	2	4	7
8	Administration and Management	59	732	408	1,353	59	732	408	1,353
9	Marketing	28	176	52	452	28	176	52	452
10	Program Delivery	7	93	33	567	7	93	33	567
11	EDC Evaluation Costs	64		412		64		412	
12	SWE Audit Costs	33		134		33		134	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,198		3,423		1,198		3,423	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**3,973**		**11,730**		**3,914**		**11,302**	
15	Total NPV Lifetime Electric Energy Benefits	5,458		17,424		5,721		16,503	
16	Total NPV Lifetime Electric Capacity Benefits	2,223		7,064		2,306		6,642	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-42		-70		-45		-23	
19	Total NPV Lifetime Water Impacts	3,639		14,898		3,861		14,205	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**11,278**		**39,317**		**11,843**		**37,327**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**2.84**		**3.35**		**3.03**		**3.30**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 47: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	1,868		5,993		1,518		4,860	
2	Rebates to Participants and Trade Allies	565		1,438		565		1,438	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	564		1,993		564		1,993	
5	Direct Installation Program Materials and Labor	60		227		60		227	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	678		2,334		328		1,201	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	2	1	2	3	2	1	2	3
8	Administration and Management	45	356	230	775	45	356	230	775
9	Marketing	9	54	16	161	9	54	16	161
10	Program Delivery	4	30	17	343	4	30	17	343
11	EDC Evaluation Costs	22		162		22		162	
12	SWE Audit Costs	15		60		15		60	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	537		1,768		537		1,768	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**2,406**		**7,761**		**2,056**		**6,628**	
15	Total NPV Lifetime Electric Energy Benefits	2,638		7,554		2,158		6,178	
16	Total NPV Lifetime Electric Capacity Benefits	720		2,414		572		1,923	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-11		-77		-9		-65	
19	Total NPV Lifetime Water Impacts	1,145		3,808		976		3,236	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**4,492**		**13,699**		**3,696**		**11,272**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.87**		**1.77**		**1.80**		**1.70**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 48: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	IMCs	4,634		14,496		4,061		12,823	
2	Rebates to Participants and Trade Allies	874		2,407		874		2,407	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,328		7,205		2,328		7,205	
5	Direct Installation Program Materials and Labor	238		680		238		680	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	1,195		4,204		622		2,531	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	5	3	6	10	5	3	6	10
8	Administration and Management	115	1,153	588	2,373	115	1,153	588	2,373
9	Marketing	32	121	58	400	32	121	58	400
10	Program Delivery	10	147	46	1,124	10	147	46	1,124
11	EDC Evaluation Costs	75		549		75		549	
12	SWE Audit Costs	47		188		47		188	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,706		5,342		1,706		5,342	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**6,340**		**19,837**		**5,767**		**18,164**	
15	Total NPV Lifetime Electric Energy Benefits	7,513		20,422		6,855		19,717	
16	Total NPV Lifetime Electric Capacity Benefits	2,073		5,829		1,864		5,443	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-2		11		-2		13	
19	Total NPV Lifetime Water Impacts	4,284		12,749		4,103		13,189	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**13,868**		**39,010**		**12,820**		**38,362**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**2.19**		**1.97**		**2.22**		**2.11**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

3.1.7 Status of Recommendations

Process evaluation activities for this program concluded in late PY15. Findings and recommendations from previous process evaluation efforts can be found in the Companies' previous annual reports.

3.2 Energy Efficient Products Program

Through the Residential Energy Efficient Products Program, customers receive incentives for installing ENERGY STAR® qualified appliances, energy efficient HVAC equipment, and energy efficient water heaters. Qualifying appliances include items such as clothes washers, dehumidifiers, and refrigerators. HVAC equipment qualifying as part of the program includes central air conditioners, air source heat pumps, ground source heat pumps, and mini-split heat pumps. The program also provides incentives to customers for the maintenance (tune-ups) of existing HVAC equipment. Water heaters rebated under the program include heat pump water heaters, efficient electric water heaters, and solar water heaters. The program also provides incentives to customers who recycle old, inefficient appliances. The Companies have retained Franklin Energy Services to administer the rebate components of the program and ARCA for the recycling component. However, ARCA unexpectedly ceased operations in early August 2023. The Companies have contracted with CLEAResult to administer the Appliance Recycling subprogram, and the program has resumed operations in all four Pennsylvania EDCs.

For the appliances component of the program, the participant count is equal to the sum of appliances rebated by the program. For the HVAC component, the participant count is equal to the sum of the distinct HVAC measures rebated by the program. For the appliance recycling component of the program, the participant count is equal to the number of unique account numbers of participants.

3.2.1 Participation and Reported Savings by Customer Segment

This program serves primarily the residential customer segment. Table 49, Table 50, Table 51, and Table 52 present the participation counts, reported energy and demand savings, and incentive payments for the EEP Program in PY16 by customer segment and EDC.

Table 49: EEP Program Participation and Reported Impacts for Met-Ed

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	15,387	0	0	15,387
PYRTD MWh/yr	6,256	0	0	6,256
PYRTD MW/yr	1.44	0.00	0.00	1.44
PYTD Incentives ($1000)	856	0.00	0.00	856

Table 50: EEP Program Participation and Reported Impacts for Penelec

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	17,368	0	0	17,368
PYRTD MWh/yr	4,694	0	0	4,694
PYRTD MW/yr	1.11	0.00	0.00	1.11
PYTD Incentives ($1000)	605	0.00	0.00	605

Table 51: EEP Program Participation and Reported Impacts for Penn Power

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	6,862	0	0	6,862
PYRTD MWh/yr	1,859	0	0	1,859
PYRTD MW/yr	0.38	0.00	0.00	0.38
PYTD Incentives ($1000)	273	0.00	0.00	273

Table 52: EEP Program Participation and Reported Impacts for WPP

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	18,443	0	0	18,443
PYRTD MWh/yr	5,609	0	0	5,609
PYRTD MW/yr	1.27	0.00	0.00	1.27
PYTD Incentives ($1000)	796	0.00	0.00	796

3.2.2 Gross Impact Evaluation

This program is disaggregated into five initiatives for evaluation. The impact evaluation of the Appliance Recycling initiative is described in Appendix J. The impact evaluation of the Upstream Electronics initiative is described in detail in Appendix K. The impact evaluation of the Res HVAC initiative is described in detail in Appendix L. The impact evaluation of the Res Appliances initiative is described in detail in Appendix M. The impact evaluation of the Res Midstream Appliances initiative is described in detail in Appendix N. Table 53 summarizes program verified impacts and realization rates for each EDC.

Table 53: EEP Program Gross Impact Evaluation Summary for PY16

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliance Recycling	3,119	0.94	108.5%	113.7%
Met-Ed	HVAC	2,264	0.34	159.0%	138.8%
Met-Ed	Appliances	613	0.08	110.6%	111.5%
Met-Ed	Midstream Appliances	1,510	0.31	107.5%	103.6%
Met-Ed Total		**7,506**	**1.67**	**120%**	**116%**
Penelec	Appliance Recycling	1,987	0.60	103.4%	103.4%
Penelec	HVAC	695	0.07	109.6%	117.7%
Penelec	Appliances	265	0.04	104.4%	102.5%
Penelec	Midstream Appliances	1,949	0.44	103.4%	100.7%
PenelecTotal		**4,897**	**1.15**	**104%**	**103%**
Penn Power	Appliance Recycling	717	0.18	108.4%	108.7%
Penn Power	HVAC	167	0.03	94.8%	99.0%
Penn Power	Appliances	127	0.02	106.5%	112.9%
Penn Power	Midstream Appliances	918	0.17	101.7%	100.7%
Penn PowerTotal		**1,929**	**0.40**	**104%**	**105%**
WPP	Appliance Recycling	2,582	0.72	109.2%	108.7%
WPP	HVAC	1,119	0.17	108.2%	105.1%
WPP	Appliances	536	0.08	103.2%	106.2%
WPP	Midstream Appliances	1,751	0.37	103.5%	100.9%
WPP Total		**5,988**	**1.34**	**107%**	**106%**

The gross realization rates for energy savings were driven primarily by the realization rates of the appliance recycling component, which has grown to become the largest program component in PY16. All program components had generally high energy and demand realization rates due to somewhat conservative assumptions in reported impacts.

3.2.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

Data to support evaluation, measurement, and verification of this program are collected with remote online and telephone surveys. As a result, the PY16 evaluation was not altered due to COVID-19 induced social distancing measures.

3.2.3 Net Impact Evaluation

The impact evaluation of the Appliance Recycling initiative is described in Appendix J. The Upstream Electronics initiative is not active in Phase IV. The impact evaluation of the Res HVAC initiative is described in detail in Appendix L. The impact evaluation of the Res Appliances initiatives are described in detail in Appendix M and Appendix N. The Appliance Recycling initiative was evaluated for NTG in PY16, the Appliance Rebate initiative was evaluated for NTG in PY14, and the HVAC rebate initiative was evaluated for NTG in PY15. Table 54 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 54: EEP Program Net Impact Evaluation Summary for PY16

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	Appliance Recycling	3,119	62.0%	1,934	0.58
Met-Ed	HVAC	2,264	50.6%	1,146	0.17
Met-Ed	Appliances	613	67.9%	416	0.06
Met-Ed	Midstream Appliances	1,510	57.6%	870	0.18
Met-Ed Total		**7,506**	**58.2%**	**4,365**	**0.99**
Penelec	Appliance Recycling	1,987	60.0%	1,192	0.36
Penelec	HVAC	695	69.7%	484	0.05
Penelec	Appliances	265	49.4%	131	0.02
Penelec	Midstream Appliances	1,949	47.8%	932	0.21
Penelec Total		**4,897**	**55.9%**	**2,740**	**0.64**
Penn Power	Appliance Recycling	717	61.0%	437	0.11
Penn Power	HVAC	167	54.7%	92	0.02
Penn Power	Appliances	127	52.3%	67	0.01
Penn Power	Midstream Appliances	918	50.2%	461	0.08
Penn Power Total		**1,929**	**54.7%**	**1,056**	**0.22**
WPP	Appliance Recycling	2,582	66.0%	1,704	0.48
WPP	HVAC	1,119	54.8%	613	0.09
WPP	Appliances	536	52.2%	280	0.04
WPP	Midstream Appliances	1,751	50.0%	875	0.19
WPP Total		**5,988**	**58.0%**	**3,473**	**0.80**

3.2.3.1 High-Impact Measure Research

The Appliance Recycling Initiative was identified as a high-impact measure and researched for net-to-gross in PY16. The net impact evaluation of the Appliance Recycling Initiative is described in Appendix J. Tetra Tech conducted net-to-gross studies for downstream appliances in PY14 but this was not identified as a high-impact measure. In PY15 Tetra Tech conducted net-to-gross studies for downstream HVAC, which was a high-impact measure in the context of the Energy Efficient Products Program. The net impact evaluation of the HVAC Initiative is described in Appendix L.

3.2.4 Verified Savings Estimates

In Table 55 the realization rates and net-to-gross ratios determined by the ADM and Tetra Tech team are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Energy Efficient Products Program in PY16. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 55: PYTD and P4TD Savings Summary

	Met-Ed		Penelec		Penn Power		WPP	
Savings Type	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	6,256	1.44	4,694	1.11	1,859	0.38	5,609	1.27
PYVTD Gross	7,506	1.67	4,897	1.15	1,929	0.40	5,988	1.34
PYVTD Net	4,365	0.99	2,740	0.64	1,056	0.22	3,473	0.80
RTD	34,144	7.48	23,118	5.46	9,054	1.98	27,997	6.37
VTD Gross	38,154	7.80	24,101	5.51	9,453	2.00	30,091	6.46
VTD Net	18,567	3.76	13,846	3.17	4,370	0.92	17,728	3.87

3.2.5 Process Evaluation

In PY16, Tetra Tech completed a process evaluation for the Appliance Recycling program component. The sample design for Phase IV process evaluation research conducted to date is shown in Table 56 below.

Table 56: EEP Program Process Evaluation Sample Design

EDC	Program Component	Activity	Target Sample Size	Achieved Sample Size	Response Rate
Met-Ed	Appliance Recyding	In-Depth Interviews (PY16) Customer Surveys (PY16)	100	379	20.3%
Penelec	Appliance Recyding		100	288	21.8%
Penn Power	Appliance Recyding		100	115	22.2%
WPP	Appliance Recyding		100	354	22.7%
Met-Ed	Downstream Appliances	Customer Surveys (PY14)	70	69	25.0%
Penelec	Downstream Appliances		70	71	25.5%
Penn Power	Downstream Appliances		70	74	26.4%
WPP	Downstream Appliances		70	72	28.6%
Met-Ed	Downstream Appliances	General Population Survey (PY14)	70	74	10.6%
Penelec	Downstream Appliances		70	72	9.0%
Penn Power	Downstream Appliances		70	76	10.9%
WPP	Downstream Appliances		70	71	10.1%
Met-Ed	Downstream HVAC	Participant Surveys (PY15)	299	65	22%
Penelec	Downstream HVAC		280	73	26%
Penn Power	Downstream HVAC		283	71	25%
WPP	Downstream HVAC		300	73	24%
All	Midstream Appliances	Retailed Interviews (PY14)	6	6	21.4%
Program Total			**2,128**	**2,003**	**21.6%**

Process evaluation efforts for each program component are summarized below. Findings and recommendations from the PY16 process evaluation are described in Section 3.2.7.

3.2.5.1 Appliance Recycling (PY16)

The Appliance Recycling program process evaluation in PY16 relied on program staff and ICSP interviews as well as participant customer surveys. Tetra Tech conducted semi-structured interviews with 15 small C/I participants who recycled 21 appliances to understand their program experience and identify potential avenues to expand participation in this sector. The researchable issues for process evaluation related to customer satisfaction and program awareness. The results of both of these metrics remain similar to the earlier PY13 evaluation. The results are also similar across the FirstEnergy EDCs. The sample for the survey was randomly selected for each EDC. The team also reviewed program tracking data and program materials, including the program website, marketing calendar, and sample content of email notifications and social media ads. The program materials were consistently clear and concise.

3.2.5.2 Downstream and Midstream Appliances (PY14)

Tetra Tech conducted process evaluation for both the downstream and midstream appliance rebate components of the EEP program in PY14. The process evaluation included downstream rebate participant surveys, in-depth interviews of retailers that participate in the midstream program, a general population survey of residential customers, and a benchmarking analysis. The participant surveys were administered by telephone in spring of 2023, and also included a net impact evaluation battery. The survey effort was preceded by a postcard invitation campaign to explain the purpose of the study and to ask for cooperation in completing the telephone survey. The general population survey targeted a sample of FirstEnergy residential customers, regardless of prior participation in an energy efficiency program or energy-saving actions, and yielded insights into customers' awareness, usage, and satisfaction with energy-efficient products. In addition, the survey sought to assess nonparticipant spillover, which was used in conjunction with the participant survey to estimate a net-to-gross ratio. The survey also included questions related to the PY15 HVAC process and NTG evaluation. Retailer interviews occurred in July 2023 and represented each of the main retail chains that participate in the midstream program component. Key findings and recommendations for the Appliances component are listed in the Companies' PY14 annual report.

3.2.5.3 HVAC (PY15)

Tetra Tech conducted process evaluation for the HVAC program component in PY15. The effort included qualitative interviews with program staff and participating HVAC contractors, and quantitative surveys of participating customers. The process evaluation gauged program awareness and customer satisfaction, and researched issues such as rebate processing times and supply chain constraints. Key findings and recommendations for the HVAC component are listed in the Companies' PY15 annual report.

3.2.5.4 Midstream Electronics

The midstream electronics sub-program has not been offered in Phase IV.

3.2.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 57, Table 58, Table 59, and Table 60 for Met-Ed, Penelec, Penn Power, and WPP respectively. The

last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2024 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 57: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	4,806		19,084		2,593		9,878	
2	Rebates to Participants and Trade Allies	991		2,680		991		2,680	
3	Upstream / Midstream Incentives	0		2,661		0		2,661	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	3,815		13,742		1,602		4,536	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	4	2	5	8	4	2	5	8
8	Administration and Management	85	1,110	464	2,217	85	1,110	464	2,217
9	Marketing	22	234	74	572	22	234	74	572
10	Program Delivery	5	103	26	1,244	5	103	26	1,244
11	EDC Evaluation Costs	76		350		76		350	
12	SWE Audit Costs	40		160		40		160	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,682		5,118		1,682		5,118	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**6,488**		**24,202**		**4,276**		**14,996**	
15	Total NPV Lifetime Electric Energy Benefits	2,394		10,418		1,345		5,179	
16	Total NPV Lifetime Electric Capacity Benefits	1,771		7,989		1,015		3,926	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	167		1,003		104		549	
19	Total NPV Lifetime Water Impacts	146		578		99		372	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**4,479**		**19,989**		**2,563**		**10,025**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.69**		**0.83**		**0.60**		**0.67**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 58: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	2,493		12,517		1,519		7,155	
2	Rebates to Participants and Trade Allies	701		1,454		701		1,454	
3	Upstream / Midstream Incentives	0		1,766		0		1,766	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	1,792		9,297		819		3,935	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	4	2	4	8	4	2	4	8
8	Administration and Management	92	648	469	1,333	92	648	469	1,333
9	Marketing	23	159	73	429	23	159	73	429
10	Program Delivery	5	61	26	866	5	61	26	866
11	EDC Evaluation Costs	71		321		71		321	
12	SWE Audit Costs	38		155		38		155	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,104		3,684		1,104		3,684	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**3,597**		**16,201**		**2,624**		**10,839**	
15	Total NPV Lifetime Electric Energy Benefits	1,493		6,297		832		3,528	
16	Total NPV Lifetime Electric Capacity Benefits	1,060		4,966		570		2,765	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	445		1,062		214		541	
19	Total NPV Lifetime Water Impacts	84		349		41		179	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**3,082**		**12,676**		**1,657**		**7,013**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.86**		**0.78**		**0.63**		**0.65**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 59: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	867		3,939		454		1,996	
2	Rebates to Participants and Trade Allies	315		573		315		573	
3	Upstream / Midstream Incentives	0		754		0		754	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	551		2,613		138		669	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	1	1	1	2	1	1	1	2
8	Administration and Management	39	234	182	499	39	234	182	499
9	Marketing	7	98	21	184	7	98	21	184
10	Program Delivery	2	20	10	296	2	20	10	296
11	EDC Evaluation Costs	21		96		21		96	
12	SWE Audit Costs	12		49		12		49	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	434		1,341		434		1,341	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**1,301**		**5,280**		**888**		**3,337**	
15	Total NPV Lifetime Electric Energy Benefits	637		2,757		338		1,300	
16	Total NPV Lifetime Electric Capacity Benefits	257		1,264		138		587	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	444		866		224		417	
19	Total NPV Lifetime Water Impacts	41		179		22		94	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**1,380**		**5,067**		**721**		**2,398**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.06**		**0.96**		**0.81**		**0.72**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 60: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	IMCs	3,216		14,475		1,737		7,816	
2	Rebates to Participants and Trade Allies	922		2,396		922		2,396	
3	Upstream / Midstream Incentives	0		1,645		0		1,645	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	2,295		10,434		816		3,776	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	5	3	5	10	5	3	5	10
8	Administration and Management	116	857	561	1,786	116	857	561	1,786
9	Marketing	28	195	89	492	28	195	89	492
10	Program Delivery	6	75	30	1,166	6	75	30	1,166
11	EDC Evaluation Costs	86		392		86		392	
12	SWE Audit Costs	46		186		46		186	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,418		4,718		1,418		4,718	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**4,635**		**19,193**		**3,156**		**12,534**	
15	Total NPV Lifetime Electric Energy Benefits	1,907		8,287		1,055		4,617	
16	Total NPV Lifetime Electric Capacity Benefits	724		3,307		406		1,866	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	395		1,213		199		630	
19	Total NPV Lifetime Water Impacts	141		638		74		347	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**3,167**		**13,444**		**1,734**		**7,459**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.68**		**0.70**		**0.55**		**0.60**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

3.2.7 Status of Recommendations

The process evaluation activities in PY16 led to the following findings and recommendations from Tetra Tech to the Companies, along with a summary of how the Companies plan to address the recommendation in program delivery. Findings and recommendations from previous process evaluation efforts can be found in the Companies' PY13 and PY14 annual reports.

3.2.7.1 Appliance Recycling

Finding #1: ***Relaunching the program with a new CSP has been smooth, with no reported issues.*** FirstEnergy reported that CLEAResult has managed the program's relaunch well. The program restarted in May 2024 after it had been inactive for 10 months. CLEAResult took over as the CSP from ARCA, which previously implemented the program. FirstEnergy reported that CLEAResult is effective, with good communication, timely and accurate reporting, and high

customer satisfaction. Additionally, CLEAResult reported no issues in their first year implementing the program. CLEAResult also believes that the relationship with FirstEnergy is also running smoothly. They indicated that the program runs well from enrollment to receiving rebates in a timely manner.

Finding #2: ***CLEAResult reports that standalone pickups of room air conditioners were successful for the program.*** They noted a high number of requests for standalone air conditioners, so they tried it as a limited-time offering (LTO) and found it successful. CLEAResult continued the offering for the rest of the survey year.

Finding #3: ***Bill inserts continue to be the most common source of program information.*** Almost one-half of residential respondents (46 percent) indicated bill inserts as a source of program information, consistent with prior evaluations. Emails from the electric distribution company (EDC) were the second most common source of program awareness, mentioned by 19 percent of residential respondents. This pattern is also reflected in responses from the small C&I participants, who also indicated that bill inserts and emails were their most common sources of program awareness. The team asked small C&I participants what their preferred source of awareness is, and respondents confirmed that bill inserts and emails are preferred. In addition to marketing sources, participants are also using the EDC websites to get information about energy efficiency programs.

Finding #4: ***Satisfaction with the program remains high, with a slight downward shift, due to dissatisfaction with the timing of rebate receipt.*** Of the program components, satisfaction with the time it took to receive the rebate was noticeably lower than in past evaluations. We found that dissatisfaction with the timing of the rebate arose because not enough time was being allowed between appliance pickup and the survey request, and this was driving lower satisfaction with the program overall.

Finding #5: ***Net-to-gross ratios are higher, rising from 55 percent in PY13 to 62 percent.*** We observed a higher frequency of those who would have removed their appliance without the program, but not within a year, resulting in 100 percent NTG for those cases. In addition, the range of NTG across EDCs is more consistent than in PY13. PY16 NTG ranges from 60 to 65 percent compared with a range of 38 to 70 percent in PY13. More details on the NTG algorithm and calculations are in the Net-to-Gross Results section.

Finding #6: ***Some participants in both residential and commercial sectors do not remember which appliances are eligible.*** Participants were asked what appliances they would like to recycle through the program that are not already offered. Respondents from both the residential survey and small C&I calling effort noted appliances that are already offered through the program (e.g., freezer, room air conditioner), suggesting they are not completely familiar with which appliances are eligible.

Finding #7: ***The tracking data shows a few instances of households recycling more than the allowed number of appliances.*** The review revealed 35 accounts in the residential and small C&I tracking data that were recorded to have recycled more than five appliances during PY16 (0.4 percent of accounts). Based on program enrollment requirements, the maximum number of appliances recycled should be five (two large and three small appliances).

Recommendation #1: ***Continue offering standalone pickups of room air conditioners.*** CLEAResult reported that these standalone pickups were a success and valuable for the program. They started as a LTO and were extended to include pickups for the whole program year. We recommend that this offering be continued in future program years.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: ***Make rebate timing a priority and increase communication about when the check will come and whether it is still coming.*** Participants reported lower satisfaction with the program overall due to slow rebate delivery after participation. To keep satisfaction high, we recommend communicating throughout the rebate delivery process with participants so that even if the rebate takes longer than expected, participants still know that it is being processed and will arrive in the future.

EDC Status Report #2: Recommendation accepted.

Recommendation #3: ***Continue to advertise the program with bill inserts and emails.*** Utility bill inserts and emails continue to be the highest source of program awareness, with 45 percent and 19 percent of participants citing them as their source of awareness, respectively. We recommend that these methods continue to be used for outreach, supplemented by increased social media use. With customers visiting the EDC websites for information, more details could be added there for customers looking for program specifics.

EDC Status Report #3: Recommendation accepted.

Recommendation #4: ***Revisit the number of applications accepted by household per year or edit the website requirement.*** A few households in the tracking data had more than the allowed five total appliances or the maximum number allowed by appliance type. This may be a difference in the timing, as the program year runs across calendar years, and the restriction on the website is listed per calendar year.

EDC Status Report #4: Recommendation accepted.

3.3 LOW-INCOME ENERGY EFFICIENCY PROGRAM

The Low-Income Energy Efficiency Program (LIEEP) has seven distinct initiatives, each described below.

The *Low-Income Direct Install* (LI DI) component is administered by the Companies, and has three distinct components:

- *WARM Plus* low-income weatherization
- *WARM Extra Measures* low-income weatherization
- *WARM Multifamily*

These programs provide for direct installation of energy efficiency measures within customers' homes and tenants' apartments. The WARM Plus and WARM Multifamily components provide for audits and direct installation of energy efficient equipment and envelope upgrades. WARM *Extra Measures* is similar to WARM Plus, except that it provides for additional measures that are Act 129 funded to be installed in homes that participate in the Companies' non-Act 129 Low-Income Usage Reduction Programs. The Companies' tracking and reporting system can cross reference account numbers with previous years to generate a list of unique, new participants for each program year. For sampling and reporting purposes, however, ADM selects to treat each unique account in the tracking data for the program year as one participant.

Each of these program components are similar to their corresponding non-Low-Income components in the Energy Efficient Homes Program, but they are targeted to low-income customers.

The *Low-Income Appliance Recycling* (LI ATI) component was administered by ARCA (as of this writing the program component has resumed operation and is administered by CLEAResult). The program is implemented in parallel with the main residential Appliance Recycling program but provides targeted marketing and enhanced incentives to income qualified customers. Each rebate application (which corresponds to an appliance pick-up event, and may involve multiple appliances) is treated as one participant.

The *Low-Income Kits* (LI Kit) component includes two subcomponents, both administered by AMCG:

- Low-Income EE Kits
- Low-Income School Education Program

The low-Income kits contained Advanced Power Strips instead of Electrical Outlet Gaskets. Each kit is treated as a participant.

The *Low-Income Appliance Rebates* (LI Appliances) component is administered by Franklin Energy Services and provides targeted marketing and enhanced downstream rebates on appliances.

The *Low-Income Home Energy Reports* (LI HER) component is similar to the HER component in the Energy Efficient Homes Program but is targeted at low-income qualified customers.

The *Low-Income Online Audits* (LI Online Audit) component is similar to the Online Audit component in the Energy Efficient Homes Program but is targeted to low-income qualified customers.

The *Low Income New Homes* component is similar to the New Homes component in the Energy Efficient Homes Program but is targeted to low-income customers.

3.3.1 Participation and Reported Savings by Customer Segment

Table 61 presents the participation counts, reported energy and demand savings, and incentive payments for the Low-Income Energy Efficiency Program in PY16 by customer segment and EDC. This program serves only the low-income residential customer segment.

Table 61: LIEEP Participation and Reported Impacts

Parameter	Met-Ed LI Residential	Penelec LI Residential	Penn Power LI Residential	WPP LI Residential
PYTD # Participants	35,720	34,513	8,056	31,613
PYRTD MWh/yr	5,750	4,481	1,228	5,708
PYRTD MW/yr	0.88	0.49	0.49	0.71
PYTD Incentives ($1000)	2,265	3,089	912	2,782

3.3.2 Gross Impact Evaluation

The impact evaluation of the Res Appliances initiative is described in detail in Appendix M. The impact evaluation of the LI Appliance Recycling sub-initiative is described in detail in Appendix O. The impact evaluation of the LI DI initiative is described in Appendix P. The impact evaluation of the HER initiative is described in Appendix B. The impact evaluation of the LI EE Kits sub-initiative is described in Appendix Q. The impact evaluation of the Res NC initiative is described in Appendix G. The impact evaluation of the Online Audit initiative is described in Appendix I. Table 62 summarizes program verified impacts and realization rates for each EDC.

Table 62: LIEEP Gross Impact Evaluation Summary for PY16

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliances	16	0.00	110.6%	111.5%
Met-Ed	Appliance Turn-In	133	0.05	116.5%	123.0%
Met-Ed	Direct Install	1,414	0.17	103.4%	103.2%
Met-Ed	Home Energy Reports	1,825	0.19	102.2%	46.9%
Met-Ed	Kits	2,494	0.29	102.8%	108.3%
Met-Ed	New Homes	0	0.00	100.8%	85.0%
Met-Ed	Online Audits	70	0.01	169.8%	234.4%
Met-Ed Total		**5,952**	**0.71**	**104%**	**80%**
Penelec	Appliances	14	0.00	104.4%	102.5%
Penelec	Appliance Turn-In	177	0.05	126.1%	117.6%
Penelec	Direct Install	2,179	0.29	100.2%	102.1%
Penelec	Home Energy Reports	1,131	-0.21	191.8%	1625.0%
Penelec	Kits	1,436	0.15	104.5%	105.3%
Penelec	New Homes	103	0.02	96.4%	85.0%
Penelec	Online Audits	176	0.03	211.5%	295.0%
PenelecTotal		**5,216**	**0.33**	**116%**	**67%**
Penn Power	Appliances	6	0.00	106.5%	112.9%
Penn Power	Appliance Turn-In	27	0.01	127.9%	113.9%
Penn Power	Direct Install	683	0.09	105.0%	104.7%
Penn Power	Home Energy Reports	264	0.07	50.1%	16.8%
Penn Power	Kits	0	0.00	100.0%	100.0%
Penn Power	New Homes	10	0.00	102.5%	78.5%
Penn Power	Online Audits	29	0.00	206.3%	312.0%
Penn PowerTotal		**1,020**	**0.17**	**83%**	**35%**
WPP	Appliances	17	0.00	103.2%	106.2%
WPP	Appliance Turn-In	155	0.04	123.7%	114.3%
WPP	Direct Install	1,905	0.27	98.0%	99.1%
WPP	Home Energy Reports	152	0.10	16.8%	116.0%
WPP	Kits	2,744	0.32	103.5%	106.2%
WPP	New Homes	7	0.00	95.8%	83.2%
WPP	Online Audits	103	0.02	176.4%	266.6%
WPP Total		**5,083**	**0.76**	**89%**	**107%**

The gross realization rates for energy savings were driven primarily by the three largest components: Kits, Home Energy Reports and Direct Install. Home Energy Reports had the greatest variability in realization rates. The relatively small cohort sizes, alongside extrinsic adjustments for dual participation and avoided decay, combine to create significantly different results from different methodologies that were used to measure reported and verified impacts.

3.3.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

The evaluation effort for the Low-Income Energy Efficiency Program was not impacted by the COVID-19 pandemic in PY16.

3.3.3 Net Impact Evaluation

Net impact evaluation was not formally conducted for this program in PY16, in accordance with our evaluation plan. The NTG for the Low-Income Energy Efficiency Program is estimated as 1.0 for the purpose of net cost effectiveness calculations.

3.3.4 Verified Savings Estimates

In Table 63 the realization rates determined by ADM are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Low-Income Energy Efficiency Program in PY16. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 63: PYTD and P4TD Savings Summary

	Met-Ed		Penelec		Penn Power		WPP	
Savings Type	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	5,750	0.88	4,481	0.49	1,228	0.49	5,708	0.71
PYVTD Gross	5,952	0.71	5,216	0.33	1,020	0.17	5,083	0.76
PYVTD Net	5,952	0.71	5,216	0.33	1,020	0.17	5,083	0.76
RTD	19,421	2.96	20,535	2.51	6,055	1.07	24,168	3.26
VTD Gross	20,449	2.82	22,258	2.30	5,427	0.78	24,890	3.14
VTD Net	20,449	2.82	22,258	2.30	5,427	0.78	24,890	3.14

The VTD demand reduction contribution from prior years has changed since the PY15 final annual report. In PY15 ADM applied incorrect historical realization rates to the Low-Income Appliance Recycling program component, which resulted in an understatement of verified energy savings of 5.36 MWh and 1.52 MWh for Met-Ed and Penelec respectively, and an understatement of 0.1 MWh for Penn Power. The corresponding errors in demand reductions all rounded to 0.00 MW. The VTD values for gross and net energy and demand reductions have been decremented in this report to reflect the necessary corrections.

3.3.5 Process Evaluation

Two initiatives within the Low-Income Energy Efficiency Program underwent process evaluation in PY15. Evaluation activities from PY16 and past years in Phase IV are summarized in Table 64 and described below. Findings and recommendations from the PY16 process evaluation are described in Section 3.3.7.

Table 64: LIEEP Program Process Evaluation Sample Design

EDC	Program Component	Activity	Target Sample Size	Achieved Sample Size	Response Rate
Met-Ed	Direct Install (WARM)	Customer Surveys (PY14)	70	71	36.8%
Penelec			70	70	29.8%
Penn Power			59	76	39.2%
WPP			70	75	38.5%
Met-Ed	Direct Install (Multifamily)	Customer Surveys (PY14)	20	15	31.9%
Penelec			35	28	15.9%
Penn Power			5	2	20.0%
WPP			35	31	17.2%
All EDCs	Direct Install (Multifamily)	Participant Surveys (PY15)	25	25	10.0%
All EDCs		Owner/Manager Surveys (PY15)	10	10	21.7%
Met-Ed	School Education	Participant Surveys (PY15)	21	2	9.5%
Penelec			224	27	12.1%
Penn Power			0	0	NA
WPP			157	19	12.1%
Met-Ed	EE Kits	Participant Surveys (PY15)	210	27	12.9%
Penelec			150	210	140.0%
Penn Power			0	0	NA
WPP			150	210	140.0%
Met-Ed	Hone Energy Reports	Participant Surveys (PY13/14)	140	148	7.8%
Penelec			140	138	7.3%
Penn Power			140	178	9.4%
WPP			140	148	7.8%
All EDCs	Direct Install (WARM)	Auditor Interviews (OY14)	8	8	100.0%
All EDCs	Direct Install (Multifamily)		5	5	100.0%
Program Total			**1,884**	**1,523**	**16.6%**

3.3.5.1 Downstream Appliances (PY14)

Tetra Tech conducted a combined process evaluation of the residential and low-income residential appliance rebate programs in PY14. The evaluation is described in Section 3.2.5.2.

3.3.5.2 Appliance Recycling (PY13)

The Appliance Recycling program process evaluation in PY13 relied on program staff and ICSP interviews as well as participant customer surveys. The researchable issues for process evaluation related to customer satisfaction and program awareness. The results of both of these metrics remain similar to Phase III. The results are also similar across the FirstEnergy EDCs. The sample for the survey was randomly selected for each EDC. Key findings and recommendations for the Appliance Recycling component are available in the Companies' PY13 annual report.

3.3.5.3 Direct Install (PY14)

Tetra Tech conducted a process evaluation for the WARM Plus/Extra Measures program component and the Multifamily program component (which together comprise the Low-Income Direct Install initiative). While there were separate samples for each program component, data collection occurred concurrently with participant surveys in February and March of 2023, and contractor interviews between February and April of 2023. In addition to surveys and interviews, Tetra Tech combined a benchmarking study for the Companies' Multifamily programs, including the low-income component.

3.3.5.4 Multifamily Direct Install (PY14 and PY15)

Tetra Tech conducted a combined process evaluation of the nonresidential, residential market-rate, and residential low-income Multifamily Direct Install programs in PY14 and PY15. The evaluation is described in Section 3.1.5.6.

3.3.5.5 Home Energy Reports (PY14)

Tetra Tech conducted a combined process evaluation of the residential and low-income Home Energy Report programs in PY14. The evaluation is described in Section 3.1.5.1.

3.3.5.6 School Education Program (PY15)

Tetra Tech conducted a combined process evaluation of the residential and low-income School Education programs in PY15. The evaluation is described in Section 3.1.5.2.

3.3.5.7 Energy Efficiency Kits (PY15)

Tetra Tech conducted a combined process evaluation of the residential and low-income Energy Efficiency Kits programs in PY15. The evaluation is described in Section 3.1.5.3.

3.3.5.8 New Homes (PY14)

Tetra Tech conducted a combined process evaluation of the residential and low-income New Homes programs in PY14. The evaluation is described in Section 3.1.5.5.

3.3.5.9 Behavioral Online Audits (PY14)

Tetra Tech conducted a combined process evaluation of the residential and low-income Behavioral Online Audit programs in PY14. The evaluation is described in Section 3.1.5.7.

3.3.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 65, Table 66, Table 67, and Table 68 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2024 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 65: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	2,554		6,882		2,554		6,882	
2	Rebates to Participants and Trade Allies	104		470		104		470	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	415		1,439		415		1,439	
5	Direct Installation Program Materials and Labor	2,103		4,778		2,103		4,778	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	-68		194		-68		194	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	3	1	3	5	3	1	3	5
8	Administration and Management	73	500	363	1,134	73	500	363	1,134
9	Marketing	2	45	2	177	2	45	2	177
10	Program Delivery	3	42	14	488	3	42	14	488
11	EDC Evaluation Costs	53		274		53		274	
12	SWE Audit Costs	24		98		24		98	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	746		2,558		746		2,558	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**3,299**		**9,440**		**3,299**		**9,440**	
15	Total NPV Lifetime Electric Energy Benefits	1,270		4,439		1,270		4,439	
16	Total NPV Lifetime Electric Capacity Benefits	624		2,534		624		2,534	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-33		-107		-33		-107	
19	Total NPV Lifetime Water Impacts	1,024		2,902		1,024		2,902	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**2,886**		**9,768**		**2,886**		**9,768**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.87**		**1.03**		**0.87**		**1.03**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 66: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	3,404		9,253		3,404		9,253	
2	Rebates to Participants and Trade Allies	211		579		211		579	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	235		1,402		235		1,402	
5	Direct Installation Program Materials and Labor	3,130		7,229		3,130		7,229	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	-172		42		-172		42	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	3	1	3	5	3	1	3	5
8	Administration and Management	87	608	439	1,332	87	608	439	1,332
9	Marketing	0	66	0	285	0	66	0	285
10	Program Delivery	3	29	16	446	3	29	16	446
11	EDC Evaluation Costs	58		313		58		313	
12	SWE Audit Costs	26		106		26		106	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	882		2,947		882		2,947	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**4,287**		**12,200**		**4,287**		**12,200**	
15	Total NPV Lifetime Electric Energy Benefits	1,062		5,091		1,062		5,091	
16	Total NPV Lifetime Electric Capacity Benefits	409		2,167		409		2,167	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-42		-190		-42		-190	
19	Total NPV Lifetime Water Impacts	440		2,431		440		2,431	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**1,869**		**9,498**		**1,869**		**9,498**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.44**		**0.78**		**0.44**		**0.78**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 67: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	1,026		2,497		1,026		2,497	
2	Rebates to Participants and Trade Allies	39		135		39		135	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		160		0		160	
5	Direct Installation Program Materials and Labor	1,017		2,206		1,017		2,206	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	-30		-4		-30		-4	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	1	0	1	2	1	0	1	2
8	Administration and Management	32	189	144	455	32	189	144	455
9	Marketing	1	6	1	59	1	6	1	59
10	Program Delivery	1	27	6	233	1	27	6	233
11	EDC Evaluation Costs	16		92		16		92	
12	SWE Audit Costs	9		35		9		35	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	282		1,027		282		1,027	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**1,308**		**3,524**		**1,308**		**3,524**	
15	Total NPV Lifetime Electric Energy Benefits	163		1,159		163		1,159	
16	Total NPV Lifetime Electric Capacity Benefits	54		344		54		344	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	0		-52		0		-52	
19	Total NPV Lifetime Water Impacts	58		252		58		252	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**274**		**1,703**		**274**		**1,703**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.21**		**0.48**		**0.21**		**0.48**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 68: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	IMCs	3,096		9,412		3,096		9,412	
2	Rebates to Participants and Trade Allies	166		481		166		481	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	448		1,655		448		1,655	
5	Direct Installation Program Materials and Labor	2,607		7,296		2,607		7,296	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	-125		-20		-125		-20	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	3	1	3	5	3	1	3	5
8	Administration and Management	84	519	400	1,214	84	519	400	1,214
9	Marketing	3	57	3	275	3	57	3	275
10	Program Delivery	3	24	15	455	3	24	15	455
11	EDC Evaluation Costs	58		295		58		295	
12	SWE Audit Costs	26		104		26		104	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	779		2,769		779		2,769	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**3,874**		**12,181**		**3,874**		**12,181**	
15	Total NPV Lifetime Electric Energy Benefits	1,402		6,075		1,402		6,075	
16	Total NPV Lifetime Electric Capacity Benefits	372		1,621		372		1,621	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-51		-213		-51		-213	
19	Total NPV Lifetime Water Impacts	916		3,458		916		3,458	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**2,638**		**10,940**		**2,638**		**10,940**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.68**		**0.90**		**0.68**		**0.90**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

3.3.7 Status of Recommendations

The process evaluation activities in PY16 led to the following findings and recommendations from Tetra Tech to the Companies, along with a summary of how the Companies plan to address the recommendation in program delivery. Findings and recommendations from previous process evaluation efforts can be found in the Companies' PY13 and PY14 annual reports.

3.3.7.1 Appliance Recycling

Findings and recommendations from the PY16 evaluation are presented in Section 3.2.7.1..

3.4 C&I Energy Solutions for Business Program - Small

The C&I Solutions for Business Program – Small (referred to as ESB-Small Program) is offered to small commercial and industrial customers and was implemented jointly by Franklin Energy Services, Willdan, and CLEAResult for PY16. The Franklin Energy Services portion of the program includes downstream and midstream incentives for customers that install energy efficient equipment. The Willdan portion of the program includes incentives for Commercial New Construction, Custom Building Upgrades, Building Operator Certification, and the Building Tune-Up direct install program in PY16. CLEAResult staff conduct most of the audits and direct installations for the CI Multifamily initiative. CLEAResult administered the Appliance Recycling program component.

3.4.1 Participation and Reported Savings by Customer Segment

Table 69 and Table 70 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Small Program in PY16 by customer segment and EDC. This program serves the Small C&I and GNI customer segments. Each separate rebate application is counted as one participant.

Table 69: ESB-Small Program Participation and Reported Impacts for Met-Ed and Penelec

Parameter	Met-Ed Small C&I (Non-GNI)	Met-Ed GNI	Met-Ed Total	Penelec Small C&I (Non-GNI)	Penelec GNI	Penelec Total
PYTD # Participants	3,546	19	3,565	4,686	54	4,740
PYRTD MWh/yr	35,536	365	35,901	54,614	1,067	55,680
PYRTD MW/yr	7.28	0.07	7.35	12.10	0.21	12.31
PYTD Incentives ($1000)	5,193	79	5,272	7,004	308	7,313

Table 70: ESB-Small Program Participation and Reported Impacts for Penn Power and WPP

Parameter	Penn Power Small C&I (Non-GNI)	Penn Power GNI	Penn Power Total	WPP Small C&I (Non-GNI)	WPP GNI	WPP Total
PYTD # Participants	488	22	510	2,032	63	2,095
PYRTD MWh/yr	11,857	392	12,249	41,816	1,867	43,683
PYRTD MW/yr	2.64	0.06	2.69	8.49	0.38	8.88
PYTD Incentives ($1000)	1,236	166	1,402	5,605	661	6,267

3.4.2 Gross Impact Evaluation

The ESB-Small Program was disaggregated into five sampling initiatives for gross impact evaluation. Downstream and midstream lighting improvements and downstream prescriptive rebates for efficient equipment such as HVAC systems, food service, refrigeration, appliances, and agricultural measures were grouped into the CI Prescriptive initiative and evaluated

according to PA TRM protocols as described in detail in Appendix R. Within the Prescriptive initiative, lighting and non-lighting, and downstream and midstream components each had distinct sampling strata. Custom projects include combinations of measures that serve multiple end-uses, as well as custom projects that involve combined heat and power, motors and drives, industrial process improvements, refrigeration, retro-commissioning, compressed air upgrades, data centers, and custom HVAC and chillers. The impact evaluation for the custom initiative is described in Appendix S. The Energy Management and New Construction (CI EMNC) initiative includes the Building Tune-Up direct install component, incentives for efficient new construction, and may eventually include additional components such as building operator certification, retro and virtual commissioning, and incentives for building improvements. The impact evaluation for the CI EMNC initiative is described in Appendix T. The Master Metered Multifamily Direct Install (CI Multifamily) initiative targets low-income customers in master-metered communities. Evaluation activities for the CI Multifamily initiative are described in Appendix U. Appendix V describes the evaluation of the Appliance Recycling initiative. Table 71 summarizes program verified impacts and realization rates for each EDC.

Table 71: ESB-Small Program Gross Impact Evaluation Summary for PY16

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	CI Prescriptive	15,786	3.10	94%	96.4%
Met-Ed	CI Custom	5,186	2.03	100%	108.4%
Met-Ed	CI EMNC	10,772	2.07	82%	77.3%
Met-Ed	CI Multifamily	742	0.11	104%	112.3%
Met-Ed	Appliance Recycling	68	0.02	109%	113.7%
Met-Ed Total		**32,555**	**7.33**	**91%**	**93%**
Penelec	CI Prescriptive	32,989	6.64	95%	79%
Penelec	CI Custom	5,473	1.93	100%	118%
Penelec	CI EMNC	13,010	2.67	89%	88%
Penelec	CI Multifamily	774	0.11	93%	103%
Penelec	Appliance Recycling	47	0.02	103%	103%
PenelecTotal		**52,293**	**11.37**	**94%**	**86%**
Penn Power	CI Prescriptive	8,999	1.95	94%	88%
Penn Power	CI Custom	1,392	0.46	102%	116%
Penn Power	CI EMNC	1,048	0.22	85%	96%
Penn Power	CI Multifamily	39	0.01	102%	103%
Penn Power	Appliance Recycling	13	0.00	108%	109%
Penn PowerTotal		**11,490**	**2.64**	**94%**	**93%**
WPP	CI Prescriptive	29,963	5.88	97%	89%
WPP	CI Custom	3,103	1.13	102%	102%
WPP	CI EMNC	11,012	1.61	113%	89%
WPP	CI Multifamily	40	0.00	101%	105%
WPP	Appliance Recycling	55	0.02	109%	109%
WPP Total		**44,174**	**8.64**	**101%**	**90%**

The gross realization rates for energy savings were driven primarily by variances between assumed lighting hours of use in advance of rebate approval and hours of use that were

determined through impact evaluation activities. For Met-Ed and Penelec, the MODIFY program, which provided direct delivery of TLEDs to small commercial businesses, had lower realization rates than other program components. This was primarily due to optimistic assumptions regarding lamp in-service rates. Midstream lighting realization rates tended to be lower for EDCs with significant manufacturing or industrial sectors. One reason for this is that the default baseline wattage assumptions in the TRM for highbay fixtures tend to be higher than what are verified on site. A second reason is that storage and manufacturing facilities are often found to be unconditioned, which lowers the demand interactive effect relative to those used in reporting assumptions. Despite these factors, the midstream lighting program is generally more cost-effective than the downstream program due to lower overall implementation cost.

3.4.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

This program's gross impact evaluation typically involves on-site visits, with occasional metering of equipment and monitoring lighting hours of use. ADM resumed on-site visits at the end of Phase III after businesses reopened. The COVID-19 pandemic did not hinder the evaluation effort for PY16, and no adjustments were made to typical evaluation processes.

3.4.3 Net Impact Evaluation

The net impact evaluation of the Prescriptive initiative is described in Appendix R. The net impact evaluation of the Custom initiative is described in Appendix S. The net impact evaluation of the CI EMNC initiative is described in Appendix T. Net impact evaluation was not conducted for the CI Multifamily initiative since that is a dedicated low-income program. The NTG for the Appliance Recycling Initiative is estimated to be the same as the NTG of the residential Appliance Recycling Initiative, as described in Appendix V.

All initiatives other than CI Multifamily were evaluated for NTG in PY14. The CI Multifamily initiative was evaluated in PY15, and the CI Custom and EMNC initiatives were evaluated in PY16. Results are shown in Table 72.

Table 72: ESB-Small Program Net Impact Evaluation Summary for PY16

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	CI Prescriptive	15,786	64.0%	10,104	1.98
Met-Ed	CI Custom	5,186	55.7%	2,886	1.13
Met-Ed	CI EMNC	10,772	67.9%	7,310	1.41
Met-Ed	CI Multifamily	742	99.5%	739	0.11
Met-Ed	Appliance Recycling	68	62.0%	42	0.01
Met-Ed Total		**32,555**	**64.8%**	**21,082**	**4.64**
Penelec	CI Prescriptive	32,989	65.9%	21,736	4.38
Penelec	CI Custom	5,473	47.6%	2,605	0.92
Penelec	CI EMNC	13,010	78.3%	10,187	2.09
Penelec	CI Multifamily	774	99.5%	770	0.11
Penelec	Appliance Recycling	47	60.0%	28	0.01
Penelec Total		**52,293**	**67.6%**	**35,326**	**7.51**
Penn Power	CI Prescriptive	8,999	77.4%	6,967	1.51
Penn Power	CI Custom	1,392	56.0%	779	0.26
Penn Power	CI EMNC	1,048	74.8%	784	0.16
Penn Power	CI Multifamily	39	99.5%	39	0.01
Penn Power	Appliance Recycling	13	61.0%	8	0.00
Penn Power Total		**11,490**	**74.6%**	**8,576**	**1.94**
WPP	CI Prescriptive	29,963	68.0%	20,376	4.00
WPP	CI Custom	3,103	56.3%	1,748	0.64
WPP	CI EMNC	11,012	71.6%	7,881	1.15
WPP	CI Multifamily	40	99.5%	40	0.00
WPP	Appliance Recycling	55	66.0%	37	0.01
WPP Total		**44,174**	**68.1%**	**30,081**	**5.80**

3.4.3.1 High-Impact Measure Research

The CI Prescriptive, CI Custom, and CI EMNC initiatives were all designated as high-impact measures in PY14. The net impact evaluation of the Prescriptive initiative is described in Appendix R. The net impact evaluation of the Custom initiative is described in Appendix S. The net impact evaluation of the CI EMNC initiative is described in Appendix T. The CI Multifamily program was evaluated for net impact in PY15 but is not considered to be a high-impact measure.

3.4.4 Verified Savings Estimates

In Table 73 the realization rates and net-to-gross ratios determined by ADM and Tetra Tech are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the ESB-Small Program in PY16. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 73: PYTD and P4TD Savings Summary

	Met-Ed		Penelec		Penn Power		WPP	
Savings Type	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	35,901	7.88	55,680	13.20	12,249	2.84	43,683	9.58
PYVTD Gross	32,555	7.33	52,293	11.37	11,490	2.64	44,174	8.64
PYVTD Net	21,082	4.64	35,326	7.51	8,576	1.94	30,081	5.80
RTD	88,101	17.60	118,904	26.78	27,085	5.68	108,104	21.97
VTD Gross	87,983	16.63	113,374	23.92	24,833	5.17	110,175	19.94
VTD Net	62,598	11.43	81,283	16.96	20,414	4.16	83,205	14.56

3.4.5 Process Evaluation

The Energy Management and New Construction (EMNC) and Custom initiatives underwent process evaluation in PY16. Evaluation activities from PY16 and past years in Phase IV are summarized in Table 74 and are described below. Key findings and recommendations from the PY16 process evaluation are described in Section 3.4.7.

Table 74: Combined C&I Program Process Evaluation Sample Design

Stratum	Population Size	Sample Size (Census Att	Response Rate
Met-Ed Custom (PY16)	53	11	21%
Met-Ed Prescriptive (PY14)	161	41	25%
Met-Ed Midstream (PY14)	64	16	25%
Met-Ed EMNC (PY16)	227	21	9%
Penelec Custom (PY16)	61	8	13%
Penelec Prescriptive (PY14)	200	70	35%
Penelec Midstream (PY14)	162	39	24%
Penelec EMNC (PY16)	228	47	21%
Penn Power Custom (PY16)	9	1	11%
Penn Power Prescriptive (PY14)	91	35	38%
Penn Power Midstream (PY14)	8	1	13%
Penn Power EMNC (PY16)	51	9	18%
WPP Custom (PY16)	60	4	7%
WPP Prescriptive (PY14)	272	97	36%
WPP Midstream (PY14)	93	20	22%
WPP EMNC (PY16)	228	38	17%
Trade Ally Surveys (PY14)	165	51	31%
Trade Ally Surveys (PY16)	84	25	30%
Midstream Distributor Interviews	17	15	88%
All EDCs MF Participant Surveys (PY15)	249	25	10%
All EDCs MF Owner/Manager Surveys (PY15)	46	10	22%
Program Total	**2,529**	**549**	**22%**

3.4.5.1 Custom, Energy Management, and Prescriptive Components (PY14)

In PY14 Tetra Tech conducted participant surveys, trade ally surveys, and midstream distributor interviews. Process evaluation activities were combined for the ESB Small and ESB Large programs. Tetra Tech opted to survey and interview the census of program participants, trade allies, and distributors. To further increase the number of survey participants, Tetra Tech drew from both PY13 and PY14 participants. Response rates varied but were generally higher than expected, which resulted in robust overall samples. Table 74 shows the sample design for the PY14 process evaluation effort. After review of the tracking and reporting system and the gross impact evaluation sample design, Tetra Tech applied a similar stratification approach as the gross impact evaluation at the initiative level. However, downstream and midstream sub-initiatives were not further disaggregated into lighting and non-lighting components. In Table 74 below, the Prescriptive stratum includes both lighting and non-lighting downstream projects, while the Midstream stratum incudes both lighting and non-lighting midstream projects. Participant telephone surveys combined net impact and process evaluation and were fielded in May and June 2023. An email campaign preceded the surveys to notify customers of the upcoming survey effort and to increase response rates. Trade ally surveys and distributor interviews occurred in July 2023.

3.4.5.2 Multifamily Direct Install (PY14 and PY15)

Tetra Tech conducted a combined process evaluation of the nonresidential, residential market-rate, and residential low-income Multifamily Direct Install programs in PY14 and PY15. The evaluation is described in Section 3.1.5.6.

3.4.5.3 Custom and Energy Management Initiatives (PY16)

Tetra Tech conducted a combined process evaluation of the custom and Energy Management initiatives in PY16. When process evaluations were previously conducted in PY14, some of the Energy Management components had not fully launched. The process evaluation of the Custom initiative provided an opportunity to follow up on findings from the PY14 evaluation and to include the more recent solar program component.

3.4.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 75, Table 76, Table 77, and Table 78 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2024 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 75: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	10,537		27,372		6,090		19,031	
2	Rebates to Participants and Trade Allies	5,464		15,522		5,464		15,522	
3	Upstream / Midstream Incentives	639		1,110		639		1,110	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		239		0		239	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	4,434		10,502		-13		2,160	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	7	3	7	13	7	3	7	13
8	Administration and Management	174	1,951	778	3,609	174	1,951	778	3,609
9	Marketing	0	139	0	391	0	139	0	391
10	Program Delivery	19	40	75	850	19	40	75	850
11	EDC Evaluation Costs	222		848		222		848	
12	SWE Audit Costs	64		259		64		259	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	2,621		6,830		2,621		6,830	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**13,158**		**34,202**		**8,711**		**25,861**	
15	Total NPV Lifetime Electric Energy Benefits	14,818		34,522		9,517		24,370	
16	Total NPV Lifetime Electric Capacity Benefits	13,794		27,490		8,680		18,783	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	864		2,165		629		1,600	
18	Total NPV Lifetime Fossil Fuel Impacts	-217		-1,350		-156		-964	
19	Total NPV Lifetime Water Impacts	0		20		0		20	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**29,260**		**62,848**		**18,672**		**43,810**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**2.22**		**1.84**		**2.14**		**1.69**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 76: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	22,000		37,065		14,202		26,223	
2	Rebates to Participants and Trade Allies	6,573		16,803		6,573		16,803	
3	Upstream / Midstream Incentives	1,893		2,524		1,893		2,524	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		892		0		892	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	13,534		16,846		5,737		6,005	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	8	4	8	14	8	4	8	14
8	Administration and Management	212	2,520	905	4,271	212	2,520	905	4,271
9	Marketing	0	168	0	459	0	168	0	459
10	Program Delivery	21	56	79	1,508	21	56	79	1,508
11	EDC Evaluation Costs	246		939		246		939	
12	SWE Audit Costs	71		287		71		287	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	3,305		8,471		3,305		8,471	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**25,305**		**45,536**		**17,507**		**34,694**	
15	Total NPV Lifetime Electric Energy Benefits	24,079		45,244		16,140		32,223	
16	Total NPV Lifetime Electric Capacity Benefits	18,749		34,955		12,306		24,717	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	974		3,266		767		2,390	
18	Total NPV Lifetime Fossil Fuel Impacts	-641		-5,002		-477		-4,178	
19	Total NPV Lifetime Water Impacts	0		3		0		3	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**43,161**		**78,466**		**28,736**		**55,154**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.71**		**1.72**		**1.64**		**1.59**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 77: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	3,463		8,468		2,532		7,143	
2	Rebates to Participants and Trade Allies	1,115		4,353		1,115		4,353	
3	Upstream / Midstream Incentives	509		599		509		599	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		67		0		67	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	1,840		3,448		909		2,123	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	2	1	2	4	2	1	2	4
8	Administration and Management	71	451	299	940	71	451	299	940
9	Marketing	0	34	0	107	0	34	0	107
10	Program Delivery	6	6	24	337	6	6	24	337
11	EDC Evaluation Costs	63		242		63		242	
12	SWE Audit Costs	19		78		19		78	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	654		2,034		654		2,034	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**4,117**		**10,501**		**3,186**		**9,176**	
15	Total NPV Lifetime Electric Energy Benefits	5,511		10,278		4,111		8,439	
16	Total NPV Lifetime Electric Capacity Benefits	2,820		4,827		2,070		3,877	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	257		754		211		639	
18	Total NPV Lifetime Fossil Fuel Impacts	-168		-393		-129		-322	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**8,420**		**15,466**		**6,263**		**12,633**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**2.05**		**1.47**		**1.97**		**1.38**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 78: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	IMCs	12,981		32,710		8,808		26,422	
2	Rebates to Participants and Trade Allies	5,799		17,001		5,799		17,001	
3	Upstream / Midstream Incentives	1,456		2,140		1,456		2,140	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		1,391		0		1,391	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	5,727		12,177		1,554		5,889	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	7	3	7	13	7	3	7	13
8	Administration and Management	195	2,688	814	4,412	195	2,688	814	4,412
9	Marketing	0	131	0	368	0	131	0	368
10	Program Delivery	17	29	65	1,320	17	29	65	1,320
11	EDC Evaluation Costs	220		840		220		840	
12	SWE Audit Costs	62		249		62		249	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	3,352		8,088		3,352		8,088	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**16,334**		**40,798**		**12,161**		**34,509**	
15	Total NPV Lifetime Electric Energy Benefits	21,349		46,304		14,519		34,770	
16	Total NPV Lifetime Electric Capacity Benefits	8,405		17,100		5,638		12,427	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,532		4,136		1,115		3,152	
18	Total NPV Lifetime Fossil Fuel Impacts	-856		-1,819		-592		-1,385	
19	Total NPV Lifetime Water Impacts	0		54		0		54	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**30,431**		**65,775**		**20,681**		**49,018**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.86**		**1.61**		**1.70**		**1.42**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

3.4.7 Status of Recommendations

The process evaluation activities in PY16 led to the following findings and recommendations from Tetra Tech to the Companies, along with a summary of how the Companies plan to address the recommendation in program delivery. Findings and recommendations from previous process evaluation efforts can be found in the Companies' prior annual reports.

3.4.7.1 Custom and EMNC Programs

Finding #1: ***Satisfaction among participating customers and vendors remains high.*** The average participant rating across all program aspects was 3.9 or higher for customers and 3.2 or higher for vendors on a 1 to 5 scale, where 1 was *not at all satisfied,* and 5 was *very satisfied*. More than half of participating customers have recommended the program to others, and 78 percent said they were very likely to participate again.

Finding #2: ***Trade allies (contractors and vendors) continue to be the most common source of respondent awareness.*** Nearly half of customer respondents learned about the program from their contractor or vendor. Alternatively, more than two-thirds of customers said they *prefer* to receive information about energy efficiency programs from FirstEnergy, specifically electronically through an email or a direct mail piece. Vendors echoed this feedback, saying they felt the most effective communication was from FirstEnergy (i.e., account manager, call center, bill inserts).

Finding #3: ***The application process received positive feedback from the participating customers, but vendor respondents had some suggestions.*** Nearly all program participants (97 percent) had no problems completing the program application. However, the application was mentioned by a few participants and some vendors as one of the program features that needs improvement. Simplifying the process and adding an electronic signature option were mentioned by both respondent groups. The application process was rated highly in satisfaction amongst customers, receiving an average score of 4.3 on a scale ranging from one to five. However, vendor respondents provided the lowest scores (3.2 on the same one to five scale) for time it took to complete the paperwork and the amount of paperwork required by the program.

Finding #4: ***Nearly two-thirds of the customer respondents had no recommended improvements or changes to the program, while half of the vendor respondents offered suggestions.*** Customers with recommendations most frequently mentioned expanding service offerings (31 percent), increasing program awareness (28 percent), and improving communication (17 percent). Vendor recommendations mostly involved reducing administrative burden, including simplifying processes and paperwork (four respondents), program requirements, and calculation tools (four respondents), and decreasing the preapproval and processing time (three respondents). Vendors also suggested limiting changes in incentive amounts to ensure stability and good customer relationships (two respondents).

Finding #5: ***Incomplete and generic contact information limited survey reach.*** A significant barrier to achieving the expected response rate was the lack of accurate contact information in the tracking data. Most records were missing individual contact names and included only generic phone numbers, which led to difficulties in reaching program participants and a high rate of refusals or incomplete attempts. Even after requesting additional contact details from the conservation service providers (CSPs), the improvement in response rates was minimal.

Finding #6: ***The evaluation activities resulted in NTG ratios ranging from 48 to 78 percent across EDCs and initiatives for the PY16 program***. NTG ratios ranged from 48 to 55 percent for the Custom initiative and 68 to 78 percent for the Energy Management initiative. In the Custom Initiative, solar projects had distinctly lower NTGs than non-solar projects. In the Energy Management Initiative, Building Operator Certification, Building Improvements, and Building Tune-Ups had particularly high NTG values, while Commercial New Construction had a far lower NTG than other components.

Finding #7: ***Program motivated participation in the Building Operator Training (BOT). Participants were highly satisfied with the training and found it valuable.*** All four BOT respondents were aware of FirstEnergy's $1,000 incentive before enrolling in the BOC training, and it played a significant role in their decision to participate. Despite challenges such as

balancing the training with full-time work, participants reported that the training was valuable. It increased their understanding of building systems, control strategies, and energy efficiency, which they have begun applying in their facilities. Satisfaction with the training and its relevance was consistently high.

Recommendation #1: ***Increase awareness and continue to utilize multiple strategies to promote the programs, especially among trade allies.*** FirstEnergy and the CSPs use many different outreach strategies to market the programs; this can be seen in the variety of sources customers reported hearing about the program, but a preference for direct communication from FirstEnergy (mailing, email, or electronic newsletters) is among the lowest actual sources of awareness. In addition, trade allies (contractors and vendors) continue to be the most common source of awareness and are identified by the CSPs as an effective channel for identifying and bringing new projects into the FirstEnergy programs. Since the CSPs indicated awareness among trade allies as a key barrier to participation, more marketing activities directed to trade allies is needed. Attending more trade shows and providing more updates to vendors were some of the recommended activities.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: ***Continue to seek opportunities to simplify the application process for trade allies.*** Most recommendations for improvement from customers and vendors involved reducing administrative burden by streamlining the process, simplifying the required paperwork and allowing digital signatures. The vendors also suggested improvements to the application process where FirstEnergy and program implementers could help by providing user-friendly calculation and tracking tools, along with streamlined materials that detail product and customer eligibility. Other recommendations from vendors included limiting changes in incentive amounts.

EDC Status Report #2: Recommendation accepted.

Recommendation #3: ***Improve data collection protocols for contact information.*** Future tracking efforts may benefit from placing greater emphasis on collecting complete and specific contact details, such as direct phone numbers and names of individuals familiar with program participation. Establishing these data protocols upfront with CSPs can enhance respondent accessibility and increase the likelihood of successful survey completions.

EDC Status Report #3: Recommendation accepted.

3.5 C&I Energy Solutions for Business Program - Large

The C&I Solutions for Business Program – Large (referred to as ESB-Large Program) is offered to large commercial and industrial customers and was implemented jointly by Franklin Energy Services and Willdan for PY16. The Franklin Energy Services portion of the program includes downstream and midstream incentives for customers that install custom and prescriptive energy efficient equipment. The Willdan portion of the program includes incentives for efficient new construction, the Building Tune-Up direct install program, custom building retrofits, retrocommissioning, and building operator certification in PY16.

3.5.1 Participation and Reported Savings by Customer Segment

Table 79 and Table 80 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Large Program in PY16 by customer segment and EDC. This program serves the Large C&I and GNI customer segments. Each separate rebate application is counted as one participant.

Table 79: ESB-Large Program Participation and Reported Impacts for Met-Ed and Penelec

Parameter	Met-Ed Large C&I (Non-GNI)	Met-Ed GNI	Met-Ed Total	Penelec Large C&I (Non-GNI)	Penelec GNI	Penelec Total
PYTD # Participants	558	10	568	493	22	515
PYRTD MWh/yr	90,153	933	91,086	32,409	1,107	33,516
PYRTD MW/yr	12.70	0.18	12.88	5.90	0.22	6.12
PYTD Incentives ($1000)	4,754	228	4,983	3,173	290	3,462

Table 80: ESB-Large Program Participation and Reported Impacts for Penn Power and WPP

Parameter	Penn Power Large C&I (Non-GNI)	Penn Power GNI	Penn Power Total	WPP Large C&I (Non-GNI)	WPP GNI	WPP Total
PYTD # Participants	123	3	126	523	8	531
PYRTD MWh/yr	8,641	241	8,881	40,103	41,745	81,848
PYRTD MW/yr	1.33	0.02	1.36	6.97	4.80	11.78
PYTD Incentives ($1000)	826	34	861	3,764	552	4,316

3.5.2 Gross Impact Evaluation

The ESB-Large Program is disaggregated into three sampling initiatives for gross impact evaluation. Each of these initiatives spans both the ESB-Large and ESB-Small programs. The gross impact evaluation of the Prescriptive initiative is described in Appendix R. The gross impact evaluation of the Custom initiative is described in Appendix S. The gross impact

evaluation of the CI EMNC initiative is described in Appendix T. Table 81 summarizes program verified impacts and realization rates for each EDC.

Table 81: ESB-Large Program Gross Impact Evaluation Summary for PY16

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	CI Prescriptive	15,940	2.76	94%	96%
Met-Ed	CI Custom	63,131	9.77	100%	108%
Met-Ed	CI EMNC	9,184	1.49	82%	77%
Met-Ed	Appliance Recycling	0	0.00	109%	114%
Met-Ed Total		**88,255**	**14.02**	**96.9%**	**101.6%**
Penelec	CI Prescriptive	24,359	3.95	95%	79%
Penelec	CI Custom	3,570	0.78	100%	118%
Penelec	CI EMNC	3,872	0.79	89%	88%
Penelec	Appliance Recycling	0	0.00	103%	103%
PenelecTotal		**31,801**	**5.52**	**94.9%**	**84.2%**
Penn Power	CI Prescriptive	3,054	0.60	94%	88%
Penn Power	CI Custom	5,212	0.81	102%	116%
Penn Power	CI EMNC	422	0.05	85%	96%
Penn Power	Appliance Recycling	0	0.00	108%	109%
Penn PowerTotal		**8,688**	**1.46**	**97.8%**	**102.2%**
WPP	CI Prescriptive	20,950	3.70	97%	89%
WPP	CI Custom	52,772	6.75	102%	102%
WPP	CI EMNC	9,711	1.70	113%	89%
WPP	Appliance Recycling	0	0.00	109%	109%
WPP Total		**83,433**	**12.15**	**101.9%**	**95.6%**

The gross realization rates for energy savings were driven primarily by variances between assumed operational characteristics in advance of rebate approval and operational characteristics that were determined through impact evaluation activities. Key operational characteristics include lighting hours of use and equivalent full load hours for chillers, air compressors, and motors. The midstream lighting program tended to have lower realization rates than other program components, largely due to lower verified baseline watts than the values assumed in Section 3.1.7 of the PA TRM for highbay fixtures, and higher incidences of fixtures installed in unconditioned spaces than assumed in reported impact calculations.

3.5.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

This program's gross impact evaluation typically involves on-site visits, with occasional metering of equipment and monitoring lighting hours of use. ADM resumed on-site visits at the end of Phase III after businesses reopened. The COVID-19 pandemic did not hinder the evaluation effort for PY16, and no adjustments were made to typical evaluation processes.

3.5.3 Net Impact Evaluation

The net impact evaluation of the Prescriptive initiative is described in Appendix R. The net impact evaluation of the Custom initiative is described in Appendix S. The net impact evaluation of the CI EMNC initiative is described in Appendix T. The NTG for the Appliance Recycling

Initiative is estimated to be the same as the NTG of the residential Appliance Recycling Initiative, as described in Appendix V.

All initiatives were evaluated for NTG in PY14, and the CI Custom and CI EMNC initiatives were also evaluated in PY16. Results are shown in Table 82.

Table 82: ESB-Large Program Net Impact Evaluation Summary for PY16

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	CI Prescriptive	15,940	64.0%	10,203	1.77
Met-Ed	CI Custom	63,131	55.7%	35,134	5.44
Met-Ed	CI EMNC	9,184	67.9%	6,233	1.01
Met-Ed	Appliance Recycling	0	62.0%	0	0.00
Met-Ed Total		**88,255**	**58.4%**	**51,570**	**8.22**
Penelec	CI Prescriptive	24,359	65.9%	16,049	2.60
Penelec	CI Custom	3,570	47.6%	1,699	0.37
Penelec	CI EMNC	3,872	78.3%	3,032	0.62
Penelec	Appliance Recycling	0	60.0%	0	0.00
Penelec Total		**31,801**	**65.3%**	**20,780**	**3.59**
Penn Power	CI Prescriptive	3,054	77.4%	2,364	0.46
Penn Power	CI Custom	5,212	56.0%	2,917	0.45
Penn Power	CI EMNC	422	74.8%	316	0.04
Penn Power	Appliance Recycling	0	61.0%	0	0.00
Penn Power Total		**8,688**	**64.4%**	**5,597**	**0.96**
WPP	CI Prescriptive	20,950	68.0%	14,247	2.52
WPP	CI Custom	52,772	56.3%	29,733	3.80
WPP	CI EMNC	9,711	71.6%	6,949	1.22
WPP	Appliance Recycling	0	66.0%	0	0.00
WPP Total		**83,433**	**61.0%**	**50,929**	**7.54**

3.5.3.1 High-Impact Measure Research

The CI Prescriptive, CI Custom, and CI EMNC initiatives were all designated as high-impact measures in PY14. The net impact evaluation of the Prescriptive initiative is described in Appendix R. The net impact evaluation of the Custom initiative is described in Appendix S. The net impact evaluation of the CI EMNC initiative is described in Appendix T. No program components were designated as high-impact measures for PY16.

3.5.4 Verified Savings Estimates

In Table 83 the realization rates and net-to-gross ratios determined by ADM and Tetra Tech are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for ESB-Large Program in PY16. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 83: PYTD and P4TD Savings Summary

	Met-Ed		Penelec		Penn Power		WPP	
Savings Type	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	91,086	13.80	33,516	6.56	8,881	1.43	81,848	12.71
PYVTD Gross	88,255	14.02	31,801	5.52	8,688	1.46	83,433	12.15
PYVTD Net	51,570	8.22	20,780	3.59	5,597	0.96	50,929	7.54
RTD	160,975	23.88	76,133	14.39	29,208	4.47	135,131	21.23
VTD Gross	162,455	23.85	74,062	12.67	28,089	4.35	138,743	19.95
VTD Net	97,061	14.36	48,927	8.29	21,073	3.30	89,926	13.21

3.5.5 Process Evaluation

The process evaluation effort for both C&I Programs is described in Sections 3.4.5 and 3.4.7. Most practical aspects of the programs are managed as one general effort rather than distinct programs, but applications are placed in one of the two programs according to their associated rate classes.

3.5.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 84, Table 85, Table 86, and Table 87 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2024 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 84: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	37,285		50,604		21,504		29,975	
2	Rebates to Participants and Trade Allies	5,428		7,533		5,428		7,533	
3	Upstream / Midstream Incentives	340		769		340		769	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	31,517		42,303		15,736		21,673	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	9	4	10	17	9	4	10	17
8	Administration and Management	222	3,841	984	4,252	222	3,841	984	4,252
9	Marketing	0	1,138	0	1,132	0	1,138	0	1,132
10	Program Delivery	19	16	72	615	19	16	72	615
11	EDC Evaluation Costs	314		1,041		314		1,041	
12	SWE Audit Costs	83		335		83		335	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	5,647		8,457		5,647		8,457	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**42,932**		**59,062**		**27,151**		**38,432**	
15	Total NPV Lifetime Electric Energy Benefits	40,434		64,741		23,621		38,623	
16	Total NPV Lifetime Electric Capacity Benefits	14,016		21,005		8,204		12,617	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	-3,182		-4,325		-1,598		-2,197	
18	Total NPV Lifetime Fossil Fuel Impacts	-8,384		-12,117		-4,677		-6,865	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**42,884**		**69,304**		**25,549**		**42,178**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.00**		**1.17**		**0.94**		**1.10**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 85: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	6,894		17,009		4,352		11,385	
2	Rebates to Participants and Trade Allies	3,475		5,887		3,475		5,887	
3	Upstream / Midstream Incentives	533		810		533		810	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	2,886		10,312		344		4,688	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	7	3	7	12	7	3	7	12
8	Administration and Management	154	2,305	734	3,078	154	2,305	734	3,078
9	Marketing	0	824	0	838	0	824	0	838
10	Program Delivery	14	11	51	331	14	11	51	331
11	EDC Evaluation Costs	232		772		232		772	
12	SWE Audit Costs	60		243		60		243	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	3,610		6,068		3,610		6,068	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**10,503**		**23,077**		**7,962**		**17,452**	
15	Total NPV Lifetime Electric Energy Benefits	14,756		29,442		9,639		19,425	
16	Total NPV Lifetime Electric Capacity Benefits	5,819		11,820		3,781		7,717	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	667		1,785		450		1,274	
18	Total NPV Lifetime Fossil Fuel Impacts	-1,502		-2,357		-1,004		-1,594	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**19,740**		**40,690**		**12,867**		**26,821**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.88**		**1.76**		**1.62**		**1.54**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 86: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	4,429		14,286		2,718		9,809	
2	Rebates to Participants and Trade Allies	800		2,176		800		2,176	
3	Upstream / Midstream Incentives	196		278		196		278	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	3,432		11,832		1,722		7,355	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	2	1	2	3	2	1	2	3
8	Administration and Management	53	550	241	961	53	550	241	961
9	Marketing	0	211	0	240	0	211	0	240
10	Program Delivery	5	1	18	143	5	1	18	143
11	EDC Evaluation Costs	58		191		58		191	
12	SWE Audit Costs	16		66		16		66	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	898		1,865		898		1,865	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**5,326**		**16,151**		**3,616**		**11,674**	
15	Total NPV Lifetime Electric Energy Benefits	4,169		11,587		2,689		8,630	
16	Total NPV Lifetime Electric Capacity Benefits	1,215		3,187		794		2,408	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	391		4,882		302		3,139	
18	Total NPV Lifetime Fossil Fuel Impacts	-13		-394		-10		-340	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**5,762**		**19,262**		**3,776**		**13,837**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.08**		**1.19**		**1.04**		**1.19**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

Table 87: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	17,478		27,754		10,561		18,587	
2	Rebates to Participants and Trade Allies	4,536		7,965		4,536		7,965	
3	Upstream / Midstream Incentives	460		843		460		843	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	12,482		18,946		5,565		9,779	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	7	3	7	12	7	3	7	12
8	Administration and Management	149	3,087	713	3,763	149	3,087	713	3,763
9	Marketing	0	840	0	833	0	840	0	833
10	Program Delivery	11	13	43	470	11	13	43	470
11	EDC Evaluation Costs	225		748		225		748	
12	SWE Audit Costs	57		230		57		230	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	4,392		6,818		4,392		6,818	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**21,871**		**34,572**		**14,953**		**25,405**	
15	Total NPV Lifetime Electric Energy Benefits	40,246		58,403		24,532		37,830	
16	Total NPV Lifetime Electric Capacity Benefits	8,087		11,761		4,995		7,766	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	-3,891		-2,182		-1,995		-852	
18	Total NPV Lifetime Fossil Fuel Impacts	-10,104		-10,327		-5,835		-6,215	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**34,337**		**57,655**		**21,697**		**38,529**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.57**		**1.67**		**1.45**		**1.52**	

* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = $2021

3.5.7 Status of Recommendations

Recommendations for other nonresidential program components are listed in Section 3.4.7.

4 Portfolio Finances and Cost Recovery

This section provides an overview of the expenditures associated with the Companies' portfolios and the recovery of those costs from ratepayers

4.1 Program Finances

Program-specific and portfolio total finances for PY16 are shown in Table 88, Table 89, Table 90, and Table 91 for Met-Ed, Penelec, Penn Power, and WPP. The columns in these tables Table 88 through Table 95 are adapted from the 'Direct Program Cost' categories in the Commission's EE&V Plan template[8] 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 EDCs employs to support program delivery). The dollar figures shown in Table 88 through Table 95 are based on EDC tracking of expenditures with no adjustments to account for inflation.[9]

Table 88: Met-Ed PY16 Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	3,212	1,364	4,576
Energy Efficient Products	991	1,643	2,633
Low Income Energy Efficiency	2,622	721	3,343
C&I Energy Solutions for Business - Small	6,103	2,556	8,659
C&I Energy Solutions for Business - Large	5,768	5,564	11,332
Common Portfolio Costs[1]		0	0
Portfolio Total	**18,696**	**11,848**	**30,544**
SWE Costs[2]	**N/A**	**N/A**	**253**
Total	**18,696**	**11,848**	**30,797**

1. Common portolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

[8] https://www.puc.pa.gov/pcdocs/1676672.docx

[9] 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 89: Penelec PY16 Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	2,501	1,165	3,666
Energy Efficient Products	701	1,066	1,767
Low Income Energy Efficiency	3,576	856	4,432
C&I Energy Solutions for Business - Small	8,465	3,234	11,699
C&I Energy Solutions for Business - Large	4,008	3,549	7,557
Common Portfolio Costs[1]		0	0
Portfolio Total	**19,251**	**9,870**	**29,121**
SWE Costs[2]	**N/A**	**N/A**	**230**
Total	**19,251**	**9,870**	**29,350**

1. Common portolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

Table 90: Penn Power PY16 Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	1,190	522	1,712
Energy Efficient Products	315	422	738
Low Income Energy Efficiency	1,056	274	1,329
C&I Energy Solutions for Business - Small	1,623	634	2,258
C&I Energy Solutions for Business - Large	996	881	1,878
Common Portfolio Costs[1]		0	0
Portfolio Total	**5,181**	**2,734**	**7,915**
SWE Costs[2]	**N/A**	**N/A**	**71**
Total	**5,181**	**2,734**	**7,986**

1. Common portolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

Table 91: WPP PY16 Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	3,439	1,659	5,098
Energy Efficient Products	922	1,372	2,294
Low Income Energy Efficiency	3,221	753	3,974
C&I Energy Solutions for Business - Small	7,254	3,291	10,545
C&I Energy Solutions for Business - Large	4,996	4,335	9,331
Common Portfolio Costs[1]		0	0
Portfolio Total	**19,832**	**11,410**	**31,242**
SWE Costs[2]	**N/A**	**N/A**	**238**
Total	**19,832**	**11,410**	**31,480**

1. Common portolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

Program-specific and portfolio total finances since the inception of Phase IV are shown in Table 92, Table 93, Table 94, and Table 95 for Met-Ed, Penn Power, Penelec, and WPP.

Table 92: Met-Ed P4TD Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	11,018	4,827	15,845
Energy Efficient Products	5,705	5,334	11,038
Low Income Energy Efficiency	7,318	2,648	9,966
C&I Energy Solutions for Business - Small	18,681	7,181	25,862
C&I Energy Solutions for Business - Large	9,299	9,045	18,344
Common Portfolio Costs[1]		0	0
Portfolio Total	**52,020**	**29,035**	**81,055**
SWE Costs[2]	**N/A**	**N/A**	**1,098**
Total	**52,020**	**29,035**	**82,153**

1. Common portolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

Table 93: Penelec P4TD Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	8,415	3,576	11,991
Energy Efficient Products	3,440	3,780	7,220
Low Income Energy Efficiency	10,082	3,060	13,143
C&I Energy Solutions for Business - Small	22,384	8,907	31,291
C&I Energy Solutions for Business - Large	7,479	6,467	13,945
Common Portfolio Costs[1]		0	0
Portfolio Total	**51,800**	**25,790**	**77,591**
SWE Costs[2]	**N/A**	**N/A**	**995**
Total	**51,800**	**25,790**	**78,586**

1. Common portolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

Table 94: Penn Power P4TD Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	3,975	1,846	5,821
Energy Efficient Products	1,419	1,388	2,807
Low Income Energy Efficiency	2,738	1,065	3,803
C&I Energy Solutions for Business - Small	5,516	2,121	7,637
C&I Energy Solutions for Business - Large	2,696	1,979	4,675
Common Portfolio Costs[1]		0	0
Portfolio Total	**16,344**	**8,398**	**24,742**
SWE Costs[2]	**N/A**	**N/A**	**309**
Total	**16,344**	**8,398**	**25,050**

1. Common portolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

Table 95: WPP P4TD Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	11,147	5,580	16,726
Energy Efficient Products	4,323	4,857	9,181
Low Income Energy Efficiency	10,330	2,872	13,201
C&I Energy Solutions for Business - Small	22,586	8,560	31,146
C&I Energy Solutions for Business - Large	9,825	7,341	17,165
Common Portfolio Costs[1]		0	0
Portfolio Total	**58,211**	**29,209**	**87,420**
SWE Costs[2]	**N/A**	**N/A**	**1,030**
Total	**58,211**	**29,209**	**88,449**

1. Common portolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

4.2 Cost Recovery

Act 129 allows Pennsylvania EDCs to recover EE&C plan costs through a cost-recovery mechanism. Each EDC's cost-recovery charges are organized separately by four customer sectors to ensure that the electric rate classes that finance the programs are the rate classes that receive the direct energy and conservation benefits. Cost-recovery is governed by tariffed rate class, so it is necessarily tied to the way customers are metered and charged for electric service. Readers should be mindful of the differences between the tables below and Section 2.3. For example, the low-income customer segments are subsets of the residential tariff(s) and therefore not listed separately in Table 96, Table 97, Table 98, and Table 99.

Table 96: Met-Ed EE&C Expenditures by Cost-Recovery Category[10] ($1,000)

Cost Recovery Sector	Rate Classes Included	PYTD $ Spending ($1,000)	P4TD $ Spending ($1,000)
Residential (incl Low Income)	Rate RS	$10,659	$37,307
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	$8,719	$26,085
Large C&I	Rate GS-Large, Rate GP and Rate TP	$11,415	$18,705
Street Lighting	Street Lighting Service, LED Street Lighting Service and Ornamental Street Lighting Service	$4	$56
Portfolio Total		**$30,797**	**$82,153**

[10] Includes SWE costs

Table 97: Penelec EE&C Expenditures by Cost-Recovery Category[11] ($1,000)

Cost Recovery Sector	Rate Classes Included	PYTD $ Spending ($1,000)	P4TD $ Spending ($1,000)
Residential (incl Low Income)	Rate RS	$9,962	$32,779
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	$11,768	$31,574
Large C&I	Rate GS-Large, Rate GP, and Rate LP	$7,618	$14,207
Street Lighting	Street Lighting Service, LED Street Lighting Service, and Ornamental Street Lighting Service	$2	$25
Portfolio Total		**$29,350**	**$78,586**

Table 98: Penn Power EE&C Expenditures by Cost-Recovery Category[12] ($1,000)

Cost Recovery Sector	Rate Classes Included	PYTD $ Spending ($1,000)	P4TD $ Spending ($1,000)
Residential (incl Low Income)	Rate RS	$3,815	$12,585
Small C&I	Rate GS, GS Special Rider GSDS, Rate GM, Rate GS-Large and POL	$2,276	$7,713
Large C&I	Rate GP, and Rate GT	$1,894	$4,745
Street Lighting	Rate Schedules SV, SVD, SM and LED	$1	$8
Portfolio Total		**$7,986**	**$25,050**

Table 99: WPP EE&C Expenditures by Cost-Recovery Category[13] ($1,000)

Cost Recovery Sector	Rate Classes Included	PYTD $ Spending ($1,000)	P4TD $ Spending ($1,000)
Residential (incl Low Income)	Rate 10	$11,485	$39,622
Small C&I	Rate GS 20, Rate GS 30	$10,604	$31,404
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	$9,389	$17,413
Street Lighting	Rate Schedules 51 through 58, 71, 72	$3	$10
Portfolio Total		**$31,480**	**$88,449**

For Phase IV of Act 129, the Companies nominated a portion of peak demand reduction (PDR) acquired via EE&C programs into the PJM Forward Capacity Market. Proceeds from resources that clear in the FCM flow back to the rate class that generated the savings to offset cost recovery. Table 100, Table 101, Table 102, and Table 103, show the proceeds received in PY16 and P4TD net of CSP fees and other administrative costs for Met-Ed, Penelec, Penn Power, and West Penn Power respectively.

[11] Includes SWE costs
[12] Includes SWE costs
[13] Includes SWE costs

Table 100: Met-Ed FCM Proceeds from Recognized PDR ($1000)

Cost Recovery Sector	Rate Classes Included	PY16 Proceeds	P4TD PJM Proceeds
Residential (incl Low Income)	Rate 10	$71.78	$123.40
Small C&I	Rate GS 20, Rate GS 30	$39.28	$69.51
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	$51.60	$90.55
Street Lighting	Rate Schedules 51 through 58, 71, 72	$0.00	$0.00
Portfolio Total		**$162.67**	**$283.45**

Table 101: Penelec FCM Proceeds from Recognized PDR ($1000)

Cost Recovery Sector	Rate Classes Included	PY16 Proceeds	P4TD PJM Proceeds
Residential (incl Low Income)	Rate 10	$74.65	$114.43
Small C&I	Rate GS 20, Rate GS 30	$41.76	$63.36
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	$60.10	$78.05
Street Lighting	Rate Schedules 51 through 58, 71, 72	$0.00	$0.00
Portfolio Total		**$176.52**	**$255.83**

Table 102: Penn Power FCM Proceeds from Recognized PDR ($1,000)

Cost Recovery Sector	Rate Classes Included	PY16 Proceeds	P4TD PJM Proceeds
Residential (incl Low Income)	Rate 10	$11.30	$17.16
Small C&I	Rate GS 20, Rate GS 30	$4.84	$6.95
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	$10.42	$15.74
Street Lighting	Rate Schedules 51 through 58, 71, 72	$0.00	$0.00
Portfolio Total		**$26.56**	**$39.85**

Table 103: WPP FCM Proceeds from Recognized PDR ($1,000)

Cost Recovery Sector	Rate Classes Included	PY16 Proceeds	P4TD PJM Proceeds
Residential (incl Low Income)	Rate 10	$34.42	$72.11
Small C&I	Rate GS 20, Rate GS 30	$20.97	$43.62
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	$47.77	$66.96
Street Lighting	Rate Schedules 51 through 58, 71, 72	$0.00	$0.00
Portfolio Total		**$103.17**	**$182.70**

At the portfolio level, PY16 cost recovery requirements were lowered by the percentages shown in the third row of Table 104 due to the FCM proceeds received from recognition of demand reductions shown in the fourth row of Table 104 for the 2024-2025 delivery year. P4TD cost

recovery requirements have been lowered by the percentage amounts shown in the second to last row of Table 104 and corresponding FCM proceeds received from recognition of demand reductions shown in the last row. The row labeled “PY17 Cost Recovery Reduction” shows the expected additional proceeds for the 2025/26 delivery year. Beginning in the 2026/2027 delivery year, peak demand reduction from energy efficiency is no longer an eligible resource so Phase V cost recovery will be unaffected by proceeds from Phase IV peak demand reductions

Table 104: Cost Recovery Offsets from Recognized FCM PDR

EDC	Met-Ed	Penelec	Penn Power	West Penn Power
PY15 Cost Recovery Reduction (%)	0.5%	0.3%	0.2%	0.3%
DY 2023/24 MW	6.33	4.22	1.19	5.97
PY16 Cost Recovery Reduction (%)	0.5%	0.6%	0.3%	0.3%
DY 2024/25 MW	9.18	9.18	1.84	9.18
Expected 2025/26 Proceeds ($1000)	**394**	**325**	**177**	**690**
DY 2025/26 MW	4.00	3.30	1.80	7.00
P4TD Cost Recovery Reduction (%)	**0.3%**	**0.3%**	**0.2%**	**0.2%**
P4TD MW	**19.51**	**16.70**	**4.83**	**22.14**

Appendix A Site Inspection Summary

Table 105: PY16 Site Visit Summary

EDC	Program	Inspection Firm	Number of Inspections Conducted	Number of Virtual Inspections Conducted	Number of Sites with Discrepancies from Reported Values	Summary of Common Discrepancies
Met-Ed	Energy Efficient Products Program - HVAC Rebates (CAC, ASHP, Mini-Splits)	Franklin	42	0	6	Physical address or phone number differed from contact information on rebate application. Typo in serial number. Customer moved in between installation and inspection, resulting in a different customer living at home at time of inspection.
Penelec		Franklin	26	0	2	
Penn Power		Franklin	4	0	1	
WPP		Franklin	32	0	8	
Met-Ed	Energy Efficient Products Program - Appliance Rebates (Clothes Washer, Clothes Dryer, Dishwasher, Refrigerator and Freezer)	Franklin	163	0	4	Site address or phone number differed from contact information listed on rebate application. Error in serial number. Customer moved in between product installation and inspection, resulting in a different customer living at home at time of inspection.
Penelec		Franklin	98	0	3	
Penn Power		Franklin	22	0	0	
WPP		Franklin	123	0	2	
Met-Ed	Energy Efficient Homes Program - New Construction	PSD	39	0	Please refer to the gross realization rates in past reports as a measure of consistency between reported and verified values.	The most common discrepancies are incorrect equipment capacities, using REM/Rate defaults for furnace fan energy usage rating rather than looking them up by model #, estimating the % of lamps that are efficient, window sizes, and building orientation.
Met-Ed		ADM	0	0		
Penelec		PSD	1	0		
Penelec		ADM	0	0		
Penn Power		PSD	23	0		
Penn Power		ADM	0	0		
WPP		PSD	81	0		
WPP		ADM	0	0		
Met-Ed	Low Income Direct Install Programs	PSD, Honeywell	60	0	0	No discrepancies found in energy savings measures. Two reveiwd projects included count differences noted between number of smoke alarms installed and invoiced. In one case an inspector found that a blower-door test was conducted, but not invoiced.
Penelec			67	0	0	
Penn Power			51	0	0	
WPP			70	0	0	
Met-Ed	C/I Programs	ADM	59	0	Please refer to gross realizaion rates as a measure of consistency.	The main discrepancy is lamp fixture counts/types. Other measures are verified essentially 100% of the time.
Penelec	C/I Programs	ADM	46	0		
Penn Power	C/I Programs	ADM	37	0		
WPP	C/I Programs	ADM	47	0		
TOTAL	**TOTAL**		**1091**	**0**	**n/a**	

Appendix B HER Impact Evaluation Detail

B.1 Gross Impact Evaluation

The Behavioral Modification subprogram provides home energy reports to residential customers in the FirstEnergy PA service territory. These reports detail customers' historical energy usage, providing tips on ways customers can save energy, and promoting other programs in FirstEnergy's residential energy efficiency portfolio. The subprogram is divided between standard residential customers and Low-Income customers, with Low-Income customers receiving reports more frequently than participants in the standard residential subprogram and exclusively receiving low-cost or no-cost tips in their reports. The subprogram is administered as a randomized control trial (RCT) and participants are enrolled in experimental cohorts, with the frequency and start date of each cohort differing for the four EDCs. A monthly billing analysis regression is the primary activity used to calculate savings. Each participant cohort is modeled separately to generate verified gross usage savings. The following section describes ADM's gross impact evaluation methodology.

B.1.1 Data Preparation and Analysis Procedure

B.1.1.1 Data Gathering

Monthly billing data dating back to 12 months prior to each experimental cohort's treatment start date through May 2025 was requested from FirstEnergy for all participants. Monthly billing data was provided with indicators identifying whether the monthly bill was estimated or based on an actual meter read. Control vs. treatment indicators were also provided in the billing data set. Demographic information such as participant account number, etc. were masked in the billing data set. ADM utilized a map of customer IDs to utility account numbers for use in dual participation analysis.

B.1.1.2 Data Preparation

During Phase III, FirstEnergy converted most residential accounts to AMI. Thus, ADM leveraged the daily AMI extract provided by FirstEnergy to conduct the billing data analysis for Home Energy Reports in Phase IV.

ADM's preparation of AMI data is as follows:

- Residential AMI data is filtered by cohort by the treatment and comparison group account numbers.
- Estimated AMI data may be present in the AMI data as a means of backfilling missing reads. Rather than interpolating estimated AMI data, estimated AMI data and any calendar day containing estimated AMI data is removed from the data set on a per-customer basis.
- Calendar days with missing/incomplete data are excluded from analysis on a per customer basis.
- The total daily kWh per customer is taken for each customer for each day by summing across the kWh for each calendar day.

- An outlier filter of +/- 300 kWh per day was applied to the data set.

An average daily kWh per month for each customer is taken by averaging the total daily kWh for each customer for each calendar month. This is done to interpolate across any missing days in the calendar month.

In discussions with the SWE for PY16, the SWE recommended re-baselining cohorts that had stopped receiving treatment for a minimum of three years and resetting their treatment start date to the date at which they resumed treatment. ADM noted concerns of potential inequivalence in re-baselining customers in the PY15 window due to continued persistence in PY15. Thus, based on an assessment of pre-treatment equivalence and data quality, ADM and the SWE agreed to re-baseline one Penelec and two West Penn Power cohorts in PY15 only.

Additionally, three cohorts fell out of equivalence for average annual pre-treatment consumption at the 90% confidence level. For these three cohorts, ADM rebalanced the cohorts using with-replacement propensity score matching and included the matching weights in the regression analysis and peak demand savings calculation. These cohorts included one cohort for Met-Ed, one cohort for Penelec, and one cohort for Penn Power.

B.1.1.3 Billing Analysis

ADM utilized a lagged seasonal (LS) multivariate regression model to estimate program savings for all experimental cohorts. The LS model is specified in the equation below:

$$kWh_{imy} = \beta_0 + \sum_{m=1}^{12}\sum_{y=2011}^{2021} \mathrm{I}_{my} * \beta_{mys} * (AvgPre_i + AvePreSummer_i + AvePreWinter_i) + \sum_{m=1}^{12}\sum_{y=2011}^{2021} \mathrm{I}_{my} * \tau_{my} * \mathrm{treatment}_{imy} + \varepsilon_{imy}$$

Equation 1: Formula specifying the lagged seasonal regression model

The variables above are defined in Table 106 below. The regression coefficient of the interaction between the month post-treatment and the treatment dummy variable represents the average treatment effect per home for that given month. A negative regression coefficient represents a savings in the overall billed usage for the treatment group. Taking the negative of that coefficient will represent the daily kWh savings attributable to the treatment effect for that month per home.

Table 106: Definition of variables in the lagged seasonal regression model

Variable	Definition
kWh_{imy}	Customer i's average daily energy usage in bill month m in year y.
β_0	Intercept of the regression equation.
I_{my}	Equal to one for each monthly bill month m, year y, and zero otherwise.
β_{mys}	The coefficient on the bill month m, year y indicator variable interacted with season s.
$AvgPre_i$	Average daily usage for customer i in the pre-treatment period.
$AvePreSummer_i$	Average daily usage for customer i in the pre-treatment period during June through September.
$AvePreWinter_i$	Average daily usage for customer i in the pre-treatment period during December through March.
$treatment_{imy}$	The treatment indicator variable. Equal to one when the treatment is in effect for the treatment group. Zero otherwise. Always zero for the control group.
τ_{my}	The estimated treatment effect in kWh per day per customer; the main parameter of interest.
ε_{imy}	The error terms.

B.1.1.4 Dual Participation Analysis

Participants in both the treatment and control groups participate in other FirstEnergy energy efficiency programs. Furthermore, the "Home Energy Report" measure received by participants in the treatment group may cause treatment group participants to seek out other programs and measures offered in the FirstEnergy efficiency portfolio to a greater extent than the control group. To the extent that the treatment group participates in other FirstEnergy programs at a rate above and beyond that of the control group, those incremental savings will be reflected in the gross energy savings calculated using the method above. However, savings for these items will also have been attributed to their respective programs and subprograms. ADM corrected for dual participation that occurred after treatment began to the extent that the treatment group participated at a higher rate than the control group.

Adjustment for Downstream Measures

For downstream measures, ADM conducted a review of the tracking and reporting system for each experimental cohort to identify EE program participation that occurred from the treatment start date onwards. The following steps detail the process of correcting for these measures:

1. The measures for the treatment group and control group were assigned to an appropriate month based on the reported date of installation for measures installed after the treatment start date.
2. For each month of the program year, the annual savings for all measures installed prior to the month of interest dating back to the treatment start date that had not yet reached the end of their effective useful life were summed for all active participants for each group. For measures installed prior to the current Program Year, ADM used verified savings for dual participation analysis. For measures installed during the Program Year, ADM utilized reported savings as

verification activities occurred concurrently to the evaluation of the Behavioral Modification subprogram.

3. The totaled savings for each group was then divided by 365.25 and then divided by the number of active customers in each group to create a daily average dual participation savings value per home.
4. For each month, the daily average dual participation savings value per home for the control group was then subtracted from the daily average dual participation savings value per home from the treatment group. This resulted in an adjustment factor which was then subtracted from the daily savings value extrapolated from the billing analysis prior to using these values to calculate gross verified energy savings.

Adjustment for Upstream Measures

Adjustments for upstream measures was conducted in accordance to the Phase IV Evaluation Framework. The adjustment was cast as a multiplier and applied after the correction for the downstream energy efficiency programs and the initial calculation of annual savings for the program year for a given participant wave. The multiplier values depended on the number of years since program enrollment for a given participation wave and are summarized in Table 107 below.

Table 107: Adjustment factors for dual participation in upstream programs.

Years Since Enrollment	Adjustment multiplier for upstream program
1	99.25%
2	98.5%
3	97.75%
4 or more	97%

B.1.1.5 Gross Energy Savings Calculation

Gross energy savings can be calculated by taking the treatment effect in a given month (the negative of the regression coefficient of the treatment effect for a given month minus the downstream dual participation adjustment factor for that month), multiplying it by the number of days in the month, the number of active treatment group participants in that month, and the upstream adjustment multiplier. Equation 2 demonstrates the algorithm for calculating verified savings for the model for each month in the program year.

$$kWh\ savings_{my} = \tau_{my} \times days_{my} \times number\ of\ participants_{my} \times upstream\ adjustment\ multiplier$$

Equation 2: kWh savings calculation

The variables in the above equation are defined in Table 108 below.

Table 108: Definition of variables for kWh savings calculation

Variable	Definition
τ_{my}	The average daily treatment effect for month *my*—the inverse of the regression coefficient from the regression model minus the downstream dual participation correction factor.
my	The month of interest.
$upstream\ adjustment\ multiplier$	The upstream adjustment multiplier for the experimental cohort.

Savings were calculated for each wave separately and then summed together to determine the total savings for each initiative (standard residential v. Low-Income) per EDC. Monthly savings were added together to generate annual savings.

Table 109: Dual participation correction results by EDC and participation wave

Wave	Treat	Control	Delta	Wave	Treat	Control	Delta
ME-1	1,393	1,420	-27	PN-5-LI	22	15	6
ME-3	13,466	12,716	749	PN-6-LI	3,917	3,998	-81
ME-5	23,852	23,104	747	PP-1	682	630	52
ME-6	254	224	29	PP-2	283	249	34
ME-1-LI	716	689	27	PP-3	4,300	4,290	10
ME-4-LI	437	436	1	PP-4	1,818	1,767	51
ME-5-LI	5,164	5,189	-25	PP-2-LI	480	429	51
PN-2	16,036	15,062	973	WP-3	3,734	3,628	106
PN-3	537	526	12	WP-5	27,350	26,047	1,303
PN-4	345	268	77	WP-6	209	164	45
PN-5	5,628	5,543	86	WP-7	270	212	58
PN-6	476	372	104	WP-1-LI	783	794	-11
PN-1-LI	861	931	-70	WP-2-LI	657	651	6
PN-2-LI	473	433	40	WP-3-LI	38	51	-14
PN-3-LI	3,602	3,532	70				

B.1.1.6 Gross Demand Savings Calculation

For cohorts established in Phase IV of Act 129, ADM leveraged advanced metering infrastructure (AMI) data to measure gross demand savings by modifying the LS model for use in the measurement of demand savings, as shown in the following equation:

$$kWh_{i\_peak} = \beta_0 + \beta_1 * AvgPre_i + \tau * treatment_i + \varepsilon_{imy}$$

Equation 3: Formula specifying the lagged peak demand regression model

Table 110: Definition of variables in the lagged peak demand regression model

Variable	Definition
kWh_{i_peak}	Customer i's hourly energy usage during the peak demand window (non-holiday weekdays between 2 p.m. to 6 p.m. from June through August) during the post-period only.
β_0	Intercept of the regression equation.
β_1	The coefficient of the lagged pre-usage term.
$AvgPre_i$	The lagged pre-usage term, representing the average hourly consumption during the peak demand window of the pre-treatment period. I.e., the average hourly consumption from June through August on non-holiday weekdays from 2 p.m. to 6 p.m.
$treatment_i$	The treatment indicator variable. Equal to one when the treatment is in effect for the treatment group. Zero otherwise. Always zero for the control group.
τ	The estimated treatment effect in kWh per hour per customer during the peak demand window; the main parameter of interest.
ε_{imy}	The error terms.

As shown in the table above, the parameter τ represents the peak demand savings out of the regression equation and simply needs to be multiplied by the number of participants and the sign inverted to obtain the cohort-level peak demand savings.

In PY16, 11 cohorts (three for Met-Ed, four for Penelec, two for Penn Power, and two for West Penn Power) received treatment but had a long period of inactivity during the initial years of Phase IV. AMI had yet to be established at the time these cohort was enrolled in the HER subprogram. Therefore, ADM followed the Phase IV Evaluation Framework guidance for measuring demand savings for customers without AMI data in the pre-treatment period by checking the equivalence in the average daily kWh during the summer pre-treatment period. Once this pre-summer equivalence was confirmed, ADM used a simple subtraction method for determining the gross demand savings for these cohorts.

B.1.1.1 Adjustment for Persistence in Energy and Demand Savings

Consistent with Section 6.1.9 of the Phase IV TRM, ADM adjusted savings for any cohorts with greater than two years of exposure to adjust for savings persistence had treatment no longer been administered to said cohort. Ten cohorts required featured such an adjustment in PY16. The equations below have been recreated from the TRM for reference:

- For y=1 or 2, i.e., the first or second year of exposure:

$$\Delta kWh_y = ATE_y * Treatment\ Accounts_y * Days_y$$

$$FYSATE_y = ATE_y$$

- For y=3, i.e., the third year of exposure:

$$FYSATE_y = ATE_y - \sum_{x=1}^{x=1} FYSATE_{y-x} - FYSATE_{y-x} * Decay * (X - 0.5)$$

$$\Delta kWh_y = FYSATE_y * Treatment\ Accounts_y * Days_y$$

- For y=4, i.e., the fourth year of exposure:

$$FYSATE_y = ATE_y - \sum_{x=1}^{x=2} FYSATE_{y-x} - FYSATE_{y-x} * Decay * (X - 0.5)$$

$$\Delta kWh_y = FYSATE_y * Treatment\ Accounts_y * Days_y$$

- And for y>=5, i.e., the fifth year of exposure and beyond:

$$FYSATE_y = ATE_y - \sum_{x=1}^{x=3} FYSATE_{y-x} - FYSATE_{y-x} * Decay * (X - 0.5)$$

$$\Delta kWh_y = FYSATE_y * Treatment\ Accounts_y * Days_y$$

In the above equations ATE_y is the average daily savings as estimated through the regression analysis and adjusted for dual participation. Y is the year of the program being evaluated; equivalently, the number of years the program has been in effect for that cohort. ADM applied the TRM's default decay rate of 31.3%.

In addition to adjusting annual savings, lifetime savings were also adjusted using the formulas below:

- For y=1:

$$\Delta kWh_{Y,lifetime} = ATE_y * Treatment\ Accounts_y * Days_y$$

- For y=2 and beyond:

$$\Delta kWh_{Y,lifetime} = \Delta kWh_Y + \sum_{X=1}^{X=3} \Big(\big(FYSATE_Y - FYSATE_Y * Decay * (X - 0.5) \big) * (1 - Churn)^X \Big) * Days_{Y+X} * Treatment\ Accounts_Y$$

  - Where Churn rate is taken to be 6%.

Adjustments to peak demand savings were applied in the same manner as the energy savings adjustments detailed above.

B.1.2 Program Participation Levels

Table 111 provides a table of the participation levels. The nomenclature in the table includes a prefix to denote the EDC, a suffix of "-LI" for low-income groups, and a number that identifies waves of participants sequentially.

Table 111: PY16 Participation Bill Counts by Month and Cohort

Wave	Jun-24	Jul-24	Aug-24	Sep-24	Oct-24	Nov-24	Dec-24	Jan-25	Feb-25	Mar-25	Apr-25	May-25
ME-1	26,454	26,263	26,073	25,898	25,701	25,534	25,418	25,281	25,160	25,070	24,934	24,773
ME-3	35,955	35,794	35,681	35,544	35,408	35,293	35,192	35,076	34,991	34,923	34,825	34,718
ME-5	57,686	57,499	57,317	57,136	56,967	56,773	56,623	56,468	56,365	56,284	56,147	55,994
ME-6	19,731	19,530	19,352	19,190	19,008	18,869	18,767	18,669	18,564	18,474	18,352	18,230
ME-1-LI	7,581	7,491	7,362	7,275	7,168	7,096	7,033	6,947	6,895	6,833	6,752	6,678
ME-4-LI	8,712	8,508	8,329	8,174	7,954	7,823	7,737	7,618	7,533	7,435	7,323	7,186
ME-5-LI	6,741	6,707	6,676	6,645	6,610	6,578	6,563	6,542	6,515	6,494	6,471	6,447
PN-2	38,695	38,609	38,499	38,391	38,284	38,173	38,087	38,002	37,935	37,891	37,805	37,712
PN-3	11,685	11,576	11,480	11,361	11,257	11,166	11,114	11,046	10,990	10,946	10,871	10,791
PN-4	18,162	17,958	17,752	17,603	17,431	17,290	17,183	17,085	16,991	16,917	16,811	16,699
PN-5	18,471	18,383	18,300	18,213	18,143	18,044	17,978	17,900	17,842	17,790	17,722	17,658
PN-6	44,171	43,673	43,243	42,868	42,446	42,075	41,821	41,565	41,333	41,123	40,851	40,532
PN-3-LI	4,505	4,483	4,461	4,439	4,427	4,411	4,401	4,387	4,372	4,365	4,355	4,336
PN-1-LI	6,955	6,858	6,750	6,661	6,557	6,478	6,433	6,377	6,338	6,295	6,230	6,179
PN-2-LI	7,276	7,134	7,015	6,889	6,780	6,664	6,589	6,513	6,452	6,378	6,302	6,196
PN-5-LI	998	991	981	969	964	960	958	953	949	948	942	939
PN-6-LI	4,938	4,906	4,866	4,831	4,798	4,766	4,742	4,727	4,707	4,697	4,671	4,632
PP-1	14,671	14,572	14,472	14,382	14,306	14,228	14,174	14,105	14,056	14,014	13,946	13,883
PP-2	16,147	16,013	15,887	15,791	15,675	15,581	15,508	15,407	15,329	15,276	15,175	15,083
PP-3	13,464	13,424	13,380	13,331	13,292	13,257	13,231	13,196	13,173	13,152	13,113	13,074
PP-4	5,398	5,387	5,370	5,354	5,340	5,320	5,309	5,295	5,285	5,274	5,261	5,249
PP-2-LI	7,002	6,905	6,814	6,724	6,633	6,534	6,486	6,430	6,370	6,316	6,262	6,159
WP-3	13,883	13,847	13,810	13,777	13,733	13,697	13,681	13,640	13,614	13,583	13,557	13,534
WP-5	91,174	90,910	90,641	90,386	90,138	89,908	89,737	89,561	89,404	89,266	89,084	88,868
WP-6	20,015	19,930	19,860	19,777	19,717	19,657	19,612	19,556	19,514	19,487	19,441	19,390
WP-7	34,761	34,496	34,145	33,899	33,704	33,508	33,360	33,204	33,080	32,967	32,800	32,626
WP-1-LI	6,044	5,963	5,895	5,838	5,768	5,695	5,647	5,614	5,586	5,549	5,500	5,441
WP-2-LI	9,415	9,254	9,073	8,928	8,755	8,635	8,552	8,480	8,424	8,357	8,277	8,152
WP-3-LI	2,335	2,327	2,314	2,302	2,292	2,279	2,272	2,266	2,262	2,257	2,247	2,234

B.1.3 Results

The reported and verified energy savings are shown in Table 112 below. The values below include dual participation adjustments. The last column of the table shows model absolute precisions for each cohort, and also combined for each distinct initiative. Table 113 shows the reported and verified demand reduction for each EDC and initiative.

Table 112: Verified Energy Savings and Absolute Precisions by EDC and Wave

Operating Company	Experimental Cohort	PYRTD (MWh)	PYVTD (MWh)	Relative Savings (%)	Absolute Precision at 95% CL
Met-Ed	ME-1	2,371	2,738	1.07%	0.33%
Met-Ed	ME-3	3,222	769	0.17%	0.48%
Met-Ed	ME-5	5,170	7,972	1.11%	0.23%
Met-Ed	ME-6	1,768	1,552	0.44%	0.17%
Met-Ed	**Total for EEH Program**	**12,532**	**13,030**	**0.73%**	**0.17%**
Met-Ed	ME-1-LI	588	-147	-0.17%	0.46%
Met-Ed	ME-4-LI	675	682	0.70%	0.44%
Met-Ed	ME-5-LI	523	1,290	1.42%	0.82%
Met-Ed	**Total for LI Program**	**1,786**	**1,825**	**0.67%**	**0.35%**
Penelec	PN-2	2,198	1,082	0.25%	0.28%
Penelec	PN-3	664	386	0.40%	0.40%
Penelec	PN-4	1,032	357	0.23%	0.30%
Penelec	PN-5	1,049	995	0.76%	0.54%
Penelec	PN-6	2,509	960	0.22%	0.17%
Penelec	**Total for EEH Program**	**7,453**	**3,780**	**0.30%**	**0.14%**
Penelec	PN-3-LI	108	380	0.71%	1.01%
Penelec	PN-1-LI	166	-150	-0.23%	0.53%
Penelec	PN-2-LI	174	474	0.67%	0.48%
Penelec	PN-5-LI	24	-2	-0.02%	0.76%
Penelec	PN-6-LI	118	430	1.15%	0.96%
Penelec	**Total for LI Program**	**590**	**1,131**	**0.47%**	**0.34%**
Penn Power	PP-1	1,256	55	0.04%	0.33%
Penn Power	PP-2	1,383	204	0.12%	0.27%
Penn Power	PP-3	1,153	2,260	1.56%	0.50%
Penn Power	PP-4	462	1,695	1.98%	0.53%
Penn Power	**Total for EEH Program**	**4,255**	**4,214**	**0.77%**	**0.20%**
Penn Power	PP-2-LI	526	264	0.34%	0.43%
Penn Power	**Total for LI Program**	**526**	**264**	**0.34%**	**0.43%**
WPP	WP-3	1,570	327	0.14%	0.50%
WPP	WP-5	10,311	3,203	0.26%	0.41%
WPP	WP-6	2,264	-361	-0.14%	0.24%
WPP	WP-7	3,931	2,126	0.37%	0.14%
WPP	**Total for EEH Program**	**18,076**	**5,294**	**0.23%**	**0.23%**
WPP	WP-1-LI	307	360	0.50%	0.49%
WPP	WP-2-LI	479	-56	-0.05%	0.39%
WPP	WP-3-LI	119	-152	-0.52%	0.54%
WPP	**Total for LI Program**	**905**	**152**	**0.07%**	**0.27%**

Table 113: Reported and verified demand reductions for the HER Initiative

Operating Company	Experimental Cohort	PYRTD (MW)	PYVTD (MW)	Demand Realization Rate
Met-Ed	ME-1	1.09	0.52	48%
Met-Ed	ME-3	1.48	-0.44	-30%
Met-Ed	ME-5	2.38	1.42	60%
Met-Ed	ME-6	0.81	0.18	23%
Met-Ed	**Total for EEH Program**	**5.77**	**1.69**	**29%**
Met-Ed	ME-1-LI	0.13	0.00	-1%
Met-Ed	ME-4-LI	0.15	0.13	86%
Met-Ed	ME-5-LI	0.12	0.06	50%
Met-Ed	**Total for LI Program**	**0.40**	**0.19**	**47%**
Penelec	PN-2	1.05	0.48	46%
Penelec	PN-3	0.32	0.08	27%
Penelec	PN-4	0.49	0.15	30%
Penelec	PN-5	0.50	0.06	12%
Penelec	PN-6	1.19	0.39	33%
Penelec	**Total for EEH Program**	**3.55**	**1.16**	**33%**
Penelec	PN-3-LI	0.00	-0.15	33370%
Penelec	PN-1-LI	0.00	-0.09	12894%
Penelec	PN-2-LI	0.00	0.00	-116%
Penelec	PN-5-LI	0.00	0.01	-5844%
Penelec	PN-6-LI	0.00	0.02	-4082%
Penelec	**Total for LI Program**	**-0.01**	**-0.21**	**1625%**
Penn Power	PP-1	0.48	-0.10	-21%
Penn Power	PP-2	0.53	0.05	9%
Penn Power	PP-3	0.44	-0.02	-4%
Penn Power	PP-4	0.18	0.30	170%
Penn Power	**Total for EEH Program**	**1.63**	**0.24**	**14%**
Penn Power	PP-2-LI	0.39	0.07	17%
Penn Power	**Total for LI Program**	**0.39**	**0.07**	**17%**
WPP	WP-3	0.61	0.13	21%
WPP	WP-5	4.00	1.87	47%
WPP	WP-6	0.88	-0.14	-16%
WPP	WP-7	1.52	0.21	14%
WPP	**Total for EEH Program**	**7.00**	**2.07**	**29%**
WPP	WP-1-LI	0.03	0.02	58%
WPP	WP-2-LI	0.05	0.11	235%
WPP	WP-3-LI	0.01	-0.02	-211%
WPP	**Total for LI Program**	**0.09**	**0.10**	**116%**

Appendix C PYTD and P4TD Summary by Customer Segment and LI Carveout

Table 114 presents a summary of the programs, components / initiatives and customer segments that contribute to the low-income carveout in PY16 and P4TD.

Table 114: Summary of Low-Income Carveout Energy Savings (MWh/Year)

EDC	Program	Component / Initiative	Customer Segment	PYVTD Gross (MWh/yr)	VTD Gross (MWh/yr)
Met-Ed	Low Income Energy Efficiency	Appliances	Residential	16	1,239
Met-Ed	Low Income Energy Efficiency	Appliance Turn-In	Residential	133	1,424
Met-Ed	Low Income Energy Efficiency	Direct Install	Residential	1,414	4,323
Met-Ed	Low Income Energy Efficiency	Home Energy Reports	Residential	1,825	3,894
Met-Ed	Low Income Energy Efficiency	Kits	Residential	2,494	8,649
Met-Ed	Low Income Energy Efficiency	New Homes	Residential	0	222
Met-Ed	Low Income Energy Efficiency	Online Audits	Residential	70	698
Met-Ed	C&I ESB - Small	CI Multifamily	Master Metered MF	742	1,921
Met-Ed Total				6,694	22,370
Penelec	Low Income Energy Efficiency	Appliances	Residential	14	1,696
Penelec	Low Income Energy Efficiency	Appliance Turn-In	Residential	177	1,464
Penelec	Low Income Energy Efficiency	Direct Install	Residential	2,179	6,873
Penelec	Low Income Energy Efficiency	Home Energy Reports	Residential	1,131	2,535
Penelec	Low Income Energy Efficiency	Kits	Residential	1,436	8,531
Penelec	Low Income Energy Efficiency	New Homes	Residential	103	114
Penelec	Low Income Energy Efficiency	Online Audits	Residential	176	1,045
Penelec	C&I ESB - Small	CI Multifamily	Master Metered MF	774	2,563
Penelec Total				5,990	24,821
Penn Power	Low Income Energy Efficiency	Appliances	Residential	6	495
Penn Power	Low Income Energy Efficiency	Appliance Turn-In	Residential	27	321
Penn Power	Low Income Energy Efficiency	Direct Install	Residential	683	2,201
Penn Power	Low Income Energy Efficiency	Home Energy Reports	Residential	264	1,311
Penn Power	Low Income Energy Efficiency	Kits	Residential	0	891
Penn Power	Low Income Energy Efficiency	New Homes	Residential	10	10
Penn Power	Low Income Energy Efficiency	Online Audits	Residential	29	198
Penn Power	C&I ESB - Small	CI Multifamily	Master Metered MF	39	198
Penn Power Total				1,059	5,625
WPP	Low Income Energy Efficiency	Appliances	Residential	17	1,446
WPP	Low Income Energy Efficiency	Appliance Turn-In	Residential	155	1,358
WPP	Low Income Energy Efficiency	Direct Install	Residential	1,905	7,375
WPP	Low Income Energy Efficiency	Home Energy Reports	Residential	152	3,185
WPP	Low Income Energy Efficiency	Kits	Residential	2,744	10,838
WPP	Low Income Energy Efficiency	New Homes	Residential	7	10
WPP	Low Income Energy Efficiency	Online Audits	Residential	103	679
WPP	C&I ESB - Small	CI Multifamily	Master Metered MF	40	2,082
WPP Total				5,124	26,972

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

D.1 Program and Initiative-Level Impacts Summary

A summary of energy impacts by program and component / initiative through PY16 is presented in Table 115, Table 116, Table 117, and Table 118.

Table 115: Met-Ed Annual Energy Savings by Program & Initiative (MWh/Year)

Program	Initiative	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	EE Kits	14,224	12,811	10,448	48,255	38,737	31,715
Energy Efficient Homes	Home Energy Reports	12,532	13,030	13,030	21,299	21,101	21,101
Energy Efficient Homes	Direct Install	495	481	417	1,260	1,317	1,174
Energy Efficient Homes	New Homes	2,266	2,283	1,644	8,338	8,367	6,046
Energy Efficient Homes	Multifamily	36	37	36	90	96	89
Energy Efficient Homes	Online Audits	520	153	153	2,883	1,252	1,252
Energy Efficient Products	Appliance Recycling	2,873	3,119	1,934	11,714	12,774	5,699
Energy Efficient Products	HVAC	1,424	2,264	1,146	4,569	6,569	3,327
Energy Efficient Products	Appliances	554	613	416	2,562	2,835	1,844
Energy Efficient Products	Midstream Appliances	1,404	1,510	870	15,299	15,975	7,697
Low Income Program	Appliances	14	16	16	1,122	1,239	1,239
Low Income Program	Appliance Turn-In	114	133	133	1,211	1,424	1,424
Low Income Program	Direct Install	1,368	1,414	1,414	4,250	4,323	4,323
Low Income Program	Home Energy Reports	1,786	1,825	1,825	3,327	3,894	3,894
Low Income Program	Kits	2,427	2,494	2,494	9,036	8,649	8,649
Low Income Program	New Homes	0	0	0	223	222	222
Low Income Program	Online Audits	41	70	70	251	698	698
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	33,829	31,726	20,307	88,786	93,909	60,800
C&I Solutions for Business Programs - Small and Large	CI Custom	68,065	68,317	38,021	113,021	113,948	63,675
C&I Solutions for Business Programs - Small and Large	CI EMNC	24,318	19,957	13,543	45,124	40,457	33,177
C&I Solutions for Business Program - Small	CI Multifamily	712	742	739	1,959	1,921	1,913
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	63	68	42	186	203	95
Portfolio Total		**169,065**	**163,063**	**108,697**	**384,767**	**379,912**	**260,053**

Table 116: Penelec Annual Energy Savings by Program & Initiative (MWh/Year)

Program	Initiative	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	EE Kits	12,987	11,692	12,410	44,403	43,392	41,280
Energy Efficient Homes	Home Energy Reports	7,453	3,780	3,780	19,678	10,038	10,038
Energy Efficient Homes	Direct Install	371	402	398	872	977	976
Energy Efficient Homes	New Homes	340	328	236	1,053	1,050	758
Energy Efficient Homes	Multifamily	64	65	65	182	209	200
Energy Efficient Homes	Online Audits	469	196	196	1,991	749	749
Energy Efficient Products	Appliance Recycling	1,922	1,987	1,192	8,529	9,068	5,795
Energy Efficient Products	HVAC	634	695	484	2,283	2,521	1,541
Energy Efficient Products	Appliances	254	265	131	1,177	1,191	602
Energy Efficient Products	Midstream Appliances	1,884	1,949	932	11,130	11,321	5,908
Low Income Program	Appliances	13	14	14	1,659	1,696	1,696
Low Income Program	Appliance Turn-In	140	177	177	1,346	1,464	1,464
Low Income Program	Direct Install	2,173	2,179	2,179	6,882	6,873	6,873
Low Income Program	Home Energy Reports	590	1,131	1,131	1,679	2,535	2,535
Low Income Program	Kits	1,374	1,436	1,436	8,478	8,531	8,531
Low Income Program	New Homes	107	103	103	117	114	114
Low Income Program	Online Audits	83	176	176	373	1,045	1,045
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	60,219	57,348	37,785	124,179	122,208	81,085
C&I Solutions for Business Programs - Small and Large	CI Custom	9,025	9,044	4,304	25,771	25,361	16,365
C&I Solutions for Business Programs - Small and Large	CI EMNC	19,072	16,882	13,219	42,103	37,158	30,112
C&I Solutions for Business Program - Small	CI Multifamily	834	774	770	2,847	2,563	2,555
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	46	47	28	139	147	93
Portfolio Total		**120,057**	**110,670**	**81,147**	**306,870**	**290,211**	**220,316**

Table 117: Penn Power Annual Energy Savings by Program & Initiative (MWh/Year)

Program	Initiative	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	EE Kits	3,448	3,168	2,691	12,966	12,116	10,274
Energy Efficient Homes	Home Energy Reports	4,255	4,214	4,214	6,323	6,082	6,082
Energy Efficient Homes	Direct Install	92	99	93	387	426	411
Energy Efficient Homes	New Homes	1,876	1,923	1,384	5,248	5,299	3,822
Energy Efficient Homes	Multifamily	39	39	39	45	45	45
Energy Efficient Homes	Online Audits	166	46	46	690	251	251
Energy Efficient Products	Appliance Recycling	661	717	437	2,834	2,875	1,257
Energy Efficient Products	HVAC	176	167	92	733	943	516
Energy Efficient Products	Appliances	120	127	67	670	719	377
Energy Efficient Products	Midstream Appliances	902	918	461	4,817	4,915	2,220
Low Income Program	Appliances	6	6	6	465	495	495
Low Income Program	Appliance Turn-In	21	27	27	299	321	321
Low Income Program	Direct Install	651	683	683	2,154	2,201	2,201
Low Income Program	Home Energy Reports	526	264	264	2,139	1,311	1,311
Low Income Program	Kits	0	0	0	914	891	891
Low Income Program	New Homes	10	10	10	10	10	10
Low Income Program	Online Audits	14	29	29	73	198	198
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	12,857	12,052	9,331	27,714	26,282	20,893
C&I Solutions for Business Programs - Small and Large	CI Custom	6,498	6,604	3,696	16,293	16,234	10,892
C&I Solutions for Business Programs - Small and Large	CI EMNC	1,726	1,470	1,100	12,013	10,144	9,476
C&I Solutions for Business Program - Small	CI Multifamily	38	39	39	210	198	198
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	12	13	8	63	64	27
Portfolio Total		**34,093**	**32,615**	**24,717**	**97,060**	**92,022**	**72,169**

Table 118: WPP Annual Energy Savings by Program & Initiative (MWh/Year)

Program	Initiative	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	EE Kits	14,455	12,942	12,386	48,237	40,265	41,324
Energy Efficient Homes	Home Energy Reports	18,076	5,294	5,294	26,931	12,128	12,128
Energy Efficient Homes	Direct Install	460	474	432	1,130	1,225	1,160
Energy Efficient Homes	New Homes	3,071	2,941	2,118	8,908	9,053	6,533
Energy Efficient Homes	Multifamily	149	150	149	372	399	364
Energy Efficient Homes	Online Audits	614	192	192	2,653	1,038	1,038
Energy Efficient Products	Appliance Recycling	2,364	2,582	1,704	11,772	12,293	8,502
Energy Efficient Products	HVAC	1,034	1,119	613	3,591	4,829	2,580
Energy Efficient Products	Appliances	519	536	280	2,366	2,512	1,348
Energy Efficient Products	Midstream Appliances	1,692	1,751	875	10,267	10,457	5,298
Low Income Program	Appliances	17	17	17	1,354	1,446	1,446
Low Income Program	Appliance Turn-In	126	155	155	1,195	1,358	1,358
Low Income Program	Direct Install	1,945	1,905	1,905	7,409	7,375	7,375
Low Income Program	Home Energy Reports	905	152	152	3,501	3,185	3,185
Low Income Program	Kits	2,650	2,744	2,744	10,456	10,838	10,838
Low Income Program	New Homes	8	7	7	11	10	10
Low Income Program	Online Audits	58	103	103	242	679	679
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	52,357	50,914	34,622	125,251	128,957	86,391
C&I Solutions for Business Programs - Small and Large	CI Custom	54,756	55,875	31,481	67,104	67,540	37,833
C&I Solutions for Business Programs - Small and Large	CI EMNC	18,328	20,722	14,830	48,178	50,176	46,714
C&I Solutions for Business Program - Small	CI Multifamily	40	40	40	2,548	2,082	2,081
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	51	55	37	155	164	112
Portfolio Total		**173,673**	**160,670**	**110,136**	**383,631**	**368,007**	**278,295**

Table 119, Table 120, Table 121, and Table 122 present summaries of the peak demand impacts by energy efficiency program and initiative through the current reporting period.

Table 119: Met-Ed Peak Demand Savings by Program & Initiative (MW/Year)

Program	Initiative	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	EE Kits	1.53	1.40	1.14	5.19	4.26	3.49
Energy Efficient Homes	Home Energy Reports	5.77	1.69	1.69	7.23	2.58	2.58
Energy Efficient Homes	Direct Install	0.09	0.07	0.06	0.23	0.17	0.15
Energy Efficient Homes	New Homes	0.51	0.44	0.32	2.63	2.04	1.47
Energy Efficient Homes	Multifamily	0.00	0.00	0.00	0.01	0.01	0.01
Energy Efficient Homes	Online Audits	0.06	0.03	0.03	0.23	0.22	0.22
Energy Efficient Products	Appliance Recycling	0.83	0.94	0.58	3.14	3.40	1.54
Energy Efficient Products	HVAC	0.24	0.34	0.17	0.76	0.94	0.47
Energy Efficient Products	Appliances	0.08	0.08	0.06	0.40	0.45	0.29
Energy Efficient Products	Midstream Appliances	0.30	0.31	0.18	3.17	3.00	1.45
Low Income Program	Appliances	0.00	0.00	0.00	0.15	0.16	0.16
Low Income Program	Appliance Turn-In	0.04	0.05	0.05	0.33	0.39	0.39
Low Income Program	Direct Install	0.17	0.17	0.17	0.60	0.61	0.61
Low Income Program	Home Energy Reports	0.40	0.19	0.19	0.83	0.52	0.52
Low Income Program	Kits	0.27	0.29	0.29	0.99	1.01	1.01
Low Income Program	New Homes	0.00	0.00	0.00	0.04	0.03	0.03
Low Income Program	Online Audits	0.00	0.01	0.01	0.02	0.11	0.11
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	6.08	5.86	3.75	16.79	16.08	10.43
C&I Solutions for Business Programs - Small and Large	CI Custom	10.88	11.80	6.56	16.61	17.51	9.78
C&I Solutions for Business Programs - Small and Large	CI EMNC	4.61	3.56	2.42	7.77	6.60	5.32
C&I Solutions for Business Program - Small	CI Multifamily	0.10	0.11	0.11	0.27	0.26	0.26
C&I Solutions for Business Program - Small	Appliance Recycling	0.01	0.02	0.01	0.04	0.05	0.02
Portfolio Total		**31.97**	**27.35**	**17.78**	**67.44**	**60.41**	**40.33**

Table 120: Penelec Peak Demand Savings by Program & Initiative (MW/Year)

Program	Initiative	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	EE Kits	1.29	1.21	1.28	4.42	4.42	4.20
Energy Efficient Homes	Home Energy Reports	3.55	1.16	1.16	5.24	2.67	2.67
Energy Efficient Homes	Direct Install	0.08	0.06	0.06	0.16	0.12	0.12
Energy Efficient Homes	New Homes	0.07	0.06	0.04	0.35	0.26	0.19
Energy Efficient Homes	Multifamily	0.01	0.01	0.01	0.02	0.02	0.02
Energy Efficient Homes	Online Audits	0.05	0.03	0.03	0.17	0.12	0.12
Energy Efficient Products	Appliance Recycling	0.58	0.60	0.36	2.29	2.35	1.50
Energy Efficient Products	HVAC	0.06	0.07	0.05	0.22	0.32	0.20
Energy Efficient Products	Appliances	0.04	0.04	0.02	0.19	0.20	0.10
Energy Efficient Products	Midstream Appliances	0.43	0.44	0.21	2.76	2.64	1.38
Low Income Program	Appliances	0.00	0.00	0.00	0.21	0.22	0.22
Low Income Program	Appliance Turn-In	0.05	0.05	0.05	0.38	0.38	0.38
Low Income Program	Direct Install	0.29	0.29	0.29	0.86	0.86	0.86
Low Income Program	Home Energy Reports	-0.01	-0.21	-0.21	0.13	-0.23	-0.23
Low Income Program	Kits	0.14	0.15	0.15	0.87	0.90	0.90
Low Income Program	New Homes	0.02	0.02	0.02	0.02	0.02	0.02
Low Income Program	Online Audits	0.01	0.03	0.03	0.03	0.15	0.15
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	13.39	10.59	6.98	26.02	22.57	14.98
C&I Solutions for Business Programs - Small and Large	CI Custom	2.30	2.71	1.29	7.34	7.46	4.92
C&I Solutions for Business Programs - Small and Large	CI EMNC	3.94	3.46	2.71	7.39	6.17	4.97
C&I Solutions for Business Program - Small	CI Multifamily	0.11	0.11	0.11	0.39	0.35	0.35
C&I Solutions for Business Program - Small	Appliance Recycling	0.02	0.02	0.01	0.04	0.04	0.03
Portfolio Total		**26.41**	**20.90**	**14.65**	**59.51**	**52.01**	**38.03**

Table 121: Penn Power Peak Demand Savings by Program & Initiative (MW/Year)

Program	Initiative	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	EE Kits	0.37	0.35	0.29	1.40	1.28	1.09
Energy Efficient Homes	Home Energy Reports	1.63	0.24	0.24	2.15	0.74	0.74
Energy Efficient Homes	Direct Install	0.01	0.01	0.01	0.06	0.05	0.05
Energy Efficient Homes	New Homes	0.41	0.33	0.23	1.60	1.19	0.86
Energy Efficient Homes	Multifamily	0.00	0.00	0.00	0.01	0.00	0.00
Energy Efficient Homes	Online Audits	0.02	0.01	0.01	0.06	0.04	0.04
Energy Efficient Products	Appliance Recycling	0.16	0.18	0.11	0.66	0.67	0.29
Energy Efficient Products	HVAC	0.03	0.03	0.02	0.14	0.17	0.09
Energy Efficient Products	Appliances	0.02	0.02	0.01	0.11	0.12	0.06
Energy Efficient Products	Midstream Appliances	0.17	0.17	0.08	1.07	1.05	0.47
Low Income Program	Appliances	0.00	0.00	0.00	0.06	0.06	0.06
Low Income Program	Appliance Turn-In	0.01	0.01	0.01	0.08	0.08	0.08
Low Income Program	Direct Install	0.09	0.09	0.09	0.28	0.29	0.29
Low Income Program	Home Energy Reports	0.39	0.07	0.07	0.54	0.23	0.23
Low Income Program	Kits	0.00	0.00	0.00	0.10	0.10	0.10
Low Income Program	New Homes	0.00	0.00	0.00	0.00	0.00	0.00
Low Income Program	Online Audits	0.00	0.00	0.00	0.01	0.03	0.03
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	2.89	2.55	1.98	5.97	5.46	4.33
C&I Solutions for Business Programs - Small and Large	CI Custom	1.10	1.27	0.71	2.22	2.37	1.55
C&I Solutions for Business Programs - Small and Large	CI EMNC	0.28	0.27	0.20	1.92	1.75	1.63
C&I Solutions for Business Program - Small	CI Multifamily	0.01	0.01	0.01	0.03	0.03	0.03
C&I Solutions for Business Program - Small	Appliance Recycling	0.00	0.00	0.00	0.01	0.01	0.01
Portfolio Total		**7.60**	**5.60**	**4.08**	**18.49**	**15.70**	**12.03**

Table 122: WPP Peak Demand Savings by Program & Initiative (MW/Year)

Program	Initiative	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	EE Kits	1.65	1.51	1.45	5.48	4.74	4.87
Energy Efficient Homes	Home Energy Reports	7.00	2.07	2.07	9.09	2.67	2.67
Energy Efficient Homes	Direct Install	0.09	0.07	0.06	0.20	0.16	0.15
Energy Efficient Homes	New Homes	0.65	0.54	0.39	2.72	1.99	1.44
Energy Efficient Homes	Multifamily	0.02	0.02	0.02	0.06	0.05	0.04
Energy Efficient Homes	Online Audits	0.07	0.03	0.03	0.23	0.18	0.18
Energy Efficient Products	Appliance Recycling	0.67	0.72	0.48	2.99	3.08	2.13
Energy Efficient Products	HVAC	0.16	0.17	0.09	0.56	0.63	0.34
Energy Efficient Products	Appliances	0.07	0.08	0.04	0.36	0.39	0.21
Energy Efficient Products	Midstream Appliances	0.37	0.37	0.19	2.46	2.36	1.19
Low Income Program	Appliances	0.00	0.00	0.00	0.17	0.18	0.18
Low Income Program	Appliance Turn-In	0.04	0.04	0.04	0.34	0.37	0.37
Low Income Program	Direct Install	0.27	0.27	0.27	1.03	1.02	1.02
Low Income Program	Home Energy Reports	0.09	0.10	0.10	0.49	0.17	0.17
Low Income Program	Kits	0.31	0.32	0.32	1.20	1.28	1.28
Low Income Program	New Homes	0.00	0.00	0.00	0.00	0.00	0.00
Low Income Program	Online Audits	0.01	0.02	0.02	0.02	0.10	0.10
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	10.81	9.59	6.52	25.28	23.05	15.46
C&I Solutions for Business Programs - Small and Large	CI Custom	7.72	7.87	4.44	8.99	8.94	5.02
C&I Solutions for Business Programs - Small and Large	CI EMNC	3.73	3.31	2.37	8.57	7.62	7.01
C&I Solutions for Business Program - Small	CI Multifamily	0.00	0.00	0.00	0.33	0.25	0.25
C&I Solutions for Business Program - Small	Appliance Recycling	0.01	0.02	0.01	0.04	0.04	0.03
Portfolio Total		**33.74**	**27.13**	**18.91**	**70.60**	**59.27**	**44.12**

D.2 Program-Level Cost-Effectiveness Summary

Table 123, Table 124, Table 125, and Table 126 show the TRC ratios by program and for the portfolio for Met-Ed, Penelec, Penn Power, and WPP respectively. The benefits in the tables were calculated using gross verified impacts. PYTD costs and benefits are expressed in the base dollars for the calendar year in which the program starts. For PY16, cost and benefits are expressed in 2024 dollars.

Table 123: PY16 Gross TRC Ratios by Program ($1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$15,740	$5,447	2.89	$10,294
Energy Efficient Products	$4,479	$6,488	0.69	-$2,009
Low Income Energy Efficiency	$2,886	$3,299	0.87	-$413
Residential Subtotal	**$23,106**	**$15,234**	**1.52**	**$7,872**
C&I Energy Solutions for Business - Small	$29,260	$13,158	2.22	$16,102
C&I Energy Solutions for Business - Large	$42,884	$42,932	1.00	-$48
Non-Residential Subtotal	**$72,143**	**$56,090**	**1.29**	**$16,053**
Portfolio Total	**$95,249**	**$71,324**	**1.34**	**$23,925**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 124: PY16 Gross TRC Ratios by Program ($1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$11,278	$3,973	2.84	$7,306
Energy Efficient Products	$3,082	$3,597	0.86	-$515
Low Income Energy Efficiency	$1,869	$4,287	0.44	-$2,417
Residential Subtotal	**$16,230**	**$11,856**	**1.37**	**$4,374**
C&I Energy Solutions for Business - Small	$43,161	$25,305	1.71	$17,856
C&I Energy Solutions for Business - Large	$19,740	$10,503	1.88	$9,237
Non-Residential Subtotal	**$62,901**	**$35,808**	**1.76**	**$27,093**
Portfolio Total	**$79,131**	**$47,664**	**1.66**	**$31,467**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 125: PY16 Gross TRC Ratios by Program ($1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$4,492	$2,406	1.87	$2,086
Energy Efficient Products	$1,380	$1,301	1.06	$79
Low Income Energy Efficiency	$274	$1,308	0.21	-$1,034
Residential Subtotal	**$6,145**	**$5,015**	**1.23**	**$1,131**
C&I Energy Solutions for Business - Small	$8,420	$4,117	2.05	$4,304
C&I Energy Solutions for Business - Large	$5,762	$5,326	1.08	$436
Non-Residential Subtotal	**$14,182**	**$9,443**	**1.50**	**$4,739**
Portfolio Total	**$20,328**	**$14,458**	**1.41**	**$5,870**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 126: PY16 Gross TRC Ratios by Program ($1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$13,868	$6,340	2.19	$7,528
Energy Efficient Products	$3,167	$4,635	0.68	-$1,468
Low Income Energy Efficiency	$2,638	$3,874	0.68	-$1,236
Residential Subtotal	**$19,673**	**$14,849**	**1.32**	**$4,824**
C&I Energy Solutions for Business - Small	$30,431	$16,334	1.86	$14,097
C&I Energy Solutions for Business - Large	$34,337	$21,871	1.57	$12,467
Non-Residential Subtotal	**$64,769**	**$38,205**	**1.70**	**$26,564**
Portfolio Total	**$84,441**	**$53,054**	**1.59**	**$31,388**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 127, Table 128, Table 129, and Table 130 present PY16 cost-effectiveness for Met-Ed, Penelec, Penn Power, and WPP respectively, using net verified savings to calculate benefits.

Table 127: PY16 Net TRC Ratios by Program ($1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$12,872	$5,016	2.57	$7,855
Energy Efficient Products	$2,563	$4,276	0.60	-$1,713
Low Income Energy Efficiency	$2,886	$3,299	0.87	-$413
Residential Subtotal	**$18,321**	**$12,591**	**1.46**	**$5,729**
C&I Energy Solutions for Business - Small	$18,672	$8,711	2.14	$9,961
C&I Energy Solutions for Business - Large	$25,549	$27,151	0.94	-$1,602
Non-Residential Subtotal	**$44,221**	**$35,862**	**1.23**	**$8,359**
Portfolio Total	**$62,542**	**$48,453**	**1.29**	**$14,089**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 128: PY16 Net TRC Ratios by Program ($1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$11,843	$3,914	3.03	$7,929
Energy Efficient Products	$1,657	$2,624	0.63	-$966
Low Income Energy Efficiency	$1,869	$4,287	0.44	-$2,417
Residential Subtotal	**$15,369**	**$10,824**	**1.42**	**$4,545**
C&I Energy Solutions for Business - Small	$28,736	$17,507	1.64	$11,229
C&I Energy Solutions for Business - Large	$12,867	$7,962	1.62	$4,905
Non-Residential Subtotal	**$41,603**	**$25,469**	**1.63**	**$16,134**
Portfolio Total	**$56,972**	**$36,292**	**1.57**	**$20,679**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 129: PY16 Net TRC Ratios by Program ($1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$3,696	$2,056	1.80	$1,641
Energy Efficient Products	$721	$888	0.81	-$167
Low Income Energy Efficiency	$274	$1,308	0.21	-$1,034
Residential Subtotal	**$4,691**	**$4,252**	**1.10**	**$439**
C&I Energy Solutions for Business - Small	$6,263	$3,186	1.97	$3,077
C&I Energy Solutions for Business - Large	$3,776	$3,616	1.04	$160
Non-Residential Subtotal	**$10,039**	**$6,801**	**1.48**	**$3,237**
Portfolio Total	**$14,730**	**$11,053**	**1.33**	**$3,676**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 130: PY16 Net TRC Ratios by Program ($1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$12,820	$5,767	2.22	$7,053
Energy Efficient Products	$1,734	$3,156	0.55	-$1,422
Low Income Energy Efficiency	$2,638	$3,874	0.68	-$1,236
Residential Subtotal	**$17,192**	**$12,797**	**1.34**	**$4,395**
C&I Energy Solutions for Business - Small	$20,681	$12,161	1.70	$8,520
C&I Energy Solutions for Business - Large	$21,697	$14,953	1.45	$6,743
Non-Residential Subtotal	**$42,378**	**$27,114**	**1.56**	**$15,263**
Portfolio Total	**$59,569**	**$39,911**	**1.49**	**$19,658**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 131, Table 132, Table 133, and Table 134 summarize cost-effectiveness by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Phase IV of Act 129. P4TD costs and benefits are expressed in 2021 dollars regardless of program or reporting year.

Table 131: P4TD Gross TRC Ratios by Program ($1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$43,720	$18,001	2.43	$25,720
Energy Efficient Products	$19,989	$24,202	0.83	-$4,214
Low Income Energy Efficiency	$9,768	$9,440	1.03	$328
Residential Subtotal	**$73,477**	**$51,643**	**1.42**	**$21,834**
C&I Energy Solutions for Business - Small	$62,848	$34,202	1.84	$28,646
C&I Energy Solutions for Business - Large	$69,304	$59,062	1.17	$10,242
Non-Residential Subtotal	**$132,151**	**$93,264**	**1.42**	**$38,888**
Portfolio Total	**$205,629**	**$144,907**	**1.42**	**$60,722**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 132: P4TD Gross TRC Ratios by Program ($1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$39,317	$11,730	3.35	$27,587
Energy Efficient Products	$12,676	$16,201	0.78	-$3,525
Low Income Energy Efficiency	$9,498	$12,200	0.78	-$2,702
Residential Subtotal	**$61,491**	**$40,131**	**1.53**	**$21,359**
C&I Energy Solutions for Business - Small	$78,466	$45,536	1.72	$32,931
C&I Energy Solutions for Business - Large	$40,690	$23,077	1.76	$17,613
Non-Residential Subtotal	**$119,156**	**$68,613**	**1.74**	**$50,543**
Portfolio Total	**$180,647**	**$108,744**	**1.66**	**$71,903**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 133: P4TD Gross TRC Ratios by Program ($1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$13,699	$7,761	1.77	$5,938
Energy Efficient Products	$5,067	$5,280	0.96	-$214
Low Income Energy Efficiency	$1,703	$3,524	0.48	-$1,821
Residential Subtotal	**$20,468**	**$16,565**	**1.24**	**$3,903**
C&I Energy Solutions for Business - Small	$15,466	$10,501	1.47	$4,965
C&I Energy Solutions for Business - Large	$19,262	$16,151	1.19	$3,111
Non-Residential Subtotal	**$34,728**	**$26,652**	**1.30**	**$8,075**
Portfolio Total	**$55,196**	**$43,217**	**1.28**	**$11,979**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 134: P4TD Gross TRC Ratios by Program ($1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$39,010	$19,837	1.97	$19,173
Energy Efficient Products	$13,444	$19,193	0.70	-$5,748
Low Income Energy Efficiency	$10,940	$12,181	0.90	-$1,241
Residential Subtotal	**$63,395**	**$51,211**	**1.24**	**$12,184**
C&I Energy Solutions for Business - Small	$65,775	$40,798	1.61	$24,978
C&I Energy Solutions for Business - Large	$57,655	$34,572	1.67	$23,083
Non-Residential Subtotal	**$123,431**	**$75,370**	**1.64**	**$48,061**
Portfolio Total	**$186,825**	**$126,580**	**1.48**	**$60,245**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 135, Table 136, Table 137, and Table 138 present P4TD cost-effectiveness results for Met-Ed, Penelec, Penn Power, and WPP respectively using net verified savings to calculate benefits. Cost and benefits are expressed in 2021 Dollars.

Table 135: P4TD Net TRC Ratios by Program ($1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$35,478	$16,126	2.20	$19,352
Energy Efficient Products	$10,025	$14,996	0.67	-$4,971
Low Income Energy Efficiency	$9,768	$9,440	1.03	$328
Residential Subtotal	**$55,271**	**$40,563**	**1.36**	**$14,709**
C&I Energy Solutions for Business - Small	$43,810	$25,861	1.69	$17,949
C&I Energy Solutions for Business - Large	$42,178	$38,432	1.10	$3,745
Non-Residential Subtotal	**$85,987**	**$64,293**	**1.34**	**$21,694**
Portfolio Total	**$141,258**	**$104,855**	**1.35**	**$36,403**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 136: P4TD Net TRC Ratios by Program ($1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$37,327	$11,302	3.30	$26,025
Energy Efficient Products	$7,013	$10,839	0.65	-$3,827
Low Income Energy Efficiency	$9,498	$12,200	0.78	-$2,702
Residential Subtotal	**$53,837**	**$34,341**	**1.57**	**$19,497**
C&I Energy Solutions for Business - Small	$55,154	$34,694	1.59	$20,460
C&I Energy Solutions for Business - Large	$26,821	$17,452	1.54	$9,369
Non-Residential Subtotal	**$81,976**	**$52,147**	**1.57**	**$29,829**
Portfolio Total	**$135,813**	**$86,488**	**1.57**	**$49,325**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 137: P4TD Net TRC Ratios by Program ($1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$11,272	$6,628	1.70	$4,644
Energy Efficient Products	$2,398	$3,337	0.72	-$939
Low Income Energy Efficiency	$1,703	$3,524	0.48	-$1,821
Residential Subtotal	**$15,373**	**$13,489**	**1.14**	**$1,884**
C&I Energy Solutions for Business - Small	$12,633	$9,176	1.38	$3,457
C&I Energy Solutions for Business - Large	$13,837	$11,674	1.19	$2,163
Non-Residential Subtotal	**$26,470**	**$20,850**	**1.27**	**$5,620**
Portfolio Total	**$41,843**	**$34,339**	**1.22**	**$7,504**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 138: P4TD Net TRC Ratios by Program ($1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	$38,362	$18,164	2.11	$20,198
Energy Efficient Products	$7,459	$12,534	0.60	-$5,076
Low Income Energy Efficiency	$10,940	$12,181	0.90	-$1,241
Residential Subtotal	**$56,761**	**$42,879**	**1.32**	**$13,882**
C&I Energy Solutions for Business - Small	$49,018	$34,509	1.42	$14,509
C&I Energy Solutions for Business - Large	$38,529	$25,405	1.52	$13,124
Non-Residential Subtotal	**$87,547**	**$59,914**	**1.46**	**$27,633**
Portfolio Total	**$144,308**	**$102,794**	**1.40**	**$41,515**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

D.3 High-Impact Measure Net-to-Gross

Findings from net-to-gross research are not used to adjust compliance savings in Pennsylvania. Instead, net-to-gross research provides directional information for program planning purposes. Table 139 and Table 140 present net-to-gross findings HIMs studied thus far in Phase IV[14]. Appliance Recycling, CI EMNC, and CI Custom initiatives were evaluated in PY16, while other HIMs were evaluated in previous years of Phase IV.

Table 139: High-Impact Measure Net-to-Gross for Met-Ed and Penelec

HIM	Met-Ed			Penelec		
	Free ridership	Spillover	Net to Gross Ratio	Free ridership	Spillover	Net to Gross Ratio
CI Custom	47.2%	4.9%	57.7%	47.2%	4.9%	57.7%
CI Prescriptive	37.0%	1.0%	64.0%	35.2%	1.1%	65.9%
CI EMNC	33.9%	1.8%	67.9%	24.4%	2.7%	78.3%
EE Kits	24.1%	5.7%	81.6%	17.4%	23.6%	106.1%
Res HVAC	50.4%	50.4%	50.4%	45.2%	14.9%	69.7%
Res Appliance Turn-In	38.0%	0.0%	62.0%	40.0%	0.0%	60.0%

Table 140: High-Impact Measure Net-to-Gross for Penn Power and WPP

HIM	Penn Power			West Penn Power		
	Free ridership	Spillover	Net to Gross Ratio	Free ridership	Spillover	Net to Gross Ratio
CI Custom	47.2%	4.9%	57.7%	47.2%	4.9%	57.7%
CI Prescriptive	23.1%	0.5%	77.4%	33.3%	1.3%	68.0%
CI EMNC	28.3%	3.1%	74.8%	31.1%	2.7%	71.6%
EE Kits	22.6%	7.5%	85.0%	13.1%	8.8%	95.7%
Res HVAC	47.4%	2.1%	54.7%	48.8%	3.6%	54.8%
Res Appliance Turn-In	39.0%	0.0%	61.0%	34.0%	0.0%	66.0%

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

[14] The Phase IV Evaluation Framework provides guidance to the 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 some program-level NTG information – that is, to over-sample HIMs, but they may also include non-HIMs in the research, as appropriate.

Table 141, Table 142, Table 143, and Table 144 present PY16 expenditures, by program, compared to the budget estimates set forth in the EE&C plan for PY16 for Met-Ed, Penelec, Penn Power, and WPP. All the dollars in these tables are presented in 2024 Dollars.

Table 141: Comparison of PYTD Expenditures to EE&C Plan ($1,000) Met-Ed

Program	PY16 Budget from EE&C Plan	PY16 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 4,650.00	$ 4,617.69	0.99
Energy Efficient Products Program	$ 2,678.00	$ 2,673.28	1.00
Low Income Energy Efficiency Program	$ 2,973.00	$ 3,367.61	1.13
C&I Energy Solutions for Business Program - Small	$ 7,490.00	$ 8,723.91	1.16
C&I Energy Solutions for Business Program - Large	$ 7,275.00	$ 11,414.91	1.57
Total	**$ 25,066.00**	**$ 30,797.40**	**1.23**

Table 142: Comparison of PYTD Expenditures to EE&C Plan ($1,000) Penelec

Program	PY16 Budget from EE&C Plan	PY16 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 3,741.00	$ 3,698.95	0.99
Energy Efficient Products Program	$ 2,393.00	$ 1,805.18	0.75
Low Income Energy Efficiency Program	$ 3,239.00	$ 4,458.12	1.38
C&I Energy Solutions for Business Program - Small	$ 8,131.00	$ 11,770.20	1.45
C&I Energy Solutions for Business Program - Large	$ 5,685.00	$ 7,617.75	1.34
Total	**$ 23,189.00**	**$ 29,350.19**	**1.27**

Table 143: Comparison of PYTD Expenditures to EE&C Plan ($1,000) Penn Power

Program	PY16 Budget from EE&C Plan	PY16 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 1,574.00	$ 1,727.13	1.10
Energy Efficient Products Program	$ 711.00	$ 749.92	1.05
Low Income Energy Efficiency Program	$ 790.00	$ 1,338.05	1.69
C&I Energy Solutions for Business Program - Small	$ 2,075.00	$ 2,276.96	1.10
C&I Energy Solutions for Business Program - Large	$ 1,545.00	$ 1,893.90	1.23
Total	**$ 6,695.00**	**$ 7,985.95**	**1.19**

Table 144: Comparison of PYTD Expenditures to EE&C Plan ($1,000) WPP

Program	PY16 Budget from EE&C Plan	PY16 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 4,952.00	$ 5,145.07	1.04
Energy Efficient Products Program	$ 2,929.00	$ 2,340.07	0.80
Low Income Energy Efficiency Program	$ 3,167.00	$ 3,999.48	1.26
C&I Energy Solutions for Business Program - Small	$ 7,091.00	$ 10,606.79	1.50
C&I Energy Solutions for Business Program - Large	$ 5,575.00	$ 9,388.61	1.68
Total	**$ 23,714.00**	**$ 31,480.02**	**1.33**

Table 145, Table 146, Table 147, and Table 148 present P4TD expenditures, by program, compared to the budget estimates set forth in the EE&C plan through PY16 for Met-Ed, Penelec, Penn Power, and WPP respectively. All the dollars in these tables are presented in nominal Dollars.

Table 145: Comparison of P4TD Expenditures to EE&C Plan ($1,000) Met-Ed

Program	Phase IV Budget from EE&C Plan through PY16	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 18,455.00	$ 16,024.98	0.87
Energy Efficient Products Program	$ 10,786.00	$ 11,210.63	1.04
Low Income Energy Efficiency Program	$ 12,215.00	$ 10,071.76	0.82
C&I Energy Solutions for Business Program - Small	$ 28,483.00	$ 26,141.15	0.92
C&I Energy Solutions for Business Program - Large	$ 29,230.00	$ 18,704.74	0.64
Total	**$ 99,169.00**	**$ 82,153.25**	**0.83**

Table 146: Comparison of P4TD Expenditures to EE&C Plan ($1,000) Penelec

Program	Phase IV Budget from EE&C Plan through PY16	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 14,859.00	$ 12,134.87	0.82
Energy Efficient Products Program	$ 9,648.00	$ 7,387.09	0.77
Low Income Energy Efficiency Program	$ 13,113.00	$ 13,257.01	1.01
C&I Energy Solutions for Business Program - Small	$ 31,122.00	$ 31,599.71	1.02
C&I Energy Solutions for Business Program - Large	$ 22,878.00	$ 14,207.12	0.62
Total	**$ 91,620.00**	**$ 78,585.79**	**0.86**

Table 147: Comparison of P4TD Expenditures to EE&C Plan ($1,000) Penn Power

Program	Phase IV Budget from EE&C Plan through PY16	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 6,358.00	$ 5,885.60	0.93
Energy Efficient Products Program	$ 2,860.00	$ 2,859.03	1.00
Low Income Energy Efficiency Program	$ 3,245.00	$ 3,839.97	1.18
C&I Energy Solutions for Business Program - Small	$ 7,989.00	$ 7,720.62	0.97
C&I Energy Solutions for Business Program - Large	$ 6,134.00	$ 4,745.26	0.77
Total	**$ 26,586.00**	**$ 25,050.49**	**0.94**

Table 148: Comparison of P4TD Expenditures to EE&C Plan ($1,000) WPP

Program	Phase IV Budget from EE&C Plan through PY16	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 19,585.00	$ 16,928.71	0.86
Energy Efficient Products Program	$ 11,813.00	$ 9,380.56	0.79
Low Income Energy Efficiency Program	$ 12,823.00	$ 13,313.20	1.04
C&I Energy Solutions for Business Program - Small	$ 27,490.00	$ 31,413.97	1.14
C&I Energy Solutions for Business Program - Large	$ 22,327.00	$ 17,413.04	0.78
Total	**$ 94,038.00**	**$ 88,449.48**	**0.94**

Table 149, Table 150, Table 151, and Table 152 compare PYTD verified gross program savings compared to the energy savings projections filed in the EE&C plan for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 149: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Met-Ed

Program	EE&C Plan Projections for PY16	PY16 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	17,442	28,795	1.65
Energy Efficient Products Program	8,978	7,506	0.84
Low Income Energy Efficiency Program	4,970	5,952	1.20
C&I Energy Solutions for Business Program - Small	24,288	32,555	1.34
C&I Energy Solutions for Business Program - Large	38,456	88,255	2.29
Total	**94,135**	**163,063**	**1.73**

Table 150: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Penelec

Program	EE&C Plan Projections for PY16	PY16 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	13,804	16,463	1.19
Energy Efficient Products Program	7,936	4,897	0.62
Low Income Energy Efficiency Program	5,312	5,216	0.98
C&I Energy Solutions for Business Program - Small	30,252	52,293	1.73
C&I Energy Solutions for Business Program - Large	33,650	31,801	0.95
Total	**90,954**	**110,670**	**1.22**

Table 151: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Penn Power

Program	EE&C Plan Projections for PY16	PY16 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	5,506	9,489	1.72
Energy Efficient Products Program	2,481	1,929	0.78
Low Income Energy Efficiency Program	1,592	1,020	0.64
C&I Energy Solutions for Business Program - Small	8,581	11,490	1.34
C&I Energy Solutions for Business Program - Large	8,206	8,688	1.06
Total	**26,367**	**32,615**	**1.24**

Table 152: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for WPP

Program	EE&C Plan Projections for PY16	PY16 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	18,130	21,992	1.21
Energy Efficient Products Program	10,368	5,988	0.58
Low Income Energy Efficiency Program	5,825	5,083	0.87
C&I Energy Solutions for Business Program - Small	25,940	44,174	1.70
C&I Energy Solutions for Business Program - Large	34,922	83,433	2.39
Total	**95,185**	**160,670**	**1.69**

Table 153, Table 154, Table 155, and Table 156 compare Phase IV verified gross program savings compared to the energy savings projections filed in the EE&C plan for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 153: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for Met-Ed

Program	EE&C Plan through PY16	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	68,799	70,870	1.03
Energy Efficient Products Program	35,912	38,154	1.06
Low Income Energy Efficiency Program	20,828	20,449	0.98
C&I Energy Solutions for Business Program - Small	92,282	87,983	0.95
C&I Energy Solutions for Business Program - Large	152,767	162,455	1.06
Total	**370,589**	**379,912**	**1.03**

Table 154: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for Penelec

Program	EE&C Plan through PY16	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	54,673	56,415	1.03
Energy Efficient Products Program	31,742	24,101	0.76
Low Income Energy Efficiency Program	20,909	22,258	1.06
C&I Energy Solutions for Business Program - Small	116,148	113,374	0.98
C&I Energy Solutions for Business Program - Large	133,543	74,062	0.55
Total	**357,015**	**290,211**	**0.81**

Table 155: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for Penn Power

Program	EE&C Plan through PY16	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	21,518	24,220	1.13
Energy Efficient Products Program	9,925	9,453	0.95
Low Income Energy Efficiency Program	6,299	5,427	0.86
C&I Energy Solutions for Business Program - Small	33,198	24,833	0.75
C&I Energy Solutions for Business Program - Large	32,338	28,089	0.87
Total	**103,278**	**92,022**	**0.89**

Table 156: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for WPP

Program	EE&C Plan through PY16	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	71,314	64,107	0.90
Energy Efficient Products Program	41,470	30,091	0.73
Low Income Energy Efficiency Program	22,987	24,890	1.08
C&I Energy Solutions for Business Program - Small	100,267	110,175	1.10
C&I Energy Solutions for Business Program - Large	138,232	138,743	1.00
Total	**374,271**	**368,007**	**0.98**

Appendix E Evaluation Detail – EE Kits Sub-Initiative

E.1 Gross Impact Evaluation

The Energy Efficiency Kits (EE Kits) initiative has two sub-initiatives – EE Kits and Low-Income EE Kits. Each sub-initiative has two sub-components: EE Kits and School Education. Both components are administered by AMGC. The EE Kits component distributes kits to customers that submit an online or telephonic request for conservation kits and also provides "new mover" kits to customers who open new accounts. The School Education program component also distributes kits by mail but collaborates with local schools to develop an energy efficiency oriented educational component for children.

E.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical for all four EDCs and for all kit types, although separate samples and realization rates are developed for each kit type (School Kits, and EE Kits). In the EE Kit subprogram, distinct types of energy conservation kits were sent to customers depending on their hot water fuel source. The kits that are provided to customers with electric water heating included LED lamps, LED night lights, energy saving aerators, a furnace whistle, an energy saving showerhead, and electrical outlet gaskets. The kits that are provided to customers with non-electric water heating excludes the showerhead and aerators. School kits included LED lamps, LED night lights, a furnace whistle, and electrical outlet gaskets. Low-Income kits included advanced power strips instead of electrical outlet gaskets.

In evaluating the gross impact analysis for the energy conservation kits, four items must be determined:

1. The average energy savings and demand reduction for the kit elements that are installed;
2. The number and type of kits mailed to customers during the program year;
3. The installation rate or in-service rate (ISR) for the various kit elements;
4. The delivery rate, or percentage of reported kits sent to customers that were not received by customers, either because of shipping problems, customers moving, or other such scenarios.

The first item has been determined through application of the partially deemed savings protocols in the 2021 TRM. The second item, the total number and type of kits mailed to customers, is determined by reviewing the program tracking and reporting system.

The third item, installation rates, are determined through online and telephone customer verification surveys, except for LED lamps which are given "deemed" installation rates of 0.92 (later multiplied by the kit receipt rate as determined through surveys), consistent with the TRM.

For a particular site in a sample, the installation rate for each kit element takes on a binary value of 1, if the element is installed in accordance with the principles that define that element as an energy efficiency measure, and 0 otherwise. In particular, faucet aerators and energy saving

showerheads are only counted as “installed” if they are installed in a home that has electric water heating.

The final item, the delivery rate is determined through the online and phone survey instrument. Online and phone survey respondents are asked to indicate whether they received the conservation kit that was mailed to them. The final in-service rates are the products of the item-wise in-service rates and the kit delivery rates.

The survey instrument that was used to verify that the shipped energy conservation kits were installed asks a series of questions that determine how many of each item was installed and where each item was installed.

Both telephone and online surveys were conducted in PY16. The two modes yielded compatible results, so each survey response for a given stratum was given equal weight.

The gross realization rates for energy savings and demand reductions were driven primarily by in-service rates for the kit components. The realization rates for EE Kits were similar to those found in past years. The following factors contributed to realization rates:

- Opt-in kits did better than New Mover kits
  - ISRs were higher for Opt-in kits for all non-lighting measures
  - Percent electric water heating for aerators and showerhead in Opt-in kits also trended higher than those in New Mover kits
  - EDCs with higher fractions of Opt-in kits had higher realization rates overall
- Low-income kits did better than non-low-income kits mainly due to higher fractions of Opt-in kits.
- Electric kits were the main source of lower realization rates for New Movers due to lower ISRs for showerheads and aerators.

While ISRs can fluctuate from survey to survey, the general trend indicated a systematic shift toward lower ISRs with the New Mover kits. The kits are still quite cost-effective despite the lower in-service rates associated with new mover kits.

E.1.2 Sampling

The low-income kits are treated as a separate sub-initiative and are discussed in Appendix Q. Each kit type was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 157, Table 158, Table 159, and Table 160.

Table 157: EE Kits Sub-Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	38,340	254	Survey (phone + online)
EE Kits - Standard	28,283	251	
School Education kits	4,624	351	
Program Total	**71,247**	**856**	

Table 158: EE Kits Sub-Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	30,123	201	Survey (phone + online)
EE Kits - Standard	33,791	202	
School Education kits	4,534	530	
Program Total	**68,448**	**933**	

Table 159: EE Kits Sub-Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	8,214	214	Survey (phone + online)
EE Kits - Standard	7,955	212	
School Education kits	1,273	44	
Program Total	**17,442**	**470**	

Table 160: EE Kits Sub-Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	35,461	175	Survey (phone + online)
EE Kits - Standard	33,447	218	
School Education kits	3,406	548	
Program Total	**72,314**	**941**	

E.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 161, Table 162, Table 163, and Table 164 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 161: EE Kits Sub-Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	8,966	89%	1.0	9.0%
EE Kits - Standard	4,519	87%	0.5	4.5%
School Education kits	739	127%	0.5	3.7%
Program Total	**14,224**	**90.1%**	**0.5**	**5.8%**

Table 162: EE Kits Sub-Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	6,893	81%	1.0	10.1%
EE Kits - Standard	5,373	97%	0.5	5.1%
School Education kits	721	129%	0.5	2.9%
Program Total	**12,987**	**90.0%**	**0.5**	**5.3%**

Table 163: EE Kits Sub-Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	1,929	84%	1.0	9.7%
EE Kits - Standard	1,309	94%	0.5	4.9%
School Education kits	209	151%	0.5	10.7%
Program Total	**3,448**	**91.9%**	**0.5**	**5.4%**

Table 164: EE Kits Sub-Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	8,376	86%	1.0	10.9%
EE Kits - Standard	5,517	91%	0.5	4.9%
School Education kits	562	131%	0.5	2.8%
Program Total	**14,455**	**89.5%**	**0.5**	**6.3%**

E.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 165, Table 166, Table 167, Table 168 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 165: EE Kits Sub-Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.95	85.8%	1.0	9.0%
EE Kits - Standard	0.50	96.2%	0.5	4.5%
School Education kits	0.082	126.0%	0.5	3.7%
Program Total	**1.53**	**91.4%**	**0.5**	**5.5%**

Table 166: EE Kits Sub-Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.69	83.0%	1.0	10.1%
EE Kits - Standard	0.53	104.7%	0.5	5.1%
School Education kits	0.07	107.8%	0.5	2.9%
Program Total	**1.29**	**93.3%**	**0.5**	**5.3%**

Table 167: EE Kits Sub-Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.20	82.6%	1.0	9.7%
EE Kits - Standard	0.15	100.9%	0.5	4.9%
School Education kits	0.02	128.0%	0.5	10.7%
Program Total	**0.37**	**92.6%**	**0.5**	**5.3%**

Table 168: EE Kits Sub-Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.92	85.4%	1.0	10.9%
EE Kits - Standard	0.66	97.4%	0.5	4.9%
School Education kits	0.07	122.3%	0.5	2.8%
Program Total	**1.65**	**91.7%**	**0.5**	**6.0%**

Note that the overall precision for the EE Kits initiative is the combined precision of the low income and non-low-income components. The combined precisions for each EDC are shown in Table 169 below.

Table 169: EE Kits Initiative Sampling Precisions

EDC	Relative Precision at 85% C.L., Energy	Relative Precision at 85% C.L., Demand
Met-Ed	5.0%	4.7%
Penelec	4.8%	4.8%
Penn Power	5.4%	5.3%
West Penn Power	5.4%	5.1%

E.2 NET IMPACT EVALUATION

E.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted a net-to-gross study in PY15. The net-to-gross evaluation for the Energy Efficiency Kits measures is based on self-report data from program participants. The following sections provide information related to the net impact evaluation effort.

E.2.2 Sampling

The sample designs for the four EDCs are shown Table 170. Note that the process and net impact evaluation survey effort included both low-income and non-low-income customers. The participant counts, sample sizes, and results shown in the following tables corresponds to the non-low-income component of the kits, which is a part of the Energy Efficient Homes Program.

Table 170: EE Kits Initiative Net-to-Gross Sampling

EDC	Population Size	Achieved Sample Size (Opt-In)	Achieved Sample Size (New Mover)	Achieved Sample Size (School)	Achieved Sample Size (Total)	Response Rate
Met-Ed	57,375	31	13	24	68	11.6%
Penelec	57,934	30	17	41	88	13.6%
Penn Power	18,185	33	18	3	54	15.4%
WPP	54,744	33	16	26	75	15.2%

E.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 171.

Table 171: EE Kits Initiative Net-to-Gross Results

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	12,811	24.1%	5.7%	81.6%	13.1%
Penelec	11,692	17.4%	23.6%	106.1%	11.5%
Penn Power	3,168	22.6%	7.5%	85.0%	14.7%
WPP	12,942	13.1%	8.8%	95.7%	12.5%

Appendix F Evaluation Detail – Residential Direct Install Initiative

The Residential Direct Install (Res DI) Initiative is implemented by CLEAResult. A participant in this program is defined as a unique address in the program, and multiple projects can be installed at one address.

This program consists of comprehensive residential energy audits performed by CLEAResult along with energy efficiency measures directly installed in customers' residences. The audit evaluates the performance of the participant's home heating and cooling system, insulation, windows, appliances, building shell and lighting equipment. The audit is used to identify energy savings opportunities. Some low-cost energy savings measures are directly installed in the consumer home during the audit. Low-cost measures can include light bulbs, nightlights, smart power strips, furnace whistles, aerators, showerheads, and pipe insulation. Major measures, (solar panels, attic insulation, wall insulation, air sealing, and windows) can also be installed. These measures are usually installed after the initial audit.

For the initial in-home audit, up to $450 is allocated to cover the costs of the customer audit fee ($150) and the rebates for the direct-install measures (capped at $300). The customer audit fee is paid as a rebate directly to the trade ally by CSP. The audit fee covers the auditor time, blower door test, home energy education, whole-home analysis, and the home energy report. Additional energy use education and recommendations for further measure installation are also part of the service. After the audit and direct-install measures are completed, the auditor will summarize their recommended measures, inform the customer of available rebates, and provide the customer with a complete list of the audit fee and direct-install measure costs covered by the Comprehensive Audit program. They also provide a FirstEnergy leave-behind flyer that includes information to help the customer with the next steps. If customers are interested in direct-install measures above the $300 cap or additional testing not covered in the program, auditors can work with the customer to complete the requests.

F.1 Gross Impact Evaluation

F.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Res DI Initiative utilized a stratified sampling plan. The projects are placed into one of three strata based on total reported project impacts.

The program tracking and reporting system is at the measure level and also identifies the rebate application and participant address associated with each measure. In general, there can be multiple measures per application and even multiple applications per household. An example of the latter scenario is when a household first undergoes an initial audit with direct installation of

low-cost measures, but later has major measures installed as identified in the audit report. The subsequent retrofits would be captured in a separate rebate application.

ADM aggregated impacts from all measures by unique address and then placed each household in one of three strata which correspond to high, medium, and low energy savings in the context of the distribution of reported impacts for the given EDC. Impact evaluation activities for sampled projects are described below.

F.1.1.1 Weatherization Measures

Engineering calculation reviews were performed on all participants with major measures. Engineering calculations were checked for TRM compliance. The customer's zip code was used to determine EFLHs, HDDs, and CDDs. Reviews also consisted of a document review to verify HVAC equipment and water heating equipment.

Insulation areas, baseline and post-installation insulation R-values were provided in the rebate forms or from accompanying project documentation.

Residential air sealing measures used $CFM50_{post}$ and $CFM50_{pre}$ values found in the project rebate forms.

F.1.1.2 Non-Weatherization Measures

A sample of projects were used to determine measure level in-service rates. Furthermore, a document review when applicable was used to verify water heating. Non-weatherization measures include light bulbs, showerheads, night lights, smart power strips, aerators, pipe wrap insulation, and smart thermostats. All measures were evaluated according to their respective protocols in the 2021 PA TRM. Several projects in the PY16 sample included solar power. ADM evaluated these projects according to the interim measure protocol issued by the SWE in PY16.

F.1.2 Sampling

Table 172, Table 173, Table 174, and Table 175 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 172: Res DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
3	0.0	314	14	Inspection of QA/QC forms, desk reviews
2	0.8	193	20	
1	5.0	8	5	
Program Total		515	39	

Table 173: Res DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
3	0.0	318	16	Inspection of QA/QC forms, desk reviews
2	0.7	157	17	
1	5.0	6	5	
Program Total		**481**	**38**	

Table 174: Res DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
3	0.0	82	30	Inspection of QA/QC forms, desk reviews
2	0.6	50	20	
1	1.2	9	6	
Program Total		**141**	**56**	

Table 175: Res DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
3	0.0	406	20	Inspection of QA/QC forms, desk reviews
2	0.7	172	36	
1	5.0	6	5	
Program Total		**584**	**61**	

F.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 176, Table 177, Table 178, and Table 179 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 176: Res DI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
3	0.0	189	104.0%	0.5	19%
2	0.8	189	97.1%	0.5	19%
1	5.0	116	86.5%	0.5	20%
Program Total		**495**	**97.2%**	**n/a**	**11.3%**

Table 177: Res DI Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
3	0.0	132	107.6%	0.5	18%
2	0.7	140	113.1%	0.5	18%
1	5.0	100	102.5%	0.5	13%
Program Total		**371**	**108.3%**	**n/a**	**9.9%**

Table 178: Res DI Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
3	0.0	30	107.0%	0.5	10%
2	0.6	41	106.8%	0.5	10%
1	1.2	21	109.5%	0.5	17%
Program Total		**92**	**107.4%**	**n/a**	**7.0%**

Table 179: Res DI Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
3	0.0	198	104.0%	0.5	16%
2	0.7	200	107.2%	0.5	16%
1	5.0	63	85.8%	0.5	13%
Program Total		**460**	**102.9%**	**n/a**	**10.0%**

F.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 180, Table 181, Table 182, and Table 183 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 180: Res DI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
3	0.0	0.03	72.1%	0.5	19%
2	0.8	0.03	75.7%	0.5	19%
1	5.0	0.03	71.1%	0.5	19%
Program Total		**0.09**	**73.0%**	**n/a**	**10.9%**

Table 181: Res DI Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
3	0.0	0.02	71.5%	0.5	18%
2	0.7	0.02	73.3%	0.5	18%
1	5.0	0.04	80.4%	0.5	18%
Program Total		**0.08**	**76.0%**	**n/a**	**10.6%**

Table 182: Res DI Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
3	0.0	0.00	71.3%	0.5	10%
2	0.6	0.01	78.6%	0.5	10%
1	1.2	0.00	75.0%	0.5	10%
Program Total		**0.01**	**75.5%**	**n/a**	**6.3%**

Table 183: Res DI Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
3	0.0	0.03	79.3%	0.5	16%
2	0.7	0.03	75.2%	0.5	16%
1	5.0	0.02	82.0%	0.5	16%
Program Total		**0.09**	**78.3%**	**n/a**	**9.3%**

F.2 Net Impact Evaluation

F.2.1 Net Impact Evaluation Methodology

Tetra Tech performed net impact evaluation in PY15 using the approach defined in the Pennsylvania Act 129 Phase IV Statewide Evaluation Framework, which is built around a customer self-report survey. The participant survey includes a series of free-ridership and spillover questions that ask program participants about the actions they would have taken if the program had not been offered.

F.2.2 Sampling

The sample of participants was selected from Q2 of PY14 through Q1 of PY15. The population sizes, achieved sample sizes, and response rates are shown in Table 184 below.

Table 184: Res DI Initiative Net-to-Gross Sampling

EDC	Population Size	Achieved Sample Size	Response Rate
Met-Ed	278	73	26.3%
Penelec	279	75	26.9%
Penn Power	269	80	29.7%
WPP	278	75	27.0%

F.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 185. Overall, the program had 17% free ridership and 10% spillover, resulting in an NTG of 93% (ranging from 87% to 99% among the four PA Companies). The top five measures contributing to spillover savings were air sealing, attic insulation, wall insulation, LEDs, and pipe wrap.

Table 185: Res DI Initiative Net-to-Gross Results by EDC

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	481	19.8%	6.6%	86.7%	7.2%
Penelec	402	17.8%	16.9%	99.1%	7.1%
Penn Power	99	14.5%	8.6%	94.1%	6.7%
WPP	474	17.4%	8.8%	91.3%	7.1%

Appendix G Evaluation Detail – Residential New Construction Initiative

The Residential New Construction program incentivizes builders to adopt energy efficient building practices. This includes building envelope improvements, high-efficiency HVAC equipment, duct sealing, and installation of ENERGY STAR® appliances, smart thermostats, and lighting. Participants are defined as each unique dwelling unit (e.g., unique mailing address).

All submitted projects used Ekotrope to generate reported energy and demand impacts.

G.1 Gross Impact Evaluation

G.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Residential New Construction (Res NC) Initiative involved reviewing the software models submitted with each sampled project, performing verification of model inputs, and re-running modified models through the same software used by program HERS raters. Models were modified based on site inspection information obtained by the implementer (PSD) during their quality control inspections, or ADM's verification site visits. Additional resources such as aerial maps were also used to verify model inputs such as orientation and number of stories. Modified models were then run against the reference home to obtain ex post energy savings and cooling demand reduction TRM inputs. Ex post cooling demand reductions followed the corresponding TRM algorithm which includes a coincidence factor. Ex post demand reductions for lighting, appliances, and water heaters were obtained from corresponding TRM algorithms. Total ex post demand reductions are the sum of the cooling demand reduction and the lighting, appliances, and water heater demand reductions. Additional algorithm parameters required by the TRM but not required by software inputs were obtained through the on-site verification efforts.

G.1.1.1 On-Site Inspections

Two types of on-site inspections were performed for the impact evaluation effort:

- Diagnostic inspection w/blower door and duct blaster
- Visual inspection without blower door and duct blaster

Diagnostic inspections include the same activity as visual inspections with the addition of blower door and duct blaster testing to verify duct leakage and whole house infiltration rates.

Visual inspection includes the following:

- Building Characteristics
  - Orientation (N, NE, E, SE, etc.)
  - Housing type (SF detached, Townhouse inside unit, Townhouse end unit, etc.)
  - Number of floors on or above grade
  - Conditioned sq. ft.
  - Number of bedrooms

    - Window type, size and orientation
    - Ceiling heights
- Envelope
    - Foundation type (slab, conditioned basement, unconditioned basement, etc.)
    - Wall and ceiling insulation R-values
    - Slab and framed floor insulation
    - Rim/band joist insulation
    - Number of exterior doors
- HVAC
    - Make and model
    - SEER, capacity, and HSPF
    - For gas furnaces, electric auxiliary energy usage (EAE) as obtained from the AHRI database
    - Smart thermostat is installed
    - Duct location (conditioned space, attic)
    - Type of mechanical ventilation if necessary
- Water heating
    - Type (storage, instantaneous)
    - Fuel (gas, electric resistance, heat pump)
    - Size in gallons
    - Energy factor as obtained from the AHRI database
- Lighting
    - Percent efficient installed interior, exterior, and in the garage. In cases of discrepancies, lighting counts were reported in the notes section of the checklist.
    - Identification of source (incandescent, LED, or CFL)
- Appliances
    - An ENERGY STAR® appliance was installed at the time of inspection
    - kWh/yr for refrigerators and dishwashers
    - Fuel for ranges and cooktops
    - Clothes washer and dryer attributes

G.1.1.2 Engineering Model Reviews

Submitted building models were reviewed as part of the evaluation activities. These reviews included the following activities:

- Baseline specifications are accurate per the TRM
- Model inputs are reasonable and self-consistent
- Models are consistent with actual as-built homes

  Each sampled home was reviewed for consistency with actual as-built homes. In cases where submitted models differed from as-built homes, models were modified prior to generating ex post values.

G.1.1.3 TRM Impact Evaluation

Demand impact parameters for cooling equipment, including peak load and EER values, were obtained from software outputs and multiplied by coincidence factors based on zip code according to the TRM algorithm. The TRM requires that demand impacts from lighting and appliances are evaluated with relevant TRM protocols rather than within engineering simulation models since approved software does not produce peak load outputs for end uses other than cooling equipment demand.

G.1.2 Sampling

Table 186, Table 187, Table 188, and Table 189 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively. New Homes and smart thermostats within those homes make up the two qualitative sampling strata.

Table 186: RES NC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	675	22	Model Review / On-Site
Smart Thermostats	162	7	
Program Total	**837**	**29**	

Table 187: RES NC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	136	12	Model Review / On-Site
Smart Thermostats	2	2	
Program Total	**138**	**14**	

Table 188: RES NC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	601	23	Model Review / On-Site
Smart Thermostats	307	7	
Program Total	**908**	**30**	

Table 189: RES NC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	973	22	Model Review / On-Site
Smart Thermostats	269	7	
Program Total	**1,242**	**29**	

G.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 190, Table 191, Table 192, and Table 193 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Gross realization rates for Smart Thermostats varied across EDCs mainly due to small sample sizes resulting in higher and lower square footage per ton than ex ante assumptions.

Table 190: RES NC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	2,228	100.6%	0.4	11.1%
Smart Thermostats	38	112.6%	0.5	26.6%
Program Total	**2,266**	**100.8%**	**0.4**	**10.9%**

Table 191: RES NC Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	446	96.4%	0.3	10.3%
Smart Thermostats	1	71.3%	0.5	0.0%
Program Total	**447**	**96.4%**	**0.3**	**10.3%**

Table 192: RES NC Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	1,827	102.5%	0.3	7.4%
Smart Thermostats	58	103.1%	0.5	26.9%
Program Total	**1,885**	**102.5%**	**0.3**	**7.3%**

Table 193: Res DI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	3,023	95.1%	0.4	12.5%
Smart Thermostats	56	132.8%	0.5	26.9%
Program Total	**3,078**	**95.8%**	**0.4**	**12.2%**

G.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 194, Table 195, Table 196, and Table 197 for Met-Ed, Penelec, Penn Power, and WPP respectively. Gross realization rates for demand savings were primarily driven by differences in methodology. Application of the TRM's coincidence factor to the peak design load results in a lower kW value than the average kW in July at 6 PM, which is the basis for reported demand reductions.

Table 194: RES NC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	0.50	84.1%	0.5	15.4%
Smart Thermostats	0.01	125.8%	0.5	26.6%
Program Total	**0.51**	**85.0%**	**0.5**	**14.9%**

Table 195: RES NC Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	0.09	85.0%	0.2	7.5%
Smart Thermostats	0.00	72.3%	0.5	0.0%
Program Total	**0.09**	**85.0%**	**0.2**	**7.4%**

Table 196: RES NC Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	0.40	76.4%	0.5	14.7%
Smart Thermostats	0.02	128.3%	0.5	26.9%
Program Total	**0.42**	**78.5%**	**0.5**	**13.9%**

Table 197: RES NC Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	0.63	82.3%	0.4	13.6%
Smart Thermostats	0.02	118.6%	0.5	26.9%
Program Total	**0.65**	**83.2%**	**0.4**	**13.1%**

G.2 Net Impact Evaluation

G.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted a net impact evaluation in PY14 by tailoring the common approach defined in the Pennsylvania Act 129 Phase IV Statewide Evaluation Framework to the New Homes program design. A series of free-ridership and spillover questions included in the builder interviews ask participating builders about the actions they would have taken if the program had not been offered and whether various program aspects influenced their actions. A total of 14

builders were interviewed from the 34 total builders that participated in the program across the four PA Companies. Builder responses resulted in a free ridership rate of 28 percent for PY14 (similar to the 27% measured in PY10). The net-to-gross research did not identify any participant spillover. Due to the homogeneity of the program approach across the four PA Companies, and the relatively small number of builders, the same NTG ratio is applied to all four Companies' programs.

G.2.2 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 198.

Table 198: Res NC Initiative Net-to-Gross Results by EDC

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	2,283	28.0%	0.0%	72.0%	14.5%
Penelec	431	28.0%	0.0%	72.0%	14.5%
Penn Power	1,933	28.0%	0.0%	72.0%	14.5%
WPP	2,948	28.0%	0.0%	72.0%	14.5%

Appendix H Evaluation Detail – Residential Multifamily Direct Install Initiative

The Residential Multifamily Direct Install (Res MF) Initiative is implemented by CLEAResult. A participant in this program is defined as a unique address in the program, and multiple projects can be installed at one address.

This program consists of brief energy audits performed by CLEAResult along with energy efficiency measures directly installed in customers' dwelling units. The audit is used to identify low-cost energy savings opportunities, with associated energy savings measures directly installed in the unit during the audit. Low-cost measures installed in PY16 included light bulbs, nightlights, smart power strips, efficient showerheads, and low-flow aerators.

H.1 Gross Impact Evaluation

H.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Res MF Initiative utilized a stratified sampling plan. Most projects are placed into one sampling stratum, with an additional stratum reserved for high-impact projects.

The program tracking and reporting system is at the measure level, and also identifies the rebate application and participant address associated with each measure. ADM aggregated all measures by unique address and then placed each household in one of the two strata: high-impact projects with reported energy savings above 2,000 kWh, and all other projects.

Due to the low participation and impacts in this initiative in Phase IV, desk reviews were the most appropriate evaluation activity. ADM evaluators compared audit reports and invoices to program tracking and reporting data to reconcile quantities of installed measures. The evaluators also independently calculated impacts for all measures according to their respective protocols in the 2021 PA TRM.

H.1.2 Sampling

Table 199, Table 200, Table 201, and Table 202 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 199: Res MF Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High-Impact	2,000	0	0	Inspection of QA/QC verification forms, desk reviews
All Other	na	82	31	
Program Total		**82**	**31**	

Table 200: Res MF Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High-Impact	2,000	1	1	Inspection of QA/QC verification forms, desk reviews
All Other	na	140	41	
Program Total		**141**	**42**	

Table 201: Res MF Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High-Impact	2,000	0	0	Inspection of QA/QC verification forms, desk reviews
All Other	na	143	34	
Program Total		**143**	**34**	

Table 202: Res MF Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High-Impact	2,000	0	0	Inspection of QA/QC verification forms, desk reviews
All Other	na	344	31	
Program Total		**344**	**31**	

H.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 203, Table 204, Table 205, and Table 206 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 203: Res MF Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0	0.0%	0.5	0%
All Other	na	36	101.2%	0.5	10%
Program Total		**36**	**101.2%**	**n/a**	**10.2%**

Table 204: Res MF Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	2	101.3%	0.5	0%
All Other	na	62	101.3%	0.5	9%
Program Total		**64**	**101.3%**	**n/a**	**9.1%**

Table 205: Res MF Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0	0.0%	0.5	0%
All Other	na	39	99.7%	0.5	11%
Program Total		**39**	**99.7%**	**n/a**	**10.8%**

Table 206: Res MF Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0	0.0%	0.5	0%
All Other	na	149	100.6%	0.5	12%
Program Total		**149**	**100.6%**	**n/a**	**12.3%**

H.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 207, Table 208, Table 209, and Table 210 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 207: Res MF Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0.00	0.0%	0.5	0%
All Other	na	0.00	90.6%	0.5	10%
Program Total		**0.00**	**90.6%**	**n/a**	**10.2%**

Table 208: Res MF Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0.00	79.0%	0.5	0%
All Other	na	0.01	75.0%	0.5	9%
Program Total		**0.01**	**75.1%**	**n/a**	**9.1%**

Table 209: Res MF Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0.00	0.0%	0.5	0%
All Other	na	0.00	77.8%	0.5	11%
Program Total		**0.00**	**77.8%**	**n/a**	**10.8%**

Table 210: Res MF Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0.00	0.0%	0.5	0%
All Other	na	0.02	91.8%	0.5	12%
Program Total		**0.02**	**91.8%**	**n/a**	**12.3%**

H.2 Net Impact Evaluation

H.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted a net impact evaluation for the CI MF initiative in PY15. The NTG evaluation relies on the survey of building owners/managers, who can report on behalf of multiple buildings because they are the decision-makers for what services and energy-saving upgrades can be provided to tenants or in common areas. Survey questions to estimate free-ridership and spillover and analysis algorithms follow the standardized self-report methodology described in the evaluation framework. Due to the small population size and a limited number of respondents, NTG ratios are estimated across the Multifamily subprograms (combining the residential and C&I components) and across EDCs. The population sizes, achieved sample sizes, and response rates from the study are shown in Table 211 below.

Table 211: Res MF Initiative Net-to-Gross Sampling

EDC	Population Size	Achieved Sample Size	Response Rate
All EDCs Combined	46	14	30.4%

H.2.2 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 212.

Table 212: Res MF Initiative Net-to-Gross Results by EDC

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	37	0.6%	0.0%	99.5%	12.8%
Penelec	65	0.6%	0.0%	99.5%	12.8%
Penn Power	39	0.6%	0.0%	99.5%	12.8%
WPP	150	0.6%	0.0%	99.5%	12.8%

Appendix I Evaluation Detail – Residential Online Audit Initiative

Online Audit is a component of the Behavioral subprogram—a subprogram administered as part of both the Energy Efficient Homes and Low-Income Energy Efficiency programs. The Online Audit component provides residential customers with a web-based platform that provides: (1) visualizations of a customer's energy use, (2) tips on ways customers can save energy, and (3) promoting other programs in FirstEnergy's residential energy efficiency portfolio. The administration of this component is divided between standard residential customers, as part of the Energy Efficient Homes Program, or Low-Income customers, as part of the Low-Income Energy Efficiency Program. Online Audits are administered as a customer opt-in program, meaning that customers can freely enroll in the program at any time.

I.1 Gross Impact Evaluation

I.1.1.1 Data Gathering

ADM receives regularly-scheduled extracts of monthly billing data and hourly AMI data from FirstEnergy. ADM receives a monthly extract of FirstEnergy's T&R system. Additionally, ADM's team has access to run custom extracts directly from the T&R system as well.

I.1.1.2 Data Preparation

During Phase III, FirstEnergy converted most residential accounts to AMI. Thus, ADM leveraged the daily AMI extract provided by FirstEnergy to conduct the billing data analysis for Online Audits in Phase IV.

ADM's preparation of AMI data is as follows:

- Residential AMI data is filtered by cohort by the treatment and comparison group account numbers.
- Estimated AMI data may be present in the AMI data as a means of backfilling missing reads. Rather than interpolating estimated AMI data, estimated AMI data and any calendar day containing estimated AMI data is removed from the data set on a per-customer basis.
- Calendar days with missing/incomplete data are excluded from analysis on a per customer basis.
- The total daily kWh per customer is taken for each customer for each day by summing across the kWh for each calendar day.
- An outlier filter of +/- 300 kWh per day was applied to the data set.

I.1.1.3 Billing Analysis

Analysis Population

As part of the development of FirstEnergy's PY13 EM&V Plan, a resampling exercise was undertaken to determine the optimal number of customers needed to measure a statistically significant result at the 85% confidence level at the projected per-customer savings level proposed by the EE&C Plan (approximately 5,000 customers per EDC). During the PY14 analysis, the SWE recommended aggregating across the marketplace and low income programs rather than aggregating across all participants. ADM retained this aggregation for PY16. The regression analysis was limited to the subset of customers with opt-in dates prior to January 1, 2025, to ensure sufficient post-exposure data.

Propensity Score Matching

The Phase IV Online Audit subprogram functions as an opt-in program, meaning that customers enroll in the program at their own discretion rather than being enrolled in the program automatically. Thus, a control group is not defined prior to program start. To develop a comparison group, ADM leveraged the population of residential AMI data and performed a nearest neighbor matching to develop a comparison group. To ensure customers were matched to appropriate comparison groups, matching occurred on a per-customer sector by EDC basis. I.e., treatment customers for the standard residential group for Met-Ed were matched to comparison customers from the standard residential population, etc. Standard and Low-Income populations for the comparison group were defined using enrollment in Health & Human Services Programs as defined by FirstEnergy's Customer Information System and low-income designation in Oracle's corresponding control-group population in the HERs program.

For PY16, ADM used the 12-month period prior to the month of participation, as the baseline period for matching. To implement this change, ADM segmented customer groups chronologically by treatment month and matched each segment serially and sequentially. Customers matched as part of the comparison group in a preceding month were excluded from subsequent months' comparison group pools to prevent having the same customer represented more than once in the comparison group.

ADM generated five pre-treatment variables for use in the matching algorithm: a pre-treatment annual variable (average daily kWh across the 12-month period), a pre-winter variable (average daily kWh for December, January, and February), a pre-spring variable (average daily kWh for March, April, and May), a pre-summer variable (average daily kWh for June, July, and August), and a pre-fall variable (average daily kWh for September, October, and November). Additionally, customer zip codes were used to look up approximate latitude and longitude for each customer address. Due to concerns with overlap with the HER sub-program, a categorical variable was also generated indicating HER treatment status and HER cohort.

These eight variables were included in the nearest neighbor matching. The nearest neighbor match used "greedy" matching without replacement, meaning that the algorithm matched treatment group customers serially and sequentially. A match was considered "good" if a MANOVA of the five pre-treatment variables are not found to be statistically different. After

testing various comparison group to treatment group ratios (from 5:1 to as low as 1:1), a 1:1 was used to meet the testing criteria.

Regression Model

Because the Online Audit component relies on a non-RCT design, ADM's method for evaluation draws from "Chapter 8: Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol" of Uniform Methods Project (UMP) (Agnew & Goldberg, 2017). The UMP protocol for whole building retrofit provides guidance for performing pooled billing analysis using a matched comparison group. The regression model recommended by the UMP is a form of the LFER model found in the Behavioral section of the Phase IV Evaluation Framework. ADM used a form of this regression model to evaluate savings for the Online Audits component.

Degree day bases were optimized for each customer by testing a range of potential CDD bases (65-80 degrees Fahrenheit) and HDD bases (50-65 degrees Fahrenheit) at all potential whole-number combinations rounded to the nearest multiple of 5 and selecting the pair that provides the highest R-squared value when regressing against each customer's monthly billing data.

Although ADM used a comparison group that should theoretically match the treatment group on pre-treatment characteristics, ADM opted to include weather terms in the Online Audit analysis to better control for potential variability between the treatment and control group. The model is specified in the equation below:

$$\mathrm{kWh}_{\mathrm{i,d}} = \beta_{\mathrm{i}} + \beta_{post} * post_{i,d} + \beta_{cdd} * \mathrm{CDD}_{i,d} + \beta_{hdd} * \mathrm{HDD}_{i,d} + \beta_{post,cdd} * post_{i,d} * \mathrm{CDD}_{i,d} + \beta_{post,hdd} * post_{i,d} * \mathrm{HDD}_{i,d} + \beta_{treat,cdd} * treat_{i} * \mathrm{CDD}_{i,d} + \beta_{treat,hdd} * treat_{i} * \mathrm{HDD}_{i,d} + \beta_{her\_post} * her\_post_{i} + \tau_{post,treat} * post_{i,d} * \mathrm{treat}_{i} + \tau_{post,treat,cdd} * post_{i,d} * \mathrm{treat} * \mathrm{CDD}_{i,d} + \tau_{post,treat,hdd} * post_{i,d} * \mathrm{treat} * \mathrm{HDD}_{i,d} + \varepsilon_{\mathrm{imy}}$$

Equation 4: Formula specifying the Online Audits regression model

The variables above are defined in Table 213 below.

Table 213: Definition of variables in the Online Audit regression model

Variable	Definition
$\mathbf{kWh_{i,d}}$	Customer i's daily electric usage on day d.
β_i	The intercept term for customer i, or the "fixed effect" term.
β_{post}	The coefficient for the main effect of "post."
β_{cdd}	The coefficient of the main effect of CDD.
β_{hdd}	The coefficient of the main effect of HDD.
$\beta_{post,cdd}$	The coefficient of the interactive effect of CDD and post.
$\beta_{post,hdd}$	The coefficient of the interactive effect of HDD and post.
$\beta_{treat,cdd}$	The coefficient of the interactive effect of CDD and treat.
$\beta_{treat,hdd}$	The coefficient of the interactive effect of HDD and treat.
β_{her_post}	The coefficient for the effect of her-treatment x post-treatment.
$post_{i,d}$	An indicator variable that equals one during the post-period for customer i.
$CDD_{i,d}$	Customer i's CDD on day d.
$HDD_{i,d}$	Customer i's HDD on day d.
$treat_i$	An indicator variable that equals 1 for customers in the treatment group and 0 for customers in the comparison group.
her_post_i	An indicator variable that equals 1 for HER-treatment customers in the post-treatment start period for HER.
$\tau_{post,treat}$	The estimated treatment effect in kWh per day; the main parameter of interest. Estimated separately for each month and year
$\tau_{post,treat,cdd}$	The estimated treatment effect in kWh per CDD.
$\tau_{post,treat,hdd}$	The estimated treatment effect in kWh per HDD.
ε_{imy}	The error term.

I.1.1.4 Dual Participation Analysis

The following sub-section provides a formal description of ADM's Dual Participation Analysis for Online Audits. On average, ADM found an annual impact of Dual Participation of approximately 14 kWh per customer.

Participants in both the treatment and comparison groups participate in other FirstEnergy energy efficiency programs. Furthermore, the Online Audits measure may cause treatment group participants to seek out other programs and measures offered in the FirstEnergy efficiency portfolio to a greater extent than the control group. To the extent that the treatment group participates in other FirstEnergy programs at a rate above and beyond that of the comparison group, those incremental savings were reflected in the gross energy savings calculated using the method above. However, savings for these items will also have been attributed to their respective programs and subprograms. ADM corrected for dual participation that occurred after treatment began to the extent that the treatment group participated at a higher rate than the comparison group.

It is important to note that dual participation with the HER component was controlled prior to the regression analysis by matching HER treatment status and cohort and including a post-treatment term for HER in the regression model.

Adjustment for Downstream Measures

For downstream measures, ADM conducted a review of the tracking and reporting system for each experimental cohort to identify EE program participation that occurred from the treatment start date onwards. The following steps detail the process of correcting for these measures:

1. The measures for the treatment group and control group were assigned to an appropriate month based on the reported date of installation for measures installed after the treatment start date.
2. For each month of the program year, the annual savings for all measures installed prior to the month of interest dating back to the treatment start date that had not yet reached the end of their effective useful life were summed for all active participants for each group. For measures installed prior to the current Program Year, ADM used verified savings for dual participation analysis. For measures installed during the Program Year, ADM utilized reported savings as verification activities occurred concurrently to the evaluation of the Behavioral Modification subprogram.
3. The totaled savings for each group was then divided by 365.25 and then divided by the number of active customers in each group to create a daily average dual participation savings value per home.
4. For each month, the daily average dual participation savings value per home for the control group was then subtracted from the daily average dual participation savings value per home from the treatment group. This resulted in an adjustment factor which was then subtracted from the daily savings value extrapolated from the billing analysis prior to using these values to calculate gross verified energy savings.

Adjustment for Upstream Measures

The Phase IV Evaluation Framework recommends adjustment for upstream measures based on years of exposure to upstream lighting programs. Because the Companies did not administer an upstream lighting program in Phase IV, an upstream adjustment did not occur.

I.1.1.5 Gross Energy Savings Calculation

The regression model provides a series of regression coefficients for the treatment term and treatment by weather terms. A negative coefficient represents savings that can be attributed to the treatment effect. Multiplying the inverse of the coefficient by the number of days, the number of participants, and for weather-interacted terms, the average daily CDD or HDD, provides the total kWh per component. Summing the savings for three components corresponding to the program year provides the savings attributable to the program year prior to adjusting for dual participation in other programs. Equation 2 demonstrates the algorithm for calculating verified savings for the model prior to correcting for dual participation in other energy efficiency programs.

$$kWh\ savings = n \times \{(\tau_{base} \times days_y) + (\tau_{cdd} \times CDD_y) + (\tau_{hdd} \times HDD_y) - Dual\ Participation/yr\}$$

Equation 5: kWh savings calculation

The variables in the above equation are defined in Table 108 below.

Table 214: Definition of variables for kWh savings calculation

Variable	Definition
τ_{base}	The regression coefficient of the treatment effect that represents savings that are not weather-related.
τ_{cdd}	The estimated treatment effect in kWh per CDD.
τ_{hdd}	The estimated treatment effect in kWh per HDD.
CDD_y	The total annual CDD in year y.
HDD_y	The total annual HDD for customer X.
n	The total number of participants in the program year of interest.
y	The program year of interest

I.1.1.6 Gross Demand Savings Calculation

Because the Online Audits program allows customers to have a floating start date at any point between the beginning and end of the program year, directly measuring gross demand savings is not a feasible task for this program. Therefore, ADM generated an ETDF using residential load profiles corresponding to the treatment group for the period beginning June 1, 2024, and ending May 31, 2025. This ETDF was then applied to energy savings to estimate demand savings.

I.1.2 Results for Energy and Demand

Table 215 below shows the number of participants, reported energy savings, and verified energy savings for each EDC and cohort. The last two columns of the table show the gross realization rates and relative precisions. The nomenclature in the table includes a prefix to denote the EDC, a suffix of "-LI" for low-income groups, and a number that identifies waves of participants sequentially. The verified values below include dual participation adjustments. Table 216 shows the reported and verified demand reductions for the program.

Based on the Phase IV Evaluation Framework, non-RCT analyses should be statistically significant at the 85% confidence level. Because the Online Audits component failed to achieve this level of significance, savings were reported as 0 kWh and 0 kW for PY13. While the measured impacts per home seem to be relatively stable from year to year, it has been noted by SWE that ADM's reported impacts from PY14 to date do not use cluster-robust standard errors. Thus, the actual relative precisions are likely higher than the ones shown in Table 215 and Table 216. Per a discussion with the SWE, ADM will modify its evaluation in PY17 and beyond to use cluster-robust standards errors. To meet relative precision requirements, ADM will aggregate participation from PY14 through PY17 to perform the PY17 analysis. It is anticipated

that, if the Online Audit program will be offered in Phase V, the combination of the four FirstEnergy rate districts into a single EDC will improve signal-to-noise resolution by approximately a factor of two.

Table 215: Res Online Audit Initiative Energy Gross Realization Rates

Operating Company	Experimental Cohort	Participants	PYRTD (MWh)	PYVTD (MWh)	Energy Realization Rate	Relative Precision at 85% CL
Met-Ed	ME-1	3,997	520	153	29.42%	74.83%
Met-Ed	**Total for EEH Program**	**3,997**	**520**	**153**	**29.42%**	**74.83%**
Met-Ed	ME-1-LI	315	41	70	169.85%	39.60%
Met-Ed	**Total for LI Program**	**315**	**41**	**70**	**169.85%**	**39.60%**
Penelec	PN-1	3,608	469	196	41.75%	50.32%
Penelec	**Total for EEH Program**	**3,608**	**469**	**196**	**41.75%**	**50.32%**
Penelec	PN-1-LI	640	83	176	211.46%	30.05%
Penelec	**Total for LI Program**	**640**	**83**	**176**	**211.46%**	**30.05%**
Penn Power	PP-1	1,279	166	46	27.42%	78.50%
Penn Power	**Total for EEH Program**	**1,279**	**166**	**46**	**27.42%**	**78.50%**
Penn Power	PP-1-LI	110	14	29	206.29%	30.58%
Penn Power	**Total for LI Program**	**110**	**14**	**29**	**206.29%**	**30.58%**
WPP	WP-1	4,724	614	192	31.19%	69.35%
WPP	**Total for EEH Program**	**4,724**	**614**	**192**	**31.19%**	**69.35%**
WPP	WP-1-LI	447	58	103	176.39%	37.05%
WPP	**Total for LI Program**	**447**	**58**	**103**	**176.39%**	**37.05%**

Table 216: Res Online Audit Initiative Demand Gross Realization Rates[15]

Operating Company	Experimental Cohort	PYRTD MW/yr	PYVTD MW/yr	Demand Realization Rate
Met-Ed	ME-1	0.06	0.03	48.61%
Met-Ed	**Total for EEH Program**	**0.06**	**0.03**	**48.61%**
Met-Ed	ME-1-LI	0.00	0.01	234.44%
Met-Ed	**Total for LI Program**	**0.00**	**0.01**	**234.44%**
Penelec	PN-1	0.05	0.03	62.59%
Penelec	**Total for EEH Program**	**0.05**	**0.03**	**62.59%**
Penelec	PN-1-LI	0.01	0.03	295.03%
Penelec	**Total for LI Program**	**0.01**	**0.03**	**295.03%**
Penn Power	PP-1	0.02	0.01	46.00%
Penn Power	**Total for EEH Program**	**0.02**	**0.01**	**46.00%**
Penn Power	PP-1-LI	0.00	0.00	312.02%
Penn Power	**Total for LI Program**	**0.00**	**0.00**	**312.02%**
WPP	WP-1	0.07	0.03	49.61%
WPP	**Total for EEH Program**	**0.07**	**0.03**	**49.61%**
WPP	WP-1-LI	0.01	0.02	266.61%
WPP	**Total for LI Program**	**0.01**	**0.02**	**266.61%**

I.2 Net Impact Evaluation

I.2.1 Net Impact Evaluation Methodology

The net-to-gross ratios are 100% because the gross impact evaluation methodology measures net impacts.

[15] The program implementer did not measure or report demand reductions for Online Audits. ADM has set the reported demand reduction to 0.013 kW per home (a rate of one kW per 10 MWh) to avoid divide-by-zero errors in reporting calculations.

Appendix J Evaluation Detail – Residential Appliance Recycling Sub-Initiative

J.1 Gross Impact Evaluation

The Appliance Recycling (ATI, for Appliance Turn-In) Initiative has three sub-initiatives: Appliance Recycling, Low-Income Appliance Recycling and Nonresidential Appliance Recycling.

There are five distinct measures offered by the program: refrigerator recycling, freezer recycling, room air conditioner (RAC) recycling, dehumidifier recycling, and mini refrigerator recycling.

J.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical for all four EDCs. A TRM-based calculation was performed using population averages for parameter values required by the TRM algorithms. The TRM parameter values were taken from project-specific data in the tracking and reporting system when applicable, from TRM defaults, and from customer verification surveys.

For refrigerators and freezers, measure attributes that participants would readily recall were determined from participant surveys, and the average parameter values were applied to all measures. Apart from measure verification, these attributes include the part-use factor, the location in the home where the appliance was used, and for refrigerators, whether the appliance was a primary or secondary unit.

Technical attributes of the appliances, such as the age, capacity, and configuration, as collected by the implementer, were taken from program tracking and reporting data. The TRM default value was used for RAC efficiency. Table 217 lists the data sources for gross impact calculation algorithms.

Table 217: Data Sources for the ATI Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
Refrigerator, Freezer	Appliance Age	Tracking and Reporting System
Refrigerator, Freezer	Pre-1990	Tracking and Reporting System
Refrigerator, Freezer	Appliance Size / Capacity	Tracking and Reporting System
Refrigerator, Freezer	Configuration/Type	Tracking and Reporting System
Refrigerator	Primary Usage	Participant Surveys
Refrigerator, Freezer	Part Use Factor	Participant Surveys
Refrigerator, Freezer	In Unconditioned Space?	Participant Surveys
Refrigerator, Freezer	CDD and HDD	TRM - Zip Code Lookup
RAC	Capacity	Tracking and Reporting System
RAC	EER	TRM Default
RAC	RAC EFLH	TRM - Zip Code Lookup
RAC	CF	TRM - Zip Code Lookup
Dehumidifier	Capacity	Tracking and Reporting System
Dehumidifier	Region (to determine kWh)	TRM - Zip Code Lookup
All Measures	Verification Rate	Participant Surveys

The gross realization rates for energy savings were driven primarily by part-use factors for refrigerators and freezers as determined through verification surveys, and by the unit energy consumptions for refrigerators and freezers, as determined through measure attributes recorded in the tracking and reporting system.

J.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 218, Table 219, Table 220, and Table 221. The population sizes and sample sizes represent individual appliances rather than individual customers. Survey samples were drawn randomly for each stratum and administered by email and telephone over the course of the program. Sample sizes reflect valid survey responses.

Table 218: ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	2,418	181	Participant Surveys
Freezers	471	63	
RACs	1,323	83	
Dehumidifiers	340	51	
Mini Friges	77	11	
Program Total	**4,629**	**389**	

Table 219: ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	1,602	141	Participant Surveys
Freezers	344	38	
RACs	986	79	
Dehumidifiers	209	25	
Mini Friges	71	9	
Program Total	**3,212**	**292**	

Table 220: ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	559	75	Participant Surveys
Freezers	124	12	
RACs	176	13	
Dehumidifiers	79	11	
Mini Friges	26	5	
Program Total	**964**	**116**	

Table 221: ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	1,960	177	Participant Surveys
Freezers	439	57	
RACs	951	76	
Dehumidifiers	262	39	
Mini Friges	96	11	
Program Total	**3,708**	**360**	

J.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 222, Table 223, Table 224, and Table 225 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 222: ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	2,214	102.8%	0.5	5.1%
Freezers	279	123.8%	0.5	8.4%
RACs	168	119.0%	0.5	7.7%
Dehumidifiers	194	142.4%	0.5	9.3%
Mini Friges	19	117.7%	0.5	20.1%
Program Total	**2,873**	**108.5%**	**0.5**	**4.0%**

Table 223: ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	1,474	100.4%	0.5	5.8%
Freezers	223	112.0%	0.5	11.0%
RACs	99	108.4%	0.5	7.8%
Dehumidifiers	109	118.5%	0.5	13.5%
Mini Friges	17	123.6%	0.5	22.4%
Program Total	**1,922**	**103.4%**	**0.5**	**4.6%**

Table 224: ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	515	104.7%	0.5	7.7%
Freezers	78	118.2%	0.5	19.8%
RACs	20	105.5%	0.5	19.2%
Dehumidifiers	42	139.6%	0.5	20.1%
Mini Friges	6	88.3%	0.5	28.9%
Program Total	**661**	**108.4%**	**0.5**	**6.6%**

Table 225: ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	1,817	106.3%	0.5	5.2%
Freezers	281	114.2%	0.5	8.9%
RACs	107	107.4%	0.5	7.9%
Dehumidifiers	136	137.8%	0.5	10.6%
Mini Friges	24	117.7%	0.5	20.4%
Program Total	**2,364**	**109.2%**	**0.5**	**4.1%**

J.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 226, Table 227, Table 228, and Table 229 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 226: ATI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.39	102.7%	0.5	5.1%
Freezers	0.05	123.8%	0.5	8.4%
RACs	0.34	120.8%	0.5	7.7%
Dehumidifiers	0.04	143.1%	0.5	9.3%
Mini Friges	0.00	169.8%	0.5	20.1%
Program Total	**0.83**	**113.7%**	**0.5**	**4.1%**

Table 227: ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.26	100.4%	0.5	5.8%
Freezers	0.04	112.0%	0.5	11.0%
RACs	0.25	102.2%	0.5	7.8%
Dehumidifiers	0.03	123.3%	0.5	13.5%
Mini Friges	0.00	178.4%	0.5	22.4%
Program Total	**0.58**	**103.4%**	**0.5**	**4.3%**

Table 228: ATI Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.09	104.7%	0.5	7.7%
Freezers	0.01	118.2%	0.5	19.8%
RACs	0.05	103.6%	0.5	19.2%
Dehumidifiers	0.01	152.6%	0.5	20.1%
Mini Friges	0.00	127.4%	0.5	28.9%
Program Total	**0.16**	**108.7%**	**0.5**	**7.1%**

Table 229: ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.32	106.4%	0.5	5.2%
Freezers	0.05	114.2%	0.5	8.9%
RACs	0.26	106.3%	0.5	7.9%
Dehumidifiers	0.03	136.4%	0.5	10.6%
Mini Friges	0.00	169.8%	0.5	20.4%
Program Total	**0.67**	**108.7%**	**0.5**	**4.0%**

Note that the overall precision for the ATI initiative is the combined precision of the low income, non-low-income, and nonresidential components. The combined precisions for each EDC are shown in Table 230 below.

Table 230: ATI Initiative Sampling Precisions

EDC	Relative Precision at 85% C.L., Energy	Relative Precision at 85% C.L., Demand
Met-Ed	5.9%	5.9%
Penelec	6.3%	6.0%
Penn Power	8.4%	8.9%
West Penn Power	5.9%	5.8%

J.2 NET IMPACT EVALUATION

J.2.1 Net Impact Evaluation Methodology

The ADM team conducted net impact evaluation for the Appliance Recycling initiative in PY13. The net-to-gross evaluation for the Appliance Recycling program followed the participant self-report methodology outlined in the PA Evaluation Framework. Net-to-gross was estimated for the program for each EDC.

The participant self-report methodology was implemented following the common approach outlined in Appendix B of the Phase IV evaluation framework. Tetra Tech added a question to identify customers who would have kept the recycled unit at least a year longer, since program results represent first-year annual savings. This clarifies that customers who respond they would have removed the unit, but at some point in the future, are really more appropriately characterized as keeping the unit for at least the program year in question. Individual free-ridership rates from the participant survey were weighted to adjust for sampling differences, non-response, and claimed energy savings to calculate overall estimates.

The Appliance Recycling program is not designed to promote spillover since it does not push customers to implement energy efficiency projects outside of FirstEnergy's programs. Because the participant survey is already lengthy, containing both gross and net impact questions, the evaluation team did not collect spillover information from customers. Moreover, because the Companies offer incentives for efficient new refrigerators and freezers, it is possible that the most likely spillover may overlap with gross impacts for the Efficient Products program and lead to undesired double-counting of net impacts.

J.2.2 Sampling

The sample designs from study for the four EDCs are shown in Table 231, Table 232, Table 233, and Table 234 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 231: ATI Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	3,464	100	379	20.3%
Program Total	**3,464**	**100**	**379**	**20.3%**

Table 232: ATI Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	2,320	100	288	21.8%
Program Total	**2,320**	**100**	**288**	**21.8%**

Table 233: ATI Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	751	100	115	22.2%
Program Total	**751**	**100**	**115**	**22.2%**

Table 234: ATI Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	2,656	100	354	22.7%
Program Total	**2,656**	**100**	**354**	**22.7%**

J.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 235, Table 236, Table 237, and Table 238 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 235: ATI Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	3,119	38.0%	0.0%	62.0%	7.4%
Program Total	**3,119**	**38.0%**	**0.0%**	**62.0%**	**7.4%**

Table 236: ATI Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	1,987	40.0%	0.0%	60.0%	8.5%
Program Total	**1,987**	**40.0%**	**0.0%**	**60.0%**	**8.5%**

Table 237: ATI Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	717	39.0%	0.0%	61.0%	13.4%
Program Total	**717**	**39.0%**	**0.0%**	**61.0%**	**13.4%**

Table 238: ATI Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	2,582	34.0%	0.0%	66.0%	7.7%
Program Total	**2,582**	**34.0%**	**0.0%**	**66.0%**	**7.7%**

Appendix K Evaluation Detail – Residential Upstream Electronics Initiative

The Companies did not offer this program component in PY16.

Appendix L Evaluation Detail – Residential HVAC Initiative

The Residential HVAC initiative provides rebates to customers who purchase high efficiency HVAC equipment, Tune-Up an existing HVAC system, install a new smart thermostat, bathroom fan, or circulating pump.

Participants are defined as each separate measure rebated. Thus, the rebate application, rather than the customer, is the sampling unit for gross impact evaluation.

L.1 Gross Impact Evaluation

L.1.1 Gross Impact Evaluation Methodology

Each component of gross impact evaluation is described below. The gross impact evaluation included customer surveys for verification purposes, coupled with documentation reviews to support detailed TRM calculations for sampled projects. The desk review process is described below.

Table 239 lists the data sources for gross impact calculation algorithms.

Table 239: Data Sources for the Res HVAC Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
All HVAC Equipment	AHRI or Model # (to get other TRM parameters)	Invoice Inspections and Tracking Data
All HVAC Equipment	Heating Capacity	AHRI database reference
All HVAC Equipment	Cooling Capacity	AHRI database reference
HVAC Maintenance	Heating Capacity	Invoice Inspections
HVAC Maintenance	Cooling Capacity	Invoice Inspections
All	SEER/EER/HSPF/COP	AHRI database reference
Minisplits	EFLH	ZIP lookup and survey for room type
Minisplits	Baseline Type	Customer Surveys
Bathroom Fans	HOU and CF	IMP defaults
Smart Thermostats	Install Type	Application Review
Smart Thermostats	Thermostat Type	Application Review
Smart Thermostats	Heating System Type	Application Review
Smart Thermostats	Cooling System Type	Application Review
Smart Thermostats	Baseline Thermostat Type	Application Review

L.1.1.1 Determination of Verification Rate

ADM conducted verification surveys on a random sample of customers selected from the tracking and reporting data. All contacted customers verified that they have purchased and installed the stated HVAC measures. The verification rates are used to inform measure-level realization rates.

L.1.1.2 Invoice and Application Review

ADM obtained invoices and applications from Franklin Energy Services. For each application, ADM verified that the manufacturer name and model number in the tracking and reporting system matches those on the invoice and rebate application. In general, all sampled measures

were matched to qualifying product lists. ADM independently retrieved the attributes necessary for TRM and IMP calculations from various supporting databases which were compiled for this purpose. These include the AHRI database and manufacturer websites.

L.1.1.3 Calculation Review using TRM algorithm and parameters

For HVAC measures with partially deemed TRM (or IMP) protocols, the T&R system reported impacts with one savings scenario rather than with specific scenarios that occur in measure implementation. For example, values from planning assumptions for capacity and efficiency are used rather than HVAC system-specific values. In general, the per-unit savings reported by the ICSP are rather conservative (the assumed average efficiency levels or capacities are lower than actual average values). For all reviewed records, ADM used project-specific attributes to calculate "On-TRM" impacts.

The average per-unit gross verified impact for a given measure is the product of the measure-specific verification rate as determined from customer surveys, and the average calculated impacts as described above.

The following provide additional details into the calculation review procedure:

CACs and ASHPs

Central HVAC systems were looked up on the AHRI database to determine individual measure attributes for use in the TRM algorithms. These attributes include heating and cooling capacities, and seasonal efficiency ratios (SEER and HSPF). EFLHs and CFs were taken from the TRM based on the reported zip code or zip code obtained through participant surveys if the reported zip code was overridden by the respondent. Baseline efficiencies were taken as TRM defaults aligned with the installation scenarios included in the tracking system.

GSHPs

Ground-source heat pump make and model numbers, or AHRI certificate numbers, are cross-referenced on the AHRI database to determine equipment parameters for use in the TRM algorithm. EFLHs and CFs were determined through zip code lookups as provided in the T&R data or with zip codes from survey data if overridden by respondents. Other TRM default values used include GSHPDF, GSER, GSOP, and GSPK. Baseline efficiencies were taken as TRM defaults for a replace on burnout scenario with an ASHP as the baseline system.

For GSHP units larger than 65 kBtuh, the commercial algorithm in section 3.2.3 of the TRM was used to calculate impacts. Here the baseline efficiencies were taken from TRM table 3-38. In these cases, the replace on burnout scenario assumes kWh_{pump} and kW_{pump} for the baseline ASHP are zero.

Mini-Splits

Ductless mini-splits (ACs and heat pumps) were also looked up on AHRI similar to the other HVAC system types, and CFs were determined with zip code lookups, but several additional steps were taken to determine gross impacts. EFLHs were determined through the TRM classification of "primary zone" or "secondary zone". Participant survey responses were used to determine the TRM classification based on which room the systems were installed in as rebate

applications do not include this information. The baseline system type was determined from participant surveys. Several response fields were considered to determine the baseline including whether the mini-split installation supplemented an existing HVAC system. In cases where there was no existing heating or cooling, or the respondent did not know what type of existing system they had, the baseline was taken to be an ASHP. Baseline efficiencies were taken from TRM tables 2-8 and 2-12 according to the type of baseline system.

Thermostats

Smart thermostats were evaluated according to the protocol in section 2.2.11 of the 2021 PA TRM. ADM evaluators reviewed invoices and application materials to determine the heating and cooling system types, the installation scenario described in the TRM, and baseline thermostats.

Furnace Fans

High-efficiency furnace fan energy savings relied on the deemed values in the TRM. EFLHs and CFs were taken from the TRM based on the reported zip code or zip code obtained through participant surveys if the reported zip code was overridden by the respondent. ADM used the results of participant surveys to determine the verification rate and the faction with central cooling. For homes without central cooling, the kWh_{cool} term in the TRM algorithm was taken to be zero.

HVAC Maintenance

Default TRM parameters were used for HVAC Tune-Up calculations. Heating and cooling capacities were determined from the rebate application for sampled units. For tune-ups performed on AC units, the kWh_{heat} term in the TRM algorithm was taken to be zero.

Bathroom Fans

ADM used the IMP for bathroom fans with hours of use and CF for intermittent operation. Fan flow rates and efficacies were obtained from ENERGY STAR® based on reported model numbers.

Circulation Pumps

ADM used TRM Section 3.3.5 to calculate impacts for ECM circulation pumps, but with residential heating EFLH.

PTACs and PTHPs

There were no three PTACs and zero PTHPs reported.

L.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 240, Table 241, Table 242, and Table 243.

Table 240: Res HVAC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	451	30	12
ASHP	361	18	7
Smart Thermostat	412	10	6
GSHP	36	3	4
CAC	579	25	5
Furnace Fan	426	11	1
Tune-Up	77	8	2
Circulating Pump	3	0	0
Bathroom Fan	63	1	0
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	**2,408**	**106**	**37**

Table 241: Res HVAC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	363	39	26
ASHP	57	3	2
Smart Thermostat	80	2	2
GSHP	18	3	2
CAC	49	5	4
Furnace Fan	108	5	2
Tune-Up	146	13	1
Circulating Pump	0	0	0
Bathroom Fan	44	2	2
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	**865**	**72**	**41**

Table 242: Res HVAC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	43	6	6
ASHP	68	7	5
Smart Thermostat	57	0	3
GSHP	0	0	0
CAC	112	11	9
Furnace Fan	135	6	4
Tune-Up	33	3	1
Circulating Pump	0	0	0
Bathroom Fan	11	1	1
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	**459**	**34**	**29**

Table 243: Res HVAC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	332	23	36
ASHP	247	13	3
Smart Thermostat	181	5	2
GSHP	38	2	4
CAC	180	12	7
Furnace Fan	677	17	7
Tune-Up	438	13	3
Circulating Pump	2	0	0
Bathroom Fan	154	1	1
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	**2,249**	**86**	**63**

L.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 244, Table 245, Table 246, and Table 247 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 244: Res HVAC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	516	241.5%	0.5	20.5%
ASHP	339	102.6%	0.5	26.9%
Smart Thermostat	209	125.3%	0.5	29.2%
GSHP	64	217.1%	0.5	33.9%
CAC	200	88.4%	0.5	32.1%
Furnace Fan	81	92.6%	0.5	71.9%
Tune-Up	12	122.0%	0.5	50.2%
Circulating Pump	1	100.0%	0.5	100.0%
Bathroom Fan	2	100.0%	0.5	100.0%
ASHP wDHW	0	100.0%	0.5	100.0%
Quality Install	0	100.0%	0.5	100.0%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	**1,424**	**159.0%**	**0.5**	**13.1%**

Table 245: Res HVAC Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	443	111.5%	0.5	13.6%
ASHP	60	110.4%	0.5	50.0%
Smart Thermostat	54	108.6%	0.5	50.3%
GSHP	32	100.0%	0.5	48.0%
CAC	12	91.2%	0.5	34.5%
Furnace Fan	20	93.8%	0.5	50.4%
Tune-Up	12	113.9%	0.5	71.8%
Circulating Pump	0	100.0%	0.5	100.0%
Bathroom Fan	2	70.2%	0.5	49.7%
ASHP wDHW	0	100.0%	0.5	100.0%
Quality Install	0	100.0%	0.5	100.0%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	**634**	**109.6%**	**0.5**	**12.0%**

Table 246: Res HVAC Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	43	74.9%	0.5	27.3%
ASHP	58	98.1%	0.5	31.0%
Smart Thermostat	19	100.2%	0.5	40.5%
GSHP	0	100.0%	0.5	100.0%
CAC	28	90.8%	0.5	23.0%
Furnace Fan	24	98.0%	0.5	35.5%
Tune-Up	4	259.5%	0.5	70.9%
Circulating Pump	0	100.0%	0.5	100.0%
Bathroom Fan	0	87.3%	0.5	68.6%
ASHP wDHW	0	100.0%	0.5	100.0%
Quality Install	0	100.0%	0.5	100.0%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	**176**	**94.8%**	**0.5**	**14.7%**

Table 247: Res HVAC Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	396	116.5%	0.5	11.3%
ASHP	238	106.3%	0.5	41.3%
Smart Thermostat	109	100.4%	0.5	50.6%
GSHP	64	128.9%	0.5	34.1%
CAC	48	88.8%	0.5	26.7%
Furnace Fan	125	92.2%	0.5	27.1%
Tune-Up	49	104.9%	0.5	41.4%
Circulating Pump	0	100.0%	0.5	100.0%
Bathroom Fan	6	82.8%	0.5	71.8%
ASHP wDHW	0	100.0%	0.5	100.0%
Quality Install	0	100.0%	0.5	100.0%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	**1,034**	**108.2%**	**0.5**	**12.3%**

L.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 248, Table 249, Table 250, and Table 251 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 248: Res HVAC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.04	270.6%	0.5	20.5%
ASHP	0.03	104.1%	0.5	26.9%
Smart Thermostat	0.03	103.1%	0.5	29.2%
GSHP	0.02	174.9%	0.5	33.9%
CAC	0.10	104.6%	0.5	32.1%
Furnace Fan	0.02	101.5%	0.5	71.9%
Tune-Up	0.00	153.5%	0.5	50.2%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	100.0%	0.5	100.0%
ASHP wDHW	0.00	100.0%	0.5	100.0%
Quality Install	0.00	100.0%	0.5	100.0%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	100.0%
Program Total	**0.24**	**138.8%**	**0.5**	**13.7%**

Table 249: Res HVAC Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.03	127.2%	0.5	13.6%
ASHP	0.00	103.7%	0.5	50.0%
Smart Thermostat	0.01	104.5%	0.5	50.3%
GSHP	0.01	100.0%	0.5	48.0%
CAC	0.01	106.6%	0.5	34.5%
Furnace Fan	0.00	120.8%	0.5	50.4%
Tune-Up	0.01	117.3%	0.5	71.8%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	51.9%	0.5	49.7%
ASHP wDHW	0.00	100.0%	0.5	100.0%
Quality Install	0.00	100.0%	0.5	100.0%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	100.0%
Program Total	**0.06**	**117.7%**	**0.5**	**13.1%**

Table 250: Res HVAC Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.00	77.5%	0.5	27.3%
ASHP	0.01	93.7%	0.5	31.0%
Smart Thermostat	0.00	100.0%	0.5	40.5%
GSHP	0.00	100.0%	0.5	100.0%
CAC	0.02	105.7%	0.5	23.0%
Furnace Fan	0.01	86.2%	0.5	35.5%
Tune-Up	0.00	131.2%	0.5	70.9%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	64.6%	0.5	68.6%
ASHP wDHW	0.00	100.0%	0.5	100.0%
Quality Install	0.00	100.0%	0.5	100.0%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	100.0%
Program Total	**0.03**	**99.0%**	**0.5**	**14.5%**

Table 251: Res HVAC Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.03	107.4%	0.5	11.3%
ASHP	0.02	104.1%	0.5	41.3%
Smart Thermostat	0.01	100.0%	0.5	50.6%
GSHP	0.02	117.4%	0.5	34.1%
CAC	0.03	104.8%	0.5	26.7%
Furnace Fan	0.03	99.9%	0.5	27.1%
Tune-Up	0.02	106.2%	0.5	41.4%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	61.2%	0.5	71.8%
ASHP wDHW	0.00	100.0%	0.5	100.0%
Quality Install	0.00	100.0%	0.5	100.0%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	100.0%
Program Total	**0.16**	**105.1%**	**0.5**	**11.9%**

L.2 NET IMPACT EVALUATION

L.2.1 Net Impact Evaluation Methodology

Tetra Tech performed the NTG analysis in PY15 using the approach defined in the Pennsylvania Act 129 Phase IV Statewide Evaluation Framework, which is built around a customer self-report survey. The participant survey included a series of free-ridership and spillover questions that asked program participants about the actions they would have taken if the program had not been offered. This section breaks down the survey results into discussions of free-ridership, spillover, and the overall NTG results.

L.2.2 Sampling

Tetra Tech sampled randomly from all participants on record in the Companies' tracking and reporting systems between Q4 of PY14 and Q2 of PY15. The sample designs for the four EDCs are shown in Table 252, Table 253, Table 254, and Table 255 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 252: Res HVAC Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,952	65	21.7%
Program Total	**2,952**	**65**	**21.7%**

Table 253: Res HVAC Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,155	73	26.1%
Program Total	**2,155**	**73**	**26.1%**

Table 254: Res HVAC Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,935	71	25.1%
Program Total	**1,935**	**71**	**25.1%**

Table 255: Res HVAC Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	4,320	73	24.3%
Program Total	**4,320**	**73**	**24.3%**

L.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 256, Table 257, Table 258, and Table 259 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 256: Res HVAC Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	2,264	50.0%	0.6%	50.6%	13.4%
Program Total	**2,264**	**50.0%**	**0.6%**	**50.6%**	**13.4%**

Table 257: Res HVAC Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	695	45.2%	14.9%	69.7%	12.6%
Program Total	**695**	**45.2%**	**14.9%**	**69.7%**	**12.6%**

Table 258 Res HVAC Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	167	47.4%	2.1%	54.7%	12.6%
Program Total	**167**	**47.4%**	**2.1%**	**54.7%**	**12.6%**

Table 259 Res HVAC Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	1,119	48.8%	3.6%	54.8%	12.6%
Program Total	**1,119**	**48.8%**	**3.6%**	**54.8%**	**12.6%**

Appendix M Evaluation Detail – Residential Appliances and LI Residential Appliances Initiative

Residential Appliances and LI Appliances are combined into a single initiative in ADM's PY16 evaluation plan. While the program process is the same between the two, the measures and rebate levels differ. Incentives for the low-income component are increased by $25 per appliance, while there are no specific income-qualified incentives for heat-pump and solar water heaters, variable speed pool-pumps or ceiling fans.

Participants are defined as each separate appliance rebated. Thus, the rebate application, rather than the customer, is the sampling unit for gross impact evaluation.

M.1 Gross Impact Evaluation

M.1.1 Gross Impact Evaluation Methodology

Each component of gross impact is described below.

M.1.1.1 Verification Surveys

ADM performed telephone and online surveys on a random sample of customers selected from the tracking and reporting data. All contacted customers verified that they have purchased and installed the stated appliances. The verification rates are used to inform measure-level realization rates.

M.1.1.2 Invoice and Application Review

ADM obtained invoices and applications from the ICSP, Franklin Energy Services. For each application, ADM verified that the manufacturer name and model number in the tracking and reporting system matches those on the invoice and rebate application. In general, all sampled appliances were matched to the qualifying ENERGY STAR® product lists. ADM independently retrieved the attributes necessary for TRM calculations from the ENERGY STAR® database. In certain cases, the make or model numbers were entered in with minor typographic errors or with missing or inserted dashes, spaces, or other delimiting characters. In such cases, manual correction of the make or model numbers results in positive identification of the involved equipment in the supporting databases.

M.1.1.3 Saving Calculations with TRM Algorithms and Parameters

For measures with partially deemed TRM (or IMP) protocols, the T&R system reported impacts with one savings scenario rather than with specific scenarios that occur in measure implementation. For example, values from planning assumptions for capacity and efficiency are used rather than rebate-specific values For all reviewed records, ADM used project-specific attributes to calculate "On-TRM" impacts.

The average per-unit gross verified impact for a given measure is the product of the measure-specific verification rate (as determined from customer surveys or retailer invoice details) and the average calculated impacts as described above.

There were no ceiling fans reported in PY16.

Table 260 lists the data sources for gross impact calculation algorithms.

Table 260: Data Sources for the Res Appliances Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
All Measures	Verification Rate	Participant Surveys
All Measures	Capacity	Energy Star Database - Model Lookup
All Measures	ETDF	TRM Default
Clothes Washer	Configuration	Energy Star Database
Clothes Washer	IMEF_base	Federal Standard - Configuration Lookup
Clothes Washer	Cycles per year	TRM Default
Clothes Washer	CW_base / CW_ee	TRM Default
Clothes Washer	DHW_base / DHW_ee	TRM Default
Clothes Washer	%ElectricDHW	Participant Surveys
Clothes Washer	Dryer_base / Dryer_ee	TRM Default
Clothes Washer	%ElectricDryer	Participant Surveys
Clothes Washer	%dry/wash	TRM Default
Clothes Washer	time per cycle / CF	TRM Default
Clothes Dryer	Fuel / Configuration	Energy Star Database
Clothes Dryer	CEF_base	Federal Standard - Configuration Lookup
Clothes Dryer	Wash Cycles per year	TRM Default
Clothes Dryer	%dry/wash	TRM Default
Clothes Dryer	Load_avg	TRM - Configuration Lookup
Clothes Dryer	time per cycle /CF	TRM Default
Refrigerator/Freezer	Product Class	Energy Star Database
Refrigerator/Freezer	Adjusted Volume	Energy Star Database
Dehumidifier	HOU / CF	TRM Default
Dehumidifier	L/kWh_base / L/kWh_ee	TRM - Capacity Lookup
Air Purifier	Annual Consumption	TRM Default
Air Purifier	HOU / CF	TRM Default
Dishwasher	Annual Consumption	TRM Default
Dishwasher	Water Heater Fuel	Application / TRM Default
Pool Pump	HOU / Volume	TRM Default
Pool Pump	Energy Factor	Energy Star Database
Room Air Conditione	HOU / CF	TRM - Zip Code Lookup
HPWH	EF_ee	Energy Star Database
HPWH	F_derate	TRM Default
Smart Thermostat	EFLH Heat/Cool	Customer Zip Code
Smart Thermostat	Previous Thermostat	Application / Participant Surveys
Smart Thermostat	HVAC Equipment Type	Application / Participant Surveys

The gross realization rates for energy savings were driven primarily by differences between project-specific TRM calculations for sampled projects and the reported energy savings in the tracking and reporting system. Verification rates were not a major driver of realization rates.

M.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 261, Table 262, Table 263, and Table 264.

Table 261: Res Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	63	1	3
Ceiling Fan	0	0	0
Clothes Dryer	446	11	9
Clothes Washer	636	18	17
Dehumidifier	178	12	1
Dishwasher	496	7	11
Freezer	105	1	2
Heat Pump Water Heater	117	6	5
Mini Refrigerator	0	0	0
Pool Pump	0	0	0
Refrigerator	941	19	15
Room Air Conditioner	51	5	3
Smart Thermostat	515	18	14
Low-Income Total	**133**	**11**	**23**
Non Low-Income Total	**3,415**	**87**	**57**
Program Total	**3,548**	**98**	**80**

Table 262: Res Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	35	4	2
Ceiling Fan	0	0	0
Clothes Dryer	234	6	5
Clothes Washer	421	12	17
Dehumidifier	133	15	10
Dishwasher	370	15	5
Freezer	79	4	2
Heat Pump Water Heater	38	4	5
Mini Refrigerator	0	0	0
Pool Pump	0	0	0
Refrigerator	720	14	14
Room Air Conditioner	53	3	4
Smart Thermostat	265	8	14
Low-Income Total	**163**	**23**	**25**
Non Low-Income Total	**2,185**	**62**	**53**
Program Total	**2,348**	**85**	**78**

Table 263: Res Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	14	0	2
Ceiling Fan	0	0	0
Clothes Dryer	101	7	6
Clothes Washer	177	5	11
Dehumidifier	59	3	6
Dishwasher	136	8	7
Freezer	13	1	1
Heat Pump Water Heater	17	1	2
Mini Refrigerator	0	0	0
Pool Pump	0	0	0
Refrigerator	270	7	12
Room Air Conditioner	4	1	1
Smart Thermostat	167	9	14
Low-Income Total	**41**	**3**	**15**
Non Low-Income Total	**917**	**39**	**47**
Program Total	**958**	**42**	**62**

Table 264: Res Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	46	2	1
Ceiling Fan	0	0	0
Clothes Dryer	476	14	9
Clothes Washer	752	13	18
Dehumidifier	183	12	6
Dishwasher	583	17	10
Freezer	115	4	2
Heat Pump Water Heater	81	5	3
Mini Refrigerator	0	0	0
Pool Pump	0	0	0
Refrigerator	1,100	25	14
Room Air Conditioner	51	2	4
Smart Thermostat	494	17	15
Low-Income Total	**189**	**24**	**35**
Non Low-Income Total	**3,692**	**87**	**47**
Program Total	**3,881**	**111**	**82**

M.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 265, Table 266, Table 267, and Table 268 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 265: Res Appliances Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	8	171.7%	0.5	40.6%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	12	91.7%	0.5	21.4%
Clothes Washer	100	121.6%	0.5	16.7%
Dehumidifier	21	95.7%	0.5	20.1%
Dishwasher	25	93.1%	0.5	21.5%
Freezer	3	145.5%	0.5	50.4%
Heat Pump Water Heater	157	114.3%	0.5	28.6%
Mini Refrigerator	0	0.0%	0.5	100.0%
Pool Pump	0	0.0%	0.5	100.0%
Refrigerator	55	103.6%	0.5	16.4%
Room Air Conditioner	3	100.0%	0.5	30.6%
Smart Thermostat	183	105.6%	0.5	16.7%
Low-Income Total	**14**	**110.6%**	**0.5**	**na**
Non Low-Income Total	**554**	**110.6%**	**0.5**	**na**
Program Total	**569**	**110.6%**	**0.5**	**10.4%**

Table 266: Res Appliances Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	5	220.0%	0.5	33.9%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	6	105.7%	0.5	29.0%
Clothes Washer	63	106.4%	0.5	17.1%
Dehumidifier	16	95.4%	0.5	17.5%
Dishwasher	17	99.9%	0.5	18.2%
Freezer	3	159.2%	0.5	35.1%
Heat Pump Water Heater	49	113.0%	0.5	30.0%
Mini Refrigerator	0	0.0%	0.5	100.0%
Pool Pump	0	0.0%	0.5	100.0%
Refrigerator	41	96.2%	0.5	19.1%
Room Air Conditioner	2	100.0%	0.5	34.6%
Smart Thermostat	67	94.5%	0.5	18.7%
Low-Income Total	**13**	**104.4%**	**0.5**	**na**
Non Low-Income Total	**254**	**104.4%**	**0.5**	**na**
Program Total	**268**	**104.4%**	**0.5**	**9.0%**

Table 267: Res Appliances Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	2	225.3%	0.5	47.1%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	3	106.6%	0.5	26.3%
Clothes Washer	26	144.1%	0.5	21.0%
Dehumidifier	7	94.5%	0.5	27.9%
Dishwasher	6	100.0%	0.5	24.7%
Freezer	0	159.5%	0.5	69.2%
Heat Pump Water Heater	14	116.3%	0.5	47.8%
Mini Refrigerator	0	0.0%	0.5	100.0%
Pool Pump	0	0.0%	0.5	100.0%
Refrigerator	16	106.4%	0.5	20.3%
Room Air Conditioner	0	100.0%	0.5	62.4%
Smart Thermostat	51	81.4%	0.5	18.4%
Low-Income Total	**6**	**106.5%**	**0.5**	**na**
Non Low-Income Total	**120**	**106.5%**	**0.5**	**na**
Program Total	**125**	**106.5%**	**0.5**	**10.7%**

Table 268: Res Appliances Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	8	208.4%	0.5	49.8%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	13	105.6%	0.5	19.0%
Clothes Washer	117	99.1%	0.5	16.8%
Dehumidifier	22	94.0%	0.5	20.1%
Dishwasher	30	100.0%	0.5	17.2%
Freezer	4	147.3%	0.5	35.4%
Heat Pump Water Heater	100	114.4%	0.5	31.2%
Mini Refrigerator	0	0.0%	0.5	100.0%
Pool Pump	0	0.0%	0.5	100.0%
Refrigerator	63	102.5%	0.5	14.2%
Room Air Conditioner	2	100.0%	0.5	34.6%
Smart Thermostat	176	95.9%	0.5	17.2%
Low-Income Total	**17**	**103.2%**	**0.5**	**na**
Non Low-Income Total	**519**	**103.2%**	**0.5**	**na**
Program Total	**536**	**103.2%**	**0.5**	**9.4%**

M.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 269, Table 270, Table 271, and Table 272 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 269: Res Appliances Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	0.00	171.9%	0.5	40.6%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	93.0%	0.5	21.4%
Clothes Washer	0.01	121.6%	0.5	16.7%
Dehumidifier	0.01	95.7%	0.5	20.1%
Dishwasher	0.00	93.1%	0.5	21.5%
Freezer	0.00	146.4%	0.5	50.4%
Heat Pump Water Heater	0.01	114.3%	0.5	28.6%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Pool Pump	0.00	0.0%	0.5	100.0%
Refrigerator	0.01	103.6%	0.5	16.4%
Room Air Conditioner	0.01	100.0%	0.5	30.6%
Smart Thermostat	0.02	115.1%	0.5	16.7%
Low-Income Total	**0.00**	**111.5%**	**0.5**	**na**
Non Low-Income Total	**0.08**	**111.5%**	**0.5**	**na**
Program Total	**0.08**	**111.5%**	**0.5**	**8.6%**

Table 270: Res Appliances Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	0.00	220.4%	0.5	33.9%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	107.0%	0.5	29.0%
Clothes Washer	0.01	106.4%	0.5	17.1%
Dehumidifier	0.00	95.4%	0.5	17.5%
Dishwasher	0.00	99.9%	0.5	18.2%
Freezer	0.00	160.1%	0.5	35.1%
Heat Pump Water Heater	0.00	113.0%	0.5	30.0%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Pool Pump	0.00	0.0%	0.5	100.0%
Refrigerator	0.01	96.2%	0.5	19.1%
Room Air Conditioner	0.00	100.0%	0.5	34.6%
Smart Thermostat	0.01	93.8%	0.5	18.7%
Low-Income Total	**0.00**	**102.5%**	**0.5**	**na**
Non Low-Income Total	**0.04**	**102.5%**	**0.5**	**na**
Program Total	**0.04**	**102.5%**	**0.5**	**8.2%**

Table 271: Res Appliances Initiative Deman Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	0.00	225.5%	0.5	47.1%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	107.9%	0.5	26.3%
Clothes Washer	0.00	144.1%	0.5	21.0%
Dehumidifier	0.00	94.4%	0.5	27.9%
Dishwasher	0.00	100.0%	0.5	24.7%
Freezer	0.00	160.5%	0.5	69.2%
Heat Pump Water Heater	0.00	116.3%	0.5	47.8%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Pool Pump	0.00	0.0%	0.5	100.0%
Refrigerator	0.00	106.4%	0.5	20.3%
Room Air Conditioner	0.00	100.0%	0.5	62.4%
Smart Thermostat	0.01	104.1%	0.5	18.4%
Low-Income Total	**0.00**	**112.9%**	**0.5**	**na**
Non Low-Income Total	**0.02**	**112.9%**	**0.5**	**na**
Program Total	**0.02**	**112.9%**	**0.5**	**9.9%**

Table 272: Res Appliances Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	0.00	208.6%	0.5	49.8%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	106.9%	0.5	19.0%
Clothes Washer	0.01	99.1%	0.5	16.8%
Dehumidifier	0.01	93.9%	0.5	20.1%
Dishwasher	0.00	100.0%	0.5	17.2%
Freezer	0.00	148.1%	0.5	35.4%
Heat Pump Water Heater	0.01	114.4%	0.5	31.2%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Pool Pump	0.00	0.0%	0.5	100.0%
Refrigerator	0.01	102.5%	0.5	14.2%
Room Air Conditioner	0.01	100.0%	0.5	34.6%
Smart Thermostat	0.02	109.5%	0.5	17.2%
Low-Income Total	**0.00**	**106.2%**	**0.5**	**na**
Non Low-Income Total	**0.07**	**106.2%**	**0.5**	**na**
Program Total	**0.08**	**106.2%**	**0.5**	**8.2%**

M.2 NET IMPACT EVALUATION

M.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted net impact evaluation for this initiative in PY14. The net-to-gross evaluation for the downstream Appliances measures was based on self-report data from program participants. This followed the self-report methodologies for free-ridership and spillover from the PA Evaluation Framework. Participants were randomly sampled since the savings for these sub-programs are relatively small and do not qualify for the higher level of rigor of high-impact measures. Individual free-ridership and spillover rates from the participant survey were weighted to adjust for sampling differences, non-response, and claimed energy savings to calculate overall estimates.

Overall NTG ratios were comparable to those found in the Phase III evaluation. An NTG ratio of 100% is used for reporting net impacts and for cost effectiveness testing for the Low-Income Appliances Initiative.

M.2.2 Sampling

Tetra Tech sampled randomly from all PY14 participants on record at the time of the survey launch (Q3 of PY14) in the Companies' tracking and reporting systems. The sample designs for the four EDCs are shown in Table 273, Table 274, Table 275, and Table 276 for Met-Ed, Penelec, Penn Power, and WPP. The achieved sample sizes and response rates in the table below are from the PY14 net impact evaluation effort.

Table 273: Res Appliances Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,752	69	25.0%
Program Total	**2,752**	**69**	**25.0%**

Table 274: Res Appliances Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,709	71	25.5%
Program Total	**1,709**	**71**	**25.5%**

Table 275: Res Appliances Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	899	74	26.4%
Program Total	**899**	**74**	**26.4%**

Table 276: Res Appliances Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,970	72	25.7%
Program Total	**2,970**	**72**	**25.7%**

M.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 277, Table 278, Table 279, and Table 280 for Met-Ed, Penelec, Penn Power, and WPP. The spillover percentages for PY15 and later are higher than the spillover percentages initially reported in PY14 due to the discovery and correction of a calculation error in the PY14 spillover analysis. As averaged for the four EDCs, the spillover is now 5.3% instead of 2.7%.

Table 277: Res Appliances Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	613	42.4%	10.3%	67.9%	13.0%
Program Total	**613**	**42.4%**	**10.3%**	**67.9%**	**13.0%**

Table 278: Res Appliances Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	265	52.2%	1.5%	49.4%	12.8%
Program Total	**265**	**52.2%**	**1.5%**	**49.4%**	**12.8%**

Table 279: Res Appliances Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	127	49.8%	2.0%	52.3%	12.6%
Program Total	**127**	**49.8%**	**2.0%**	**52.3%**	**12.6%**

Table 280: Res Appliances Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	536	50.0%	2.2%	52.2%	12.7%
Program Total	**536**	**50.0%**	**2.2%**	**52.2%**	**12.7%**

Appendix N Evaluation Detail – Residential Midstream Appliances Initiative

In this initiative, rebates are paid to retailers for point-of-sale discounts on the purchase price for dehumidifiers, heat pump water heaters, ceiling fans, air purifiers, room air conditioners, and smart thermostats at participating stores. Residential customers do not file rebate applications; instead, retailers discount the appliances and invoice for rebates with point-of-sale data files as supporting documentation.

Some measures are offered in both the downstream and midstream offerings. Double-dipping is not allowed by the program, meaning that customers who purchase program measures at participating retail stores for the midstream program are not eligible to submit a mail-in rebate. For income-qualified customers, the downstream offering already has increased rebates available. If an income-qualified customer were to purchase an eligible appliance through the midstream offering, they could apply for an additional rebate, referred to as an 'enhanced rebate.' The ICSP, Franklin Energy has processes to ensure only eligible customers receive a rebate.

Participants are defined as each separate appliance rebated. Additional rebates provided to LI customers are not included in the participation counts. Thus, the rebate application, rather than the customer, is the sampling unit for gross impact evaluation.

N.1 Gross Impact Evaluation

N.1.1 Gross Impact Evaluation Methodology

Each component of gross impact is described below.

N.1.1.1 Invoice and Application Review

For midstream appliances, ADM obtained retailer invoices with supporting documentation containing details of the rebated appliance models. Each model on the invoices was matched to the ENERGY STAR® database to obtain measure attributes. A census of the reported models was researched in this way.

N.1.1.2 Saving Calculations with TRM Algorithms and Parameters

For all reviewed records, ADM used model-specific attributes to calculate “On-TRM” impacts.

The average per-unit gross verified impact for a given measure is the product of the measure-specific verification rate (as determined from retailer invoice details) and the average calculated impacts as described above. The gross realization rates for energy savings were driven primarily by the reported energy savings in the tracking and reporting system. The reported impacts are based on market-average efficiency and capacity attributes while the verified impacts are calculated with model-specific attributes as derived from the ENERGY STAR® database.

N.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 281, Table 282, Table 283, and Table 284.

Table 281: Res Midstream Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	4,508	4,508
Heat Pump Water Heater	274	274
Ceiling Fan	0	0
Air Purifier	824	824
Room Air Conditioner	560	560
Smart Thermostat	764	764
Program Total	**6,930**	**6,930**

Table 282: Res Midstream Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	8,493	8,493
Heat Pump Water Heater	134	134
Ceiling Fan	0	0
Air Purifier	866	866
Room Air Conditioner	541	541
Smart Thermostat	2,449	2,449
Program Total	**12,483**	**12,483**

Table 283: Res Midstream Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	1,911	1,911
Heat Pump Water Heater	18	18
Ceiling Fan	0	0
Air Purifier	206	206
Room Air Conditioner	102	102
Smart Thermostat	2,671	2,671
Program Total	**4,908**	**4,908**

Table 284: Res Midstream Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	6,877	6,877
Heat Pump Water Heater	127	127
Ceiling Fan	0	0
Air Purifier	806	806
Room Air Conditioner	386	386
Smart Thermostat	2,341	2,341
Program Total	**10,537**	**10,537**

N.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 285, Table 286, Table 287, and Table 288 for Met-Ed, Penelec, Penn Power, and WPP respectively. In general, gross realization rates were slightly higher than 100%, driven by high realization rates for air purifiers and heat pump water heaters.

Table 285: Res Midstream Appliances Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	537.8	98.9%	0.5	0.0%
Heat Pump Water Heater	490.1	110.1%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	108.7	157.0%	0.5	0.0%
Room Air Conditioner	34.1	100.0%	0.5	0.0%
Smart Thermostat	233.4	100.0%	0.5	0.0%
Program Total	**1,404**	**107.5%**	**0.5**	**0.0%**

Table 286: Res Midstream Appliances Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	1,013.2	97.2%	0.5	0.0%
Heat Pump Water Heater	227.3	112.8%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	117.8	154.6%	0.5	0.0%
Room Air Conditioner	20.9	100.0%	0.5	0.0%
Smart Thermostat	504.7	100.0%	0.5	0.0%
Program Total	**1,884**	**103.4%**	**0.5**	**0.0%**

Table 287: Res Midstream Appliances Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	228.0	98.1%	0.5	0.0%
Heat Pump Water Heater	30.5	112.0%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	29.0	155.7%	0.5	0.0%
Room Air Conditioner	6.2	100.0%	0.5	0.0%
Smart Thermostat	608.5	100.0%	0.5	0.0%
Program Total	**902**	**101.7%**	**0.5**	**0.0%**

Table 288: Res Midstream Appliances Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	820.4	97.5%	0.5	0.0%
Heat Pump Water Heater	211.4	112.1%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	99.3	153.9%	0.5	0.0%
Room Air Conditioner	17.1	100.0%	0.5	0.0%
Smart Thermostat	543.9	100.0%	0.5	0.0%
Program Total	**1,692**	**103.5%**	**0.5**	**0.0%**

N.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 289, Table 290, Table 291, and Table 292 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 289: Res Midstream Appliances Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	0.1	98.9%	0.5	0.0%
Heat Pump Water Heater	0.0	110.1%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	0.0	157.2%	0.5	0.0%
Room Air Conditioner	0.1	100.0%	0.5	0.0%
Smart Thermostat	0.0	100.0%	0.5	0.0%
Program Total	**0.30**	**103.6%**	**0.5**	**0.0%**

Table 290: Res Midstream Appliances Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	0.3	97.2%	0.5	0.0%
Heat Pump Water Heater	0.0	112.8%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	0.0	154.8%	0.5	0.0%
Room Air Conditioner	0.0	100.0%	0.5	0.0%
Smart Thermostat	0.1	100.0%	0.5	0.0%
Program Total	**0.43**	**100.7%**	**0.5**	**0.0%**

Table 291: Res Midstream Appliances Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	0.1	98.1%	0.5	0.0%
Heat Pump Water Heater	0.0	112.0%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	0.0	156.0%	0.5	0.0%
Room Air Conditioner	0.0	100.0%	0.5	0.0%
Smart Thermostat	0.1	100.0%	0.5	0.0%
Program Total	**0.17**	**100.7%**	**0.5**	**0.0%**

Table 292: Res Midstream Appliances Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	0.2	97.5%	0.5	0.0%
Heat Pump Water Heater	0.0	112.1%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	0.0	154.1%	0.5	0.0%
Room Air Conditioner	0.0	100.0%	0.5	0.0%
Smart Thermostat	0.1	100.0%	0.5	0.0%
Program Total	**0.37**	**100.9%**	**0.5**	**0.0%**

N.2 NET IMPACT EVALUATION

N.2.1 Net Impact Evaluation Methodology

A net impact evaluation was not conducted for midstream appliances in PY16. Net impact evaluation results from downstream appliances are used as a proxy, with the modification that spillover was not included for the midstream program. The midstream and downstream program components offer identical rebate amounts per appliance and efficiency grade. The net-to-gross evaluation for the downstream Appliances measures was based on self-report data from program participants. The following sections provide information related to the downstream net impact evaluation effort that informs the initiative's NTG values for PY16.

N.2.2 Sampling

The sampling scheme for the downstream appliance initiative, which informed NTG for the midstream appliances, is summarized below. Tetra Tech sampled randomly from all participants on record in the Companies' tracking and reporting systems in early PY14 Q3. The sample designs for the four EDCs are shown in Table 293. The achieved sample sizes and response rates in the table below are from the PY14 net impact evaluation effort.

Table 293: Res Appliances Initiative Net-to-Gross Sampling

EDC	Stratum	Population Size	Achieved Sample Size	Response Rate
Met-Ed	All Rebates	2,752	69	25.0%
Met-Ed Total		**2,752**	**69**	**25.0%**
Penelec	All Rebates	1,709	71	25.5%
Penele Total		**1,709**	**71**	**25.5%**
Penn Power	All Rebates	899	74	26.4%
Penn Power Total		**899**	**74**	**26.4%**
WPP	All Rebates	2,970	72	25.7%
WPP Total		**2,970**	**72**	**25.7%**

N.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 294.

Table 294: Res Appliances Initiative Net-to-Gross Results

EDC	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	1,510	42.4%	0.0%	57.6%	13.0%
Penelec	1,949	52.2%	0.0%	47.8%	12.8%
Penn Power	918	49.8%	0.0%	50.2%	12.6%
WPP	1,751	50.0%	0.0%	50.0%	12.7%

Appendix O Evaluation Detail – Low-Income Residential Appliance Recycling Sub-Initiative

O.1 Gross Impact Evaluation

Gross impact evaluation for the Low-Income Appliance Recycling (LI ATI) Sub-Initiative included customer verification surveys and TRM calculations of measure-level impacts. There are five distinct measures offered by the program: refrigerator recycling, freezer recycling, room AC (RAC) recycling, mini-fridge recycling, and dehumidifier recycling.

O.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical for all four EDCs. A TRM-based calculation was performed for each entry in the tracking and reporting system. The parameter values from the TRM (or for dehumidifiers, IMP) algorithms were taken from project-specific data from the tracking and reporting system when applicable, from TRM defaults, or from customer verification surveys. For refrigerators and freezers, measure attributes that participants would readily recall were determined from participant surveys, and the average parameter values were applied to all measures. Apart from measure verification, these attributes include the part-use factor, the location in the home where the appliance was used, and for refrigerators, whether the appliance was a primary or secondary unit. Technical attributes of the appliances, such as the age, capacity, and configuration, as collected by CLEAResult, were taken from program tracking and reporting data. TRM or IMP default parameters were used tor room air conditioners (RACs) and dehumidifiers. Table 295 lists the data sources for gross impact calculation algorithms.

Table 295: Data Sources for the LI ATI Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
Refrigerator, Freezer	Appliance Age	Tracking and Reporting System
Refrigerator, Freezer	Pre-1990	Tracking and Reporting System
Refrigerator, Freezer	Appliance Size / Capacity	Tracking and Reporting System
Refrigerator, Freezer	Configuration/Type	Tracking and Reporting System
Refrigerator	Primary Usage	Participant Surveys
Refrigerator, Freezer	Part Use Factor	Participant Surveys
Refrigerator, Freezer	In Unconditioned Space?	Participant Surveys
Refrigerator, Freezer	CDD and HDD	TRM - Zip Code Lookup
RAC	Capacity	Tracking and Reporting System
RAC	EER	TRM Default
RAC	RAC EFLH	TRM - Zip Code Lookup
RAC	CF	TRM - Zip Code Lookup
Dehumidifier	Capacity	Tracking and Reporting System
Dehumidifier	Region (to determine kWh)	TRM - Zip Code Lookup
All Measures	Verification Rate	Participant Surveys

The gross realization rates for energy savings were driven primarily by part-use factors for refrigerators and freezers as determined through verification surveys, and by the unit energy consumptions for refrigerators and freezers, as determined through measure attributes recorded in the tracking and reporting system.

O.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 296, Table 297, Table 298, and Table 299. The population sizes and sample sizes represent individual appliances rather than individual customers. Most surveys were conducted online, with telephone surveys employed to meet sample quotas if only a few more sample points were needed. Note that the overall precision for the ATI initiative is the combined precision of the low income, non-low-income, and nonresidential components. The combined precisions for each EDC are shown in Table 230 in Appendix J.

Table 296: LI ATI Sub-Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	100	16	Participant Surveys
Freezers	10	1	
RACs	96	14	
Dehumidifiers	9	1	
Mini Friges	5	2	
Program Total	**220**	**34**	

Table 297: LI ATI Sub-Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	118	19	Participant Surveys
Freezers	23	5	
RACs	91	10	
Dehumidifiers	14	3	
Mini Friges	3	2	
Program Total	**249**	**39**	

Table 298: LI ATI Sub-Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	21	1	Participant Surveys
Freezers	1	0	
RACs	10	0	
Dehumidifiers	0	0	
Mini Friges	1	1	
Program Total	**33**	**2**	

Table 299: LI ATI Sub-Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	109	21	Participant Surveys
Freezers	21	3	
RACs	65	7	
Dehumidifiers	12	2	
Mini Friges	3	1	
Program Total	**210**	**34**	

O.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 300, Table 301, Table 302, and Table 303 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 300: LI ATI Sub-Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	92	113.6%	0.5	0.0%
Freezers	6	124.7%	0.5	0.0%
RACs	9	132.7%	0.5	0.0%
Dehumidifiers	6	127.1%	0.5	0.0%
Mini Friges	1	117.7%	0.5	0.0%
Program Total	**114**	**116.5%**	**0.5**	**0.0%**

Table 301: LI ATI Sub-Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	109	129.4%	0.5	0.0%
Freezers	15	124.2%	0.5	0.0%
RACs	9	114.1%	0.5	0.0%
Dehumidifiers	7	96.1%	0.5	0.0%
Mini Friges	1	117.7%	0.5	0.0%
Program Total	**140**	**126.1%**	**0.5**	**0.0%**

Table 302: LI ATI Sub-Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	19	134.7%	0.5	0.0%
Freezers	1	0.0%	0.5	0.0%
RACs	1	82.1%	0.5	0.0%
Dehumidifiers	0	100.0%	0.5	0.0%
Mini Friges	0	100.0%	0.5	0.0%
Program Total	**21**	**127.9%**	**0.5**	**0.0%**

Table 303: LI ATI Sub-Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	101	119.8%	0.5	0.0%
Freezers	13	134.1%	0.5	0.0%
RACs	7	102.5%	0.5	0.0%
Dehumidifiers	4	222.1%	0.5	0.0%
Mini Friges	1	117.7%	0.5	0.0%
Program Total	**126**	**123.7%**	**0.5**	**0.0%**

O.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 304, Table 305, Table 306, and Table 307 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 304: LI ATI Sub-Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.02	113.6%	0.5	0.0%
Freezers	0.00	124.7%	0.5	0.0%
RACs	0.02	130.5%	0.5	0.0%
Dehumidifiers	0.00	123.9%	0.5	0.0%
Mini Friges	0.00	169.8%	0.5	0.0%
Program Total	**0.04**	**123.0%**	**0.5**	**0.0%**

Table 305: LI ATI Sub-Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.02	129.4%	0.5	0.0%
Freezers	0.00	124.3%	0.5	0.0%
RACs	0.02	107.0%	0.5	0.0%
Dehumidifiers	0.00	113.3%	0.5	0.0%
Mini Friges	0.00	169.8%	0.5	0.0%
Program Total	**0.05**	**117.6%**	**0.5**	**0.0%**

Table 306: LI ATI Sub-Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.00	134.7%	0.5	0.0%
Freezers	0.00	100.0%	0.5	0.0%
RACs	0.00	83.5%	0.5	0.0%
Dehumidifiers	0.00	100.0%	0.5	0.0%
Mini Friges	0.00	144.3%	0.5	0.0%
Program Total	**0.01**	**113.9%**	**0.5**	**0.0%**

Table 307: LI ATI Sub-Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.02	119.8%	0.5	0.0%
Freezers	0.00	134.1%	0.5	0.0%
RACs	0.02	99.2%	0.5	0.0%
Dehumidifiers	0.00	202.6%	0.5	0.0%
Mini Friges	0.00	169.8%	0.5	0.0%
Program Total	**0.04**	**114.3%**	**0.5**	**0.0%**

O.2 NET IMPACT EVALUATION

O.2.1 Net Impact Evaluation Methodology

As with other programs that target income-qualified participants, an NTG ratio of 100% is used for calculation of portfolio-level net verified impacts and for net-level TRC calculations.

Appendix P Evaluation Detail – Residential Low-Income Direct Install Initiative

The Low-Income direct install initiative is comprised of three subprograms: WARM – Plus, WARM – Extra Measure, and WARM Multifamily. Each subprogram is implemented by FirstEnergy. Each sub program offers similar measures to its participants.

Participants are defined as the number of unique project numbers in the program. Participants can receive numerous measures installed over the course of the program year. Participants must have a gross household income at or below 150% of the 2023 Federal Income Poverty Guideline (FPIG).

To join this program, new participants must submit their most recent Household Income Tax Return and pay stubs for the last 30 days to FirstEnergy contractors to verify their income. FirstEnergy also maintains a list of known Low-Income customers to verify the customer's income.

P.1 Gross Impact Evaluation

P.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the LI DI Initiative involved using TRM calculations for measures installed throughout the program. Unique measure calculations were performed in accordance with the 2021 PA TRM for each measure type. The impact evaluation process is described below.

P.1.1.1 Determination of In-Service Rates

In-service rates are calculated by using QA/QC forms created by a third-party inspector. Inspectors verified measure installations during a site visit after the project was completed. The verified installed quantities were compared to reported quantities to develop the in-service rates.

In PY8, ADM performed ride along site visits with three different QA/QC contractors to ensure that the contractors were performing the QA/QC visit properly. It was found that the QA/QC contractors were indeed looking for the right measures and measure quantities. ADM verified the same quantity of measures as the QA/QC contractors. ADM continues to rely on QA/QC contractors' inspections to determine in-service rates for measures.

In-service rates were used in all savings calculations except air sealing and attic insulation measures.

P.1.1.2 TRM Calculations

For lighting measures, efficient and baseline lamp wattages are stated in the reported data and supporting documents. The hours of use are assumed to be the TRM defaults of 3 or 2.5 hours, depending on the proportion of lamps in a household that are retrofitted. TRM defaults were used for other portions of the calculation.

TRM defaults were used for the LED Nights Lights.

For refrigerator and freezer measures, each installation was assigned a category number using model numbers provided in supporting documentation. If the name and description fields contradicted each other, the description field was used because the description column is more accurate and detailed. The appliance age-based variables of the savings calculations for recycling come from supporting documentation if available, or from the appliance recycling program otherwise. Input values for other variables come from the determined category number of the appliance. All appliances were assumed to be primary appliances and are installed within conditioned space.

For domestic hot water measures, first the water heater type was verified. The housing type identified in the customer tracking data is used in showerhead and aerator measure savings calculations. The heat pump water heater measure calculation uses the efficient energy factor rating and volume stated in the customer tracking data or found in the supporting documentation. TRM defaults are assumed when specific values are not known or found.

Project audit forms were used to determine heating and cooling equipment types for accounts which received attic insulation. Once the heating and cooling equipment type was verified, the attic insulation savings calculation was completed. Insulation area, Rbase, Ree were provided in the project documentation. The HDDs, CDDs, and $EFLH_{cool}$ were found using the zip code lookup table to the projects reference city.

Residential air sealing measures used $CFM50_{post}$ and $CFM50_{pre}$ values found in the project audit forms. The heating equipment type was found in the customer tracking data and the cooling equipment type was in project audit forms.

The default savings values were used for the smart strip plug outlets. The equip name or description columns were used to find the quantity of the plugs on the smart strips. Projects which have multiple smart strips installed were assigned the savings values for the “Unspecified use or multiple purchased” smart strips. The description column indicates if the smart strip was installed on an entertainment center. Descriptions which included phrases such as “TV”, “Living room”, or “entertain” were considered entertainment center installations.

P.1.2 Sampling

The sampling strategy for gross impact evaluation is summarized in Table 308, Table 309, Table 310, and Table 311 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 308: LI DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1.5	176	12	TRM Analysis + On-Site Verification
Medium Savings	0.7	505	15	
Low Savings	0.0	1,215	20	
Program Total		**1,896**	**47**	

Table 309: LI DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1.5	308	12	TRM Analysis + On-Site Verification
Medium Savings	0.8	848	22	
Low Savings	0.0	1,708	16	
Program Total		**2,864**	**50**	

Table 310: LI DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1.4	69	9	TRM Analysis + On-Site Verification
Medium Savings	0.8	282	13	
Low Savings	0.0	509	18	
Program Total		**860**	**40**	

Table 311: LI DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1.6	298	18	TRM Analysis + On-Site Verification
Medium Savings	0.9	524	19	
Low Savings	0.0	1,296	15	
Program Total		**2,118**	**52**	

P.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 312, Table 313, Table 314, and Table 315 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 312: LI DI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.5	415	99.0%	0.5	20%
Medium Savings	0.7	505	108.2%	0.5	18%
Low Savings	0.0	448	102.0%	0.5	16%
Program Total		**1,368**	**103.4%**	**0.5**	**10.5%**

Table 313: LI DI Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.5	588	92.4%	0.5	20%
Medium Savings	0.8	922	103.2%	0.5	15%
Low Savings	0.0	663	103.0%	0.5	18%
Program Total		**2,173**	**100.2%**	**0.5**	**10.1%**

Table 314: LI DI Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.4	144	97.6%	0.5	22%
Medium Savings	0.8	281	104.9%	0.5	20%
Low Savings	0.0	225	110.0%	0.5	17%
Program Total		**651**	**105.0%**	**0.5**	**11.3%**

Table 315: LI DI Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.6	670	101.1%	0.5	16%
Medium Savings	0.9	634	98.7%	0.5	16%
Low Savings	0.0	641	93.9%	0.5	18%
Program Total		**1,945**	**98.0%**	**0.5**	**9.8%**

P.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 316, Table 317, Table 318, and Table 319 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 316: LI DI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.5	0.04	100.7%	0.5	20%
Medium Savings	0.7	0.07	105.7%	0.5	18%
Low Savings	0.0	0.06	102.2%	0.5	16%
Program Total		**0.17**	**103.2%**	**0.5**	**10.6%**

Table 317: LI DI Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.5	0.08	94.5%	0.5	20%
Medium Savings	0.8	0.13	104.2%	0.5	15%
Low Savings	0.0	0.08	105.8%	0.5	18%
Program Total		**0.29**	**102.1%**	**0.5**	**10.1%**

Table 318: LI DI Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.4	0.02	100.0%	0.5	22%
Medium Savings	0.8	0.04	105.8%	0.5	20%
Low Savings	0.0	0.03	106.0%	0.5	17%
Program Total		**0.09**	**104.7%**	**0.5**	**11.6%**

Table 319: LI DI Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.6	0.09	105.2%	0.5	16%
Medium Savings	0.9	0.09	98.4%	0.5	16%
Low Savings	0.0	0.09	93.8%	0.5	18%
Program Total		**0.27**	**99.1%**	**0.5**	**9.8%**

P.2 Net Impact Evaluation

P.2.1 Net Impact Evaluation Methodology

An independent net impact evaluation was not conducted for this initiative.

Appendix Q Evaluation Detail – LI EE Kits Sub-Initiative

Q.1 Gross Impact Evaluation

The Low Income EE Kits initiative has two sub-components: Low-income EE Kits and the Low-Income School Education program, both administered by AMCG. Both program components are similar to their non-income-qualified counterparts described in Appendix E . Other than minor differences in kit contents, the low-income EE Kit program components differ from the general EE Kit program components in the way customers are targeted and enrolled. The Low Income EE Kit program targets customers that are income qualified in the Companies' customer information systems databases. The Low-Income Schools program targets schools in low-income areas.

Q.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical to the process described for EE Kits in Appendix E. The gross realization rates and underlying in-service rates were generally higher for the Low-Income EE kits. ISRs for showerheads, aerators, and night lights are appreciably higher for the low-income subgroup.

Q.1.2 Sampling

Each kit type was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 320, Table 321, Table 322, and Table 323. Note that the overall precision for the EE Kits initiative is the combined precision of the low income and non-low-income components. The combined precisions for each EDC are shown in Table 169 in Appendix E.

Table 320: LI EE Kits Sub-Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	4,918	136	Survey (phone + online)
LI EE Kits - Standard	3,479	114	
LI School Education Kits	1,613	89	
Program Total	**10,010**	**339**	

Table 321: LI EE Kits Sub-Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	1,555	71	Survey (phone + online)
LI EE Kits - Standard	1,343	59	
LI School Education Kits	2,976	581	
Program Total	**5,874**	**711**	

Table 322: LI EE Kits Sub-Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	0	0	Survey (phone + online)
LI EE Kits - Standard	0	0	
LI School Education Kits	0	0	
Program Total	**0**	**0**	

Table 323: LI EE Kits Sub-Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	4,669	105	Survey (phone + online)
LI EE Kits - Standard	3,664	115	
LI School Education Kits	2,548	289	
Program Total	**10,881**	**509**	

Q.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 324, Table 325, Table 326, and Table 327 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 324: LI EE Kits Sub-Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	1,327	114.5%	1.0	12%
LI EE Kits - Standard	743	86.3%	0.5	7%
LI School Education Kits	357	93.1%	0.5	7%
Program Total	**2,427**	**102.8%**	**1.00**	**7.7%**

Table 325: LI EE Kits Sub-Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	415	116.8%	1.0	17%
LI EE Kits - Standard	291	92.1%	0.5	9%
LI School Education Kits	669	102.3%	0.5	3%
Program Total	**1,374**	**104.5%**	**1.00**	**6.0%**

Table 326: LI EE Kits Sub-Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0	0.0%	1.0	0%
LI EE Kits - Standard	0	0.0%	0.5	0%
LI School Education Kits	0	0.0%	0.5	0%
Program Total	**0**	**100.0%**	**1.00**	**0.0%**

Table 327: LI EE Kits Sub-Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	1,267	114.6%	1.0	14%
LI EE Kits - Standard	803	86.7%	0.5	7%
LI School Education Kits	580	102.8%	0.5	4%
Program Total	**2,650**	**103.5%**	**1.00**	**7.6%**

Q.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 328, Table 329, Table 330, and Table 331 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 328: LI EE Kits Sub-Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.14	121.5%	1.0	12%
LI EE Kits - Standard	0.08	93.8%	0.5	7%
LI School Education Kits	0.04	92.0%	0.5	7%
Program Total	**0.27**	**108.3%**	**1.00**	**7.5%**

Table 329: LI EE Kits Sub-Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.04	122.8%	1.0	17%
LI EE Kits - Standard	0.03	98.7%	0.5	9%
LI School Education Kits	0.07	97.4%	0.5	3%
Program Total	**0.14**	**105.3%**	**1.00**	**6.2%**

Table 330: LI EE Kits Sub-Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.00	0.0%	1.0	0%
LI EE Kits - Standard	0.00	0.0%	0.5	0%
LI School Education Kits	0.00	0.0%	0.5	0%
Program Total	**0.00**	**100.0%**	**1.00**	**0.0%**

Table 331: LI EE Kits Sub-Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.14	118.9%	1.0	14%
LI EE Kits - Standard	0.10	93.4%	0.5	7%
LI School Education Kits	0.07	98.8%	0.5	4%
Program Total	**0.305**	**106.2%**	**1.00**	**7.4%**

Q.2 NET IMPACT EVALUATION

A net impact evaluation was not conducted for the LI EE Kits Initiative.

Appendix R Evaluation Detail – Commercial and Industrial Prescriptive Initiative

R.1 Gross Impact Evaluation

The Commercial and Industrial Prescriptive (C&I Prescriptive) initiative is administered by Franklin Energy Services and includes four components: Downstream lighting, midstream lighting, downstream non-lighting, and midstream non-lighting.

Gross impact evaluation for C&I Prescriptive Initiative involved stratified sampling, on-site verifications, and project-specific data collection and calculations. For the lighting sub-initiatives, evaluation activities also include TRM Appendix C calculations with primary data collection for lighting hours of use for medium savings and high savings projects, and application of TRM deemed hours of operation for low savings projects.

R.1.1 Gross Impact Evaluation Methodology

As a first step, projects are categorized into one of the four components described above. Projects are clearly defined by subprogram names, which simplifies the process. The evaluation method for each component is described below.

R.1.1.1 Downstream Lighting

As a first step, projects are placed into one of three sampling strata as described in the next section. Each sampled lighting project first undergoes a desk review. The desk review includes reconciliation of invoices, fixture specification sheets (cut sheets), and re-calculating reported savings using TRM algorithms and/or ex-ante assumptions and identifying key parameters to be researched in the M&V plan. One aspect of the desk review is to transfer the calculation data into the PA TRM's Appendix C calculator. Although the Companies' implementation vendor processes rebates with an independent calculator that mirrors the TRM's Appendix C calculations (augmented with worksheets to suit rebate application purposes), the transferring of the data to ADM's version of Appendix C is an evaluation step to ensure that all verified impacts for lighting projects are derived using the 2021 TRM's Appendix C.

Evaluation of all but the simplest of projects requires a site-specific M&V plan (SSMVP). The first step in the M&V planning process is to check that the project is sufficiently documented. For example, contractors working on large projects often have detailed, space-by-space inventories of the baseline and new lighting fixtures. If such detailed information is found to be lacking, ADM analysts will contact the applicant or the contractor directly, or through a request to the ICSP, and ask if such documentation is available.

The desk review and M&V plan inform the data acquisition activities needed to evaluate the sampled project. Evaluation activities can include calculation reviews, reconciliation of the Appendix C calculator with invoices and equipment specification sheets, determination of hours of use through interviews or logging, and on-site verification.

In cases where projects have limited scope and complexity, the desk review process may indicate that an on-site visit would not add sufficient value to the evaluation effort. In such cases, a verification interview may suffice to reduce uncertainty regarding the project. Where loggers are used, data analysis is finalized following their retrieval. Billing analysis is a viable option for certain projects, and in some cases the verified results are determined wholly or partially by billing analysis.

R.1.1.1 Midstream Lighting

Once a project has been sampled, evaluation activities are similar to those described for downstream lighting projects. The business name and address where the lighting equipment will be installed is recorded for each project, so surveys and site inspections are possible, similar to the downstream component. Midstream lighting projects tend to be much smaller in scope than downstream projects (of 97 sampled projects, 30 exceeded 120 MWh in reported energy savings).

Note, in PY16, a small fraction of LED lamps were found to be recessed downlights, which are no longer eligible for rebates. Initially, ADM addressed these on a project-by-project basis, reducing the project realization rate if a sampled project was found to have ineligible lamps. However, not all EDC samples included projects that had recessed downlights. Following SWE's guidance, the Companies amended their reported impacts to zero for LED lamps, and ADM dropped one sampled project that solely included such lamps. No other sampled projects included recessed downlights.

R.1.1.2 Downstream Non-Lighting

As with lighting projects, each sampled prescriptive project undergoes a desk review prior to M&V activities. The desk review includes a full documentation review and if needed, additional topical research. Some projects may require M&V plans and additional verification activities, but most projects can be evaluated through documentation review. The prescriptive non-lighting projects (both downstream and midstream) accounted for less than 2% of nonresidential impacts in PY16. Due to the low evaluation risk posed by these projects, desk reviews were identified as the most appropriate impact evaluation activity.

R.1.1.3 Midstream Non-Lighting

Once a project has been sampled, evaluation activities are similar to those described for downstream non-lighting projects.

Figure 7 shows the fraction of verified energy savings, as averaged over the four PA Companies, by primary evaluation activities.

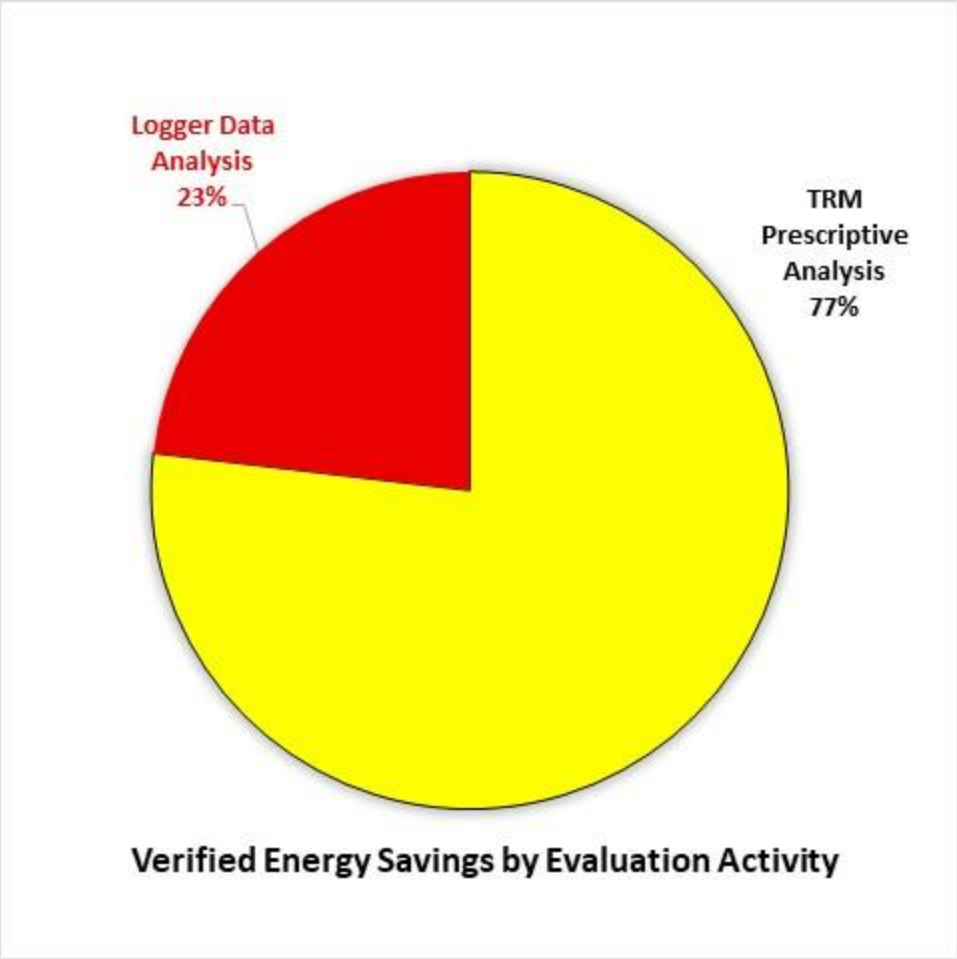


Figure 7: Fraction of verified energy savings by evaluation activity.

As a final step in the evaluation process, ADM analysts determine the incremental material and labor costs. In estimating the material and labor costs, preference is given first to invoices, then to the SWE incremental cost database, and then to the cost values from the CA DEER database, then to the costs used in the EDCs' EE&C plans. Incremental costs for downstream lighting projects are evaluated under the "early replacement" scenario unless the project is a new construction or remodeling project. Incremental costs for midstream projects are evaluated under the "replace on burnout" scenario.

R.1.2 Sampling

In PY16, both midstream and downstream lighting components had the volume and heterogeneity to motivate savings-based stratification. Downstream lighting projects were placed into three strata. The first stratum or "certainty" stratum consists of projects that are expected to result in energy savings in excess of 750 MWh. All of these projects are sampled for evaluation, and nearly all of them are evaluated prior to rebate approval. Therefore, the gross realization rate for the certainty stratum is essentially 100% by design, although reported impacts may at times be lower than the 750 MWh threshold, as the threshold is on ex ante

MWh, while ex post MWh are reported for these projects. The remaining projects are placed into two sampling strata according to their reported energy impacts. The sample design is not optimized for efficiency in the sense of achieving the desired precision with the absolute minimum number of sample points. Rather, the sample is designed to facilitate specific evaluation protocols that are based on energy savings thresholds. For example, projects in the certainty stratum are evaluated with the highest level of rigor in advance of rebate approval to ensure that customers' incentives are determined from verified energy savings. The smallest projects, those with expected impacts under 120 MWh, are placed in a separate stratum. For these projects, hours of use may be determined by logging, customer interviews, or application of deemed hours in the PA TRM depending on the level of uncertainty in lighting schedules and how closely the business schedule aligns with the archetypal building types in the TRM. Midstream lighting had two sampling strata corresponding to projects with expected impacts above or below 120 MWh. In addition to lighting, there is one stratum for downstream non-lighting, and one for midstream non-lighting. The sample designs for the four EDCs are shown in Table 332, Table 333, Table 334, and Table 335.

Table 332: CI Prescriptive Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	5	5	Desk Review, On-Site Verification
Downstream Lighting-2	120	30	6	
Downstream Lighting-1	0	90	4	
Downstream Nonlighting	0	33	3	
Midstream Lighting-1	0	1,146	14	
Midstream Lighting-2	120	19	10	
Midstream Nonlighting	0	0	0	
Program Total	**n/a**	**1,323**	**42**	

Table 333: CI Prescriptive Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	3	3	Desk Review, On-Site Verification
Downstream Lighting-2	120	36	8	
Downstream Lighting-1	0	128	4	
Downstream Nonlighting	0	41	4	
Midstream Lighting-1	0	2,039	18	
Midstream Lighting-2	120	56	6	
Midstream Nonlighting	0	3	1	
Program Total	**n/a**	**2,306**	**44**	

Table 334: CI Prescriptive Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	0	0	Desk Review, On-Site Verification
Downstream Lighting-2	120	6	4	
Downstream Lighting-1	0	67	7	
Downstream Nonlighting	0	17	2	
Midstream Lighting-1	0	442	18	
Midstream Lighting-2	120	14	8	
Midstream Nonlighting	0	0	0	
Program Total	**n/a**	**546**	**39**	

Table 335: CI Prescriptive Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	3	3	Desk Review, On-Site Verification
Downstream Lighting-2	120	31	4	
Downstream Lighting-1	0	126	3	
Downstream Nonlighting	0	46	3	
Midstream Lighting-1	0	1,949	15	
Midstream Lighting-2	120	37	6	
Midstream Nonlighting	0	2	1	
Program Total	**n/a**	**2,194**	**35**	

R.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 336, Table 337, Table 338, and Table 339 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 8 plots the verified energy savings against the reported energy savings for all evaluated prescriptive projects for the program year. The figure includes data points from all four EDCs and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficient of variation of 0.4, as prescriptive projects tend to have homogeneous realization rates. However, the Midstream Lighting-2 stratum was found to have more variance between reported and verified impacts, and the CV was accordingly set to 0.7.

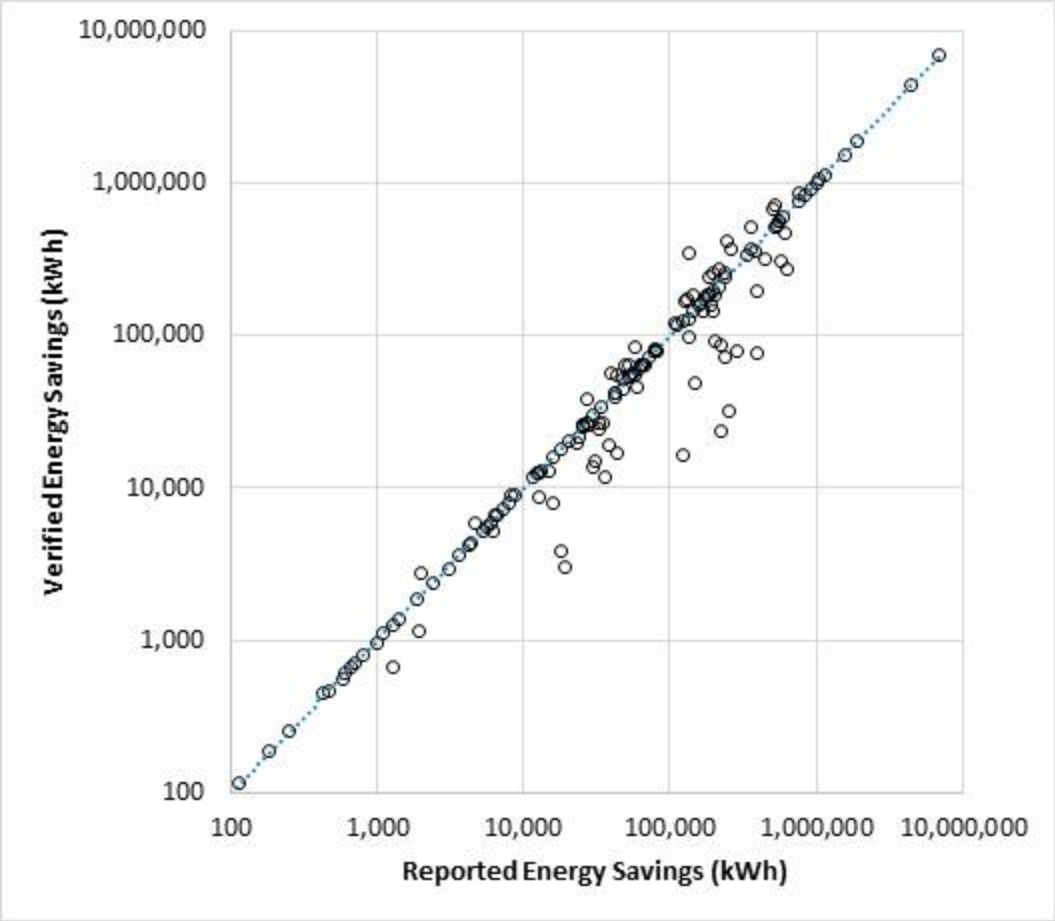


Figure 8: Verified vs. Reported Energy Savings for Sampled Prescriptive Projects.

Table 336: CI Prescriptive Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	5,159	100.0%	0.4	0%
Downstream Lighting-2	120	8,816	89.9%	0.4	21%
Downstream Lighting-1	0	2,002	96.3%	0.4	28%
Downstream Nonlighting	0	177	55.9%	0.4	32%
Midstream Lighting-1	0	9,370	94.6%	0.4	15%
Midstream Lighting-2	120	8,306	93.3%	0.7	22%
Midstream Nonlighting	0	0	100.0%	0.4	0%
Program Total	**n/a**	**33,829**	**93.8%**		**8.8%**

Table 337: CI Prescriptive Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	6,998	100.0%	0.4	0%
Downstream Lighting-2	120	10,530	82.0%	0.4	18%
Downstream Lighting-1	0	3,108	90.5%	0.4	28%
Downstream Nonlighting	0	507	98.9%	0.4	27%
Midstream Lighting-1	0	21,985	101.9%	0.4	14%
Midstream Lighting-2	120	17,088	93.6%	0.7	39%
Midstream Nonlighting	0	2	100.0%	0.4	47%
Program Total	**n/a**	**60,219**	**95.2%**		**12.4%**

Table 338: CI Prescriptive Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	0	100.0%	0.4	0%
Downstream Lighting-2	120	1,435	82.5%	0.4	17%
Downstream Lighting-1	0	1,836	86.7%	0.4	21%
Downstream Nonlighting	0	220	95.9%	0.4	38%
Midstream Lighting-1	0	5,394	99.7%	0.4	13%
Midstream Lighting-2	120	3,972	92.9%	0.7	23%
Midstream Nonlighting	0	0	100.0%	0.4	0%
Program Total	**n/a**	**12,857**	**93.7%**		**9.8%**

Table 339: CI Prescriptive Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	8,867	100.0%	0.4	0%
Downstream Lighting-2	120	9,364	115.4%	0.4	27%
Downstream Lighting-1	0	3,515	111.0%	0.4	33%
Downstream Nonlighting	0	574	91.0%	0.4	32%
Midstream Lighting-1	0	19,457	96.8%	0.4	15%
Midstream Lighting-2	120	10,578	75.4%	0.7	38%
Midstream Nonlighting	0	1	97.2%	0.4	41%
Program Total	**n/a**	**52,357**	**97.2%**		**10.2%**

R.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 340, Table 341, Table 342, and Table 343 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 340: CI Prescriptive Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	0.93	100.0%	0.4	0%
Downstream Lighting-2	120	1.08	97.7%	0.4	21%
Downstream Lighting-1	0	0.27	89.2%	0.4	28%
Downstream Nonlighting	0	0.03	83.1%	0.4	32%
Midstream Lighting-1	0	2.07	113.0%	0.4	15%
Midstream Lighting-2	120	1.70	74.7%	0.7	22%
Midstream Nonlighting	0	0.00	100.0%	0.4	0%
Program Total	**n/a**	**6.08**	**96.4%**		**8.7%**

Table 341: CI Prescriptive Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	1.13	100.0%	0.4	0%
Downstream Lighting-2	120	1.90	80.8%	0.4	18%
Downstream Lighting-1	0	0.69	87.9%	0.4	28%
Downstream Nonlighting	0	0.08	99.0%	0.4	27%
Midstream Lighting-1	0	5.28	73.5%	0.4	14%
Midstream Lighting-2	120	4.31	77.9%	0.7	39%
Midstream Nonlighting	0	0.00	100.0%	0.4	47%
Program Total	**n/a**	**13.39**	**79.1%**		**13.6%**

Table 342: CI Prescriptive Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	0.00	100.0%	0.4	0%
Downstream Lighting-2	120	0.20	78.5%	0.4	17%
Downstream Lighting-1	0	0.32	97.8%	0.4	21%
Downstream Nonlighting	0	0.03	95.7%	0.4	38%
Midstream Lighting-1	0	1.31	88.3%	0.4	13%
Midstream Lighting-2	120	1.03	87.6%	0.7	23%
Midstream Nonlighting	0	0.00	100.0%	0.4	0%
Program Total	**n/a**	**2.89**	**88.5%**		**10.6%**

Table 343: CI Prescriptive Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	1.31	100.0%	0.4	0%
Downstream Lighting-2	120	1.58	108.1%	0.4	27%
Downstream Lighting-1	0	0.57	110.1%	0.4	33%
Downstream Nonlighting	0	0.11	91.7%	0.4	32%
Midstream Lighting-1	0	4.48	88.1%	0.4	15%
Midstream Lighting-2	120	2.76	68.4%	0.7	38%
Midstream Nonlighting	0	0.00	97.2%	0.4	41%
Program Total	**n/a**	**10.81**	**88.6%**		**11.0%**

R.2 NET IMPACT EVALUATION

R.2.1 Net Impact Evaluation Methodology

In PY14, Tetra Tech assessed free-ridership through participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. The customer free-ridership portion captures two components: (1) intention to carry out the energy-efficient project without program funds, and (2) influence of the program in the decision to carry out the energy-efficient project. Customer-identified influential vendors were asked a series of questions assessing the program's influence on their recommendations to the customer(s) who identified them as being influential in their decision-making process to support the free-ridership assessment. Like the customer self-report methodology, an influence component score was calculated for each influential vendor specific to each project. If the vendor's influence score is greater than the customer's score from the participant survey, the vendor score replaced the customer score in the self-report free-ridership scoring algorithm, under the rationale that the vendor's recommendation was a program-attributable factor because the vendor, in turn, was influenced by the program.

In addition to free-ridership, the NTG evaluation also assessed both participant spillover and nonparticipant spillover. Participant spillover was assessed through participant customer self-reports. We excluded like-spillover for the Midstream program component as this equipment was likely received at a discounted price and therefore benefited from FirstEnergy's buydown. The evaluation team felt that these midstream customers were likely to get the equipment from the same vendor as their original purchase; therefore, the savings would be double counted if it was reported as spillover. Nonparticipant spillover was estimated from vendor self-report surveys at the program component level (i.e., Custom and EMNC). According to the Pennsylvania Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates. Individual free-ridership and spillover rates from the customer and vendor surveys were weighted to adjust for proportional sampling differences, non-response, and claimed energy savings to calculate overall estimates.

The following sections provide information related to the net impact evaluation effort that informs the initiative's NTG values for PY15.

R.2.2 Sampling

The sample designs for the four EDCs are shown in Table 344, Table 345, Table 346, and Table 347 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 344: CI Prescriptive Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Downstream Prescriptive	161	41	25%
Midstream Prescriptive	64	16	25%
Program Total	**225**	**57**	**25.3%**

Table 345: CI Prescriptive Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Downstream Prescriptive	200	70	35%
Midstream Prescriptive	162	39	24%
Program Total	**362**	**109**	**30.1%**

Table 346: CI Prescriptive Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Downstream Prescriptive	91	35	38%
Midstream Prescriptive	8	1	13%
Program Total	**99**	**36**	**36.4%**

Table 347: CI Prescriptive Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Downstream Prescriptive	272	97	36%
Midstream Prescriptive	93	20	22%
Program Total	**365**	**117**	**32.1%**

R.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 348, Table 349, Table 350, and Table 351 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 348: CI Prescriptive Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	15,011	29.1%	2.1%	73.0%	9.7%
Downstream Nonlighting	99	29.1%	2.1%	73.0%	9.7%
Midstream Lighting	16,616	44.2%	0.0%	55.8%	15.6%
Midstream Nonlighting	0	44.2%	0.0%	55.8%	15.6%
Program Total	**31,726**	**37.0%**	**1.0%**	**64.0%**	**5.2%**

Table 349: CI Prescriptive Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	18,449	37.3%	3.3%	66.0%	6.9%
Downstream Nonlighting	501	37.3%	3.3%	66.0%	6.9%
Midstream Lighting	38,396	34.2%	0.0%	65.8%	10.0%
Midstream Nonlighting	2	34.2%	0.0%	65.8%	10.0%
Program Total	**57,348**	**35.2%**	**1.1%**	**65.9%**	**2.2%**

Table 350 CI Prescriptive Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	2,775	17.4%	2.1%	84.8%	9.5%
Downstream Nonlighting	211	17.4%	2.1%	84.8%	9.5%
Midstream Lighting	9,066	25.0%	0.0%	75.0%	67.3%
Midstream Nonlighting	0	25.0%	0.0%	75.0%	67.3%
Program Total	**12,052**	**23.1%**	**0.5%**	**77.4%**	**2.4%**

Table 351 CI Prescriptive Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	23,579	42.8%	2.7%	59.9%	5.9%
Downstream Nonlighting	522	42.8%	2.7%	59.9%	5.9%
Midstream Lighting	26,811	24.7%	0.0%	75.3%	14.3%
Midstream Nonlighting	1	24.7%	0.0%	75.3%	14.3%
Program Total	**50,914**	**33.3%**	**1.3%**	**68.0%**	**2.4%**

Appendix S Evaluation Detail – Commercial and Industrial Custom Initiative

S.1 Gross Impact Evaluation

Gross impact evaluation for the Commercial and Industrial Custom (C&I Custom) Initiative involved stratified sampling, on-site verifications, and project-specific data collection and calculations.

S.1.1 Gross Impact Evaluation Methodology

As a first step, projects are placed into one of three sampling strata as described in the next section. As with lighting projects, each sampled custom project undergoes a desk review prior to M&V plan construction. The desk review includes a full documentation review and if needed, additional topical research. Evaluation of most projects requires an M&V plan. The first step in the M&V planning process is to check that the project is sufficiently documented, and that the evaluation engineer can articulate the mechanism or process that will yield the expected energy savings. ADM engineers typically contact the applicant early on in the M&V planning process to ask for additional documentation, clarification, or even to seek feedback on the feasibility of the proposed data acquisition and analysis methodology. The desk review and M&V plan will depend on the opportunities and constraints posed by each project. However, some defaults or "modes" are discussed for certain categories of projects below:

Air Compressor Projects: In many cases, vendors perform a baseline metering study prior to air compressor upgrades. The data collected from such studies are very useful, provided that they appear to be consistent with the overall project documentation. In many cases it is possible to use metered flow data or power data along with compressor curves to establish the facility's compressed air load profile. The energy usage of the proposed air compressor may then be derived from application of compressor curves to the compressed air load profile. Additional activities such as post-installation metering or a billing analysis may be recommended, depending on project specifics. In some cases, baseline meter data are not available. In these cases, ADM will meter the new air compressor and use compressor curves to establish the underlying compressed air load profile, and then determine the baseline usage through application of the baseline compressor curves and (if needed) compressor staging practices.

Water Pumping Projects: Pumping projects are typically evaluated through billing analysis, using water throughput as the normalizing variable.

Combined Heat and Power (CHP): CHP projects are typically evaluated through trending data analysis. The generator output is typically modeled as a function of explanatory variables that may include weather-related information, calendar day types (especially for universities), and availability of biofuels, if applicable. Parasitic loads are estimated through inspection of trending data, monitoring, or an inspection equipment specifications and operating schedules.

General Process Improvements: For general process improvements, the evaluation determines the change in the energy usage intensity associated with the creation or maintenance of one production unit. Production data are typically provided by the applicant upon ADM's request. Energy usage is measured either through power monitoring, energy management system trending, or billing analysis.

Solar Power Projects: ADM divided solar power projects into "small" and "large" categories. Small projects (under 150 MWh) were evaluated with the C&I Photovoltaic IMP issued by SWE in PY16. For larger projects, ADM attempted to collect site-specific generation data to calibrate System Advisor Model (SAM) models and only relied on the IMP if site-specific data were not available. All projects had annual generation impacts capped at the given facility's annual energy usage (or, if applicable, the combined usage of any facilities that were virtually net metered). However, peak load reductions were not capped as ADM's interpretation of the IMP is that the modules may feed into the power grid to meet the needs of other customers at times when generation exceeds the given building's electricity demand.

General Space and Process Cooling Improvements: Data acquisition for such projects involves the determination of independent variables that predict the cooling load (units produced, degree-days, etc.) along with utility bills, EMS trending data, or sub-metering. The data analysis may involve regressions or energy simulation models.

In some cases, the desk review process may indicate that an on-site visit would not add sufficient value to the evaluation effort. For example, billing analysis or trending data analysis is a viable option for certain projects. Figure 9 shows the fraction of verified energy savings, as averaged over the four PA Companies, by primary evaluation activities.

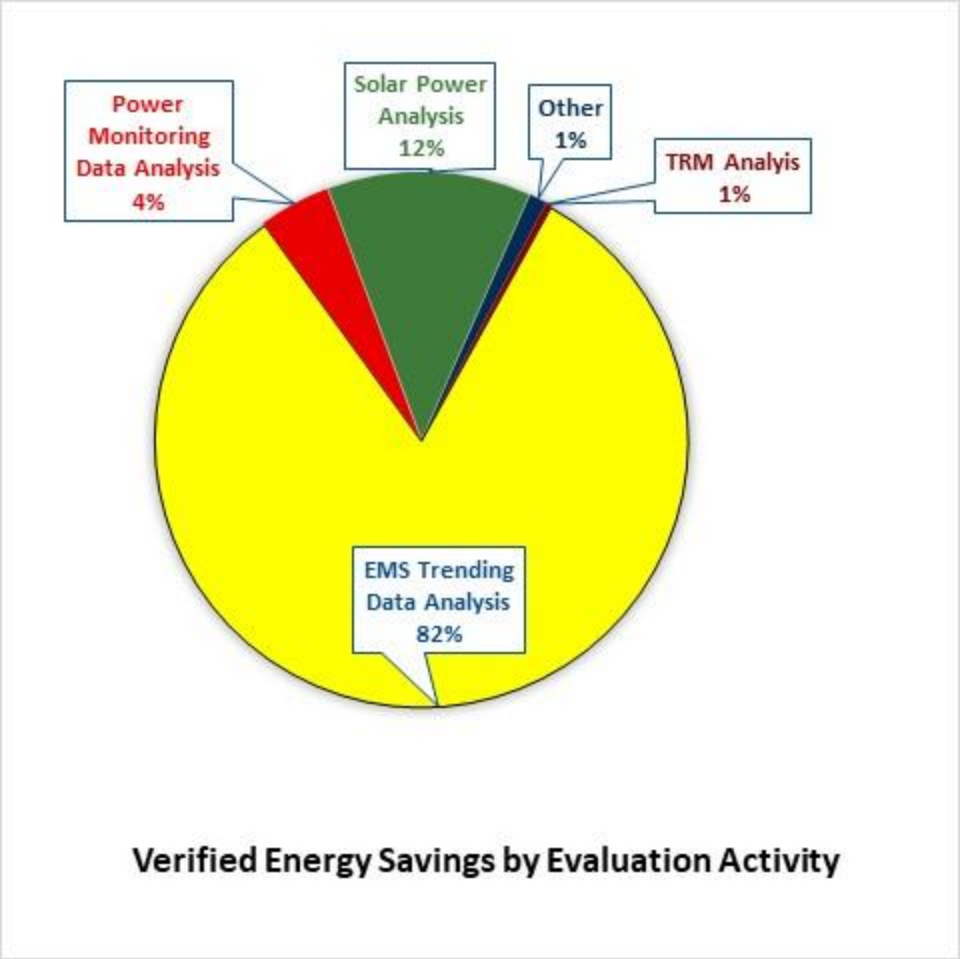


Figure 9: Fraction of verified energy savings by evaluation activity.

As a final step in custom project analysis, ADM analysts determine the incremental material and labor costs. In estimating the material and labor costs, preference is given first to invoices, then to the SWE incremental cost database, and then to the cost values from the CA DEER database, then to the costs used in the EDCs' EE&C plans.

S.1.2 Sampling

Projects are placed into three strata. The first stratum or "certainty" stratum consists of projects that are expected to result in energy savings in excess of 500 MWh. All of these projects are sampled for evaluation, and nearly all of them are evaluated prior to rebate approval. Therefore, the gross realization rate for the certainty stratum is essentially 100% by design, although reported impacts may at times be lower than the 500 MWh threshold, as the threshold is on ex ante MWh, while ex post MWh are reported for these projects. The remaining projects are placed into one of two sampling strata: one for projects with expected savings above 75 MWh, and one for smaller projects. The sample designs for the four EDCs are shown in Table 352, Table 353, Table 354, and Table 355.

Table 352: CI Custom Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	6	6	Desk Review, On-Site Verification, Metering
Custom-2	75	23	8	
Custom-1	0	31	4	
Program Total	**n/a**	**60**	**18**	

Table 353: CI Custom Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	2	2	Desk Review, On-Site Verification, Metering
Custom-2	75	27	10	
Custom-1	0	47	5	
Program Total	**n/a**	**76**	**17**	

Table 354: CI Custom Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	3	3	Desk Review, On-Site Verification, Metering
Custom-2	75	6	2	
Custom-1	0	9	1	
Program Total	**n/a**	**18**	**6**	

Table 355: CI Custom Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	7	7	Desk Review, On-Site Verification, Metering
Custom-2	75	14	2	
Custom-1	0	44	2	
Program Total	**n/a**	**65**	**11**	

S.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 356, Table 357, Table 358, and Table 359 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 10 plots the verified energy savings against the reported energy savings for all evaluated custom projects for the program year. The figure includes data points from all four EDCs and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficient of variation of 0.4 or 0.5, depending on the observed realization rate variability in each stratum.

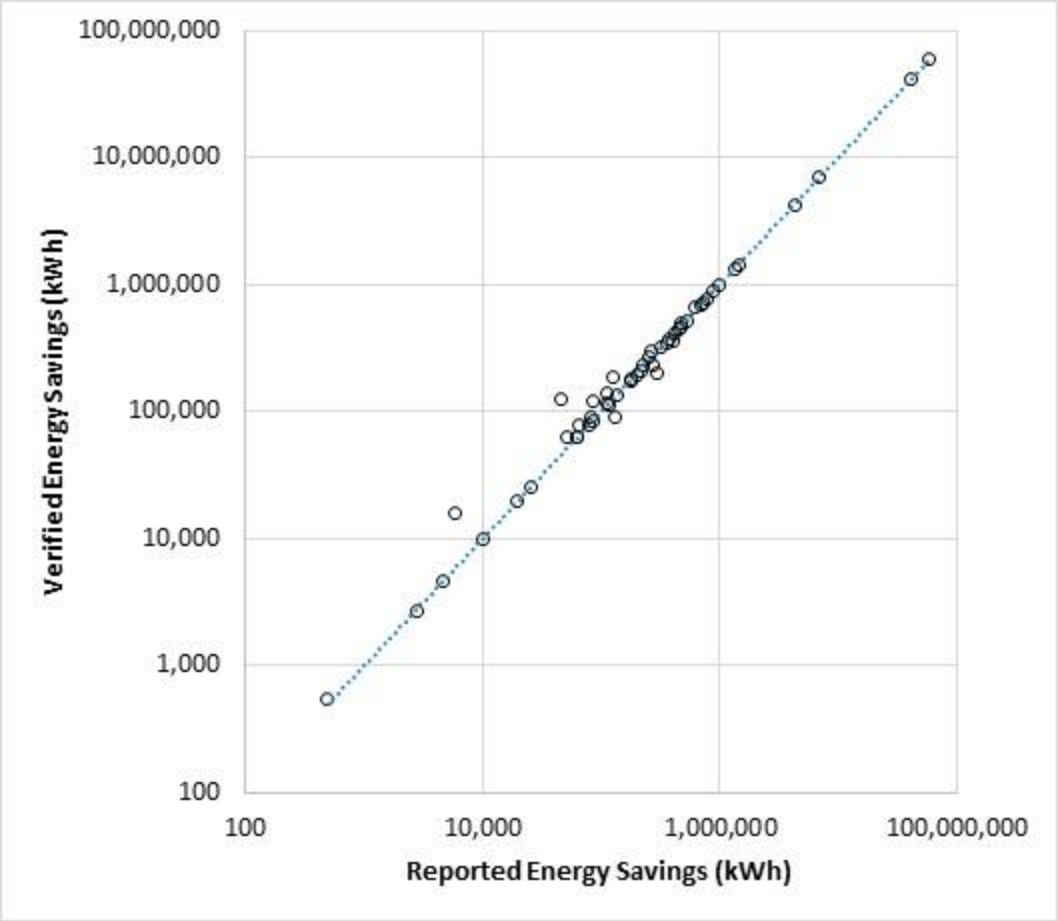


Figure 10: Verified vs. Reported Energy Savings for Sampled Custom Projects.

Table 356: CI Custom Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	61,945	99.9%	0.4	0%
Custom-2	75	5,289	103.2%	0.4	16%
Custom-1	0	830	116.5%	0.5	34%
Program Total	**n/a**	**68,065**	**100.4%**		**1.4%**

Table 357: CI Custom Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	2,093	100.0%	0.4	0%
Custom-2	75	5,744	98.7%	0.4	14%
Custom-1	0	1,189	108.0%	0.5	30%
Program Total	**n/a**	**9,025**	**100.2%**		**10.0%**

Table 358: CI Custom Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	5,257	100.2%	0.4	0%
Custom-2	75	1,054	108.9%	0.4	33%
Custom-1	0	187	100.0%	0.5	68%
Program Total	**n/a**	**6,498**	**101.6%**		**6.1%**

Table 359: CI Custom Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	51,590	100.0%	0.4	0%
Custom-2	75	2,044	92.7%	0.4	38%
Custom-1	0	1,121	213.1%	0.5	50%
Program Total	**n/a**	**54,756**	**102.0%**		**2.5%**

S.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 360, Table 361, Table 362, and Table 363 for Met-Ed, Penelec, Penn Power, and WPP respectively. Realization rates were slightly higher than 100% primarily due to an error in the designation of peak demand window for solar projects. The initial peak demand window was based on standard time instead of daylight savings time. The SWE noted this error in their advanced review of ADM's analyses, and ADM revised the verified impacts. This increased verified demand impacts relative to reported demand impacts.

Table 360: CI Custom Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	9.15	102.1%	0.4	0%
Custom-2	75	1.34	152.5%	0.4	16%
Custom-1	0	0.40	105.0%	0.5	34%
Program Total	**n/a**	**10.88**	**108.4%**		**3.1%**

Table 361: CI Custom Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	0.49	123.0%	0.4	0%
Custom-2	75	1.44	115.6%	0.4	14%
Custom-1	0	0.37	120.5%	0.5	30%
Program Total	**n/a**	**2.30**	**118.0%**		**10.2%**

Table 362: CI Custom Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	0.94	106.0%	0.4	0%
Custom-2	75	0.13	194.3%	0.4	33%
Custom-1	0	0.04	100.0%	0.5	68%
Program Total	**n/a**	**1.10**	**115.9%**		**6.7%**

Table 363: CI Custom Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	6.77	101.2%	0.4	0%
Custom-2	75	0.61	105.9%	0.4	38%
Custom-1	0	0.34	111.5%	0.5	50%
Program Total	**n/a**	**7.72**	**102.1%**		**3.9%**

S.2 NET IMPACT EVALUATION

S.2.1 Net Impact Evaluation Methodology

In PY16, Tetra Tech assessed free-ridership through participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. The customer free-ridership portion captures two components: (1) intention to carry out the energy-efficient project without program funds, and (2) influence of the program in the decision to carry out the energy-efficient project. Customer-identified influential vendors were asked a series of questions assessing the program's influence on their recommendations to the customer(s) who identified them as being influential in their decision-making process to support the free-ridership assessment. Like the customer self-report methodology, an influence component score was calculated for each influential vendor specific to each project. If the vendor's influence score is greater than the customer's score from the participant survey, the vendor score replaced the customer score in the self-report free-ridership scoring algorithm, under the rationale that the vendor's recommendation was a program-attributable factor because the vendor, in turn, was influenced by the program.

In addition to free-ridership, the NTG evaluation also assessed both participant spillover and nonparticipant spillover. Participant spillover was assessed through participant customer self-reports. Nonparticipant spillover was estimated from vendor self-report surveys at the program component level (i.e., Custom and EMNC). According to the Pennsylvania Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates. Individual free-ridership and spillover rates from the customer and vendor surveys were weighted to adjust for proportional sampling differences, non-response, and claimed energy savings to calculate overall estimates.

The following sections provide information related to the net impact evaluation effort that informs the initiative's NTG values for PY16.

S.2.2 Sampling

The sample designs for the four EDCs are shown in Table 364, Table 365, Table 366, and Table 367 for Met-Ed, Penelec, Penn Power, and WPP respectively. Tetra Tech attempted outreach to the census of participants but it was not possible to achieve the desired quotas due to high refusal rates and high rates of partial survey completions. It was particularly difficult to reach and garner participation of Large C/I participants, although those that installed solar panels had higher response rates. Results from all four EDCs were combined as a remediation measure for the low response rates.

Table 364: CI Custom Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom Non-Solar	105	7	7%
Custom Solar	97	17	18%
Program Total	**202**	**24**	**12%**

Table 365: CI Custom Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom Non-Solar	105	7	7%
Custom Solar	97	17	18%
Program Total	**202**	**24**	**12%**

Table 366: CI Custom Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom Non-Solar	105	7	7%
Custom Solar	97	17	18%
Program Total	**202**	**24**	**12%**

Table 367: CI Custom Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom Non-Solar	105	7	7%
Custom Solar	97	17	18%
Program Total	**202**	**24**	**12%**

S.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 368, Table 369, Table 370, and Table 371 for Met-Ed, Penelec, Penn Power, and WPP respectively. Solar power projects had lower NTGs than non-solar custom projects. This may be due to multiple sources of incentives, such as tax credits and accelerated depreciation, that are available for this measure.

Table 368: CI Custom Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom Non-Solar	59,816	47.2%	4.9%	57.7%	26.3%
Custom Solar	8,501	59.8%	1.1%	41.3%	15.9%
Program Total	**68,317**	**48.8%**	**4.5%**	**55.7%**	**23.9%**

Table 369: CI Custom Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom Non-Solar	3,482	47.2%	4.9%	57.7%	26.3%
Custom Solar	5,562	59.8%	1.1%	41.3%	15.9%
Program Total	**9,044**	**55.0%**	**2.6%**	**47.6%**	**14.9%**

Table 370: CI Custom Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom Non-Solar	5,910	47.2%	4.9%	57.7%	26.3%
Custom Solar	694	59.8%	1.1%	41.3%	15.9%
Program Total	**6,604**	**48.6%**	**4.5%**	**56.0%**	**24.3%**

Table 371: CI Custom Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom Non-Solar	51,262	47.2%	4.9%	57.7%	26.3%
Custom Solar	4,613	59.8%	1.1%	41.3%	15.9%
Program Total	**55,875**	**48.3%**	**4.6%**	**56.3%**	**24.7%**

Appendix T Evaluation Detail – Commercial and Industrial Energy Management and New Construction Initiative

T.1 Gross Impact Evaluation

The Commercial and Industrial Energy Management and New Construction (CI EMNC) initiative has five subcomponents:

- The *Building Tune-Ups* subprogram is a direct-install effort targeting small and medium-sized businesses.
- The *New Construction* subprogram provides design assistance, energy calculations, and incentives for efficient new construction methods and equipment.
- The *Commissioning* subprogram for existing buildings includes both virtual and retro-commissioning components.
- The *Custom Building Improvements* subprogram provides incentives for envelope and equipment upgrades in existing buildings.
- The *Building Operations Certification* (BOC) subprogram provides incentives for qualified personnel to obtain BOC through a certified training program related to the efficient design, operations, and maintenance of buildings.
- The *MODIFY* subprogram, offered for Met-Ed and Penelec only, delivered boxes of 25 or 50 TLEDs to small business customers.

All six subprograms completed rebate applications in PY16.

T.1.1 Gross Impact Evaluation Methodology

As a first step, projects from the five subprograms are consolidated into four sub-initiatives by combining the Custom Building Improvements sub-initiative, and by combining the Commissioning and Custom Building Improvements projects into the *Custom Building/Retrocommissioning* (CBI-RCX) sub-initiative. Projects within the Building Tune-Ups sub-initiative are stratified according to savings, while all other sub-initiatives each have one sampling stratum. Projects are sampled randomly from the population of projects for impact evaluation, with activities for each sub-initiative described below.

T.1.1.1 Building Tune-Up

Each sampled building tune-up project first undergoes a desk review. The desk review includes reconciliation of invoices with fixture or equipment specification sheets (cut sheets) and re-calculating reported savings using TRM algorithms and/or ex-ante assumptions and identifying key parameters to be researched in the M&V plan. The Building Tune-Up program is new for Phase IV. ADM opted for on-site inspections of most sampled projects.

T.1.1.2 Commercial New Construction

Gross Impact Evaluation Activities

ADM sampled each project for evaluation and reviewed all documents and calculations. The program ICSP, Willdan, has built a process to promote and rebate new construction projects in a uniform manner. The process uses Willdan's Net Energy Optimizer (NEO) building simulation tool to develop baseline, design, and as-built simulation models. The NEO tool is a web-based front-end for the DOE2 simulation engine. Willdan has developed additional features to NEO to facilitate modeling efficiency measures such as machine room-less elevators and efficient food-service equipment. Willdan staff develop the baseline model as well as several design options that feature various energy efficiency measures and design changes. Once the participant selects the desired efficiency features and completes building construction, Willdan staff perform either an on-site or virtual inspection, and gather data to develop the final as-built simulation model. Project documentation includes a final verification report which lists all efficiency measures and provides itemized energy savings for each measure. ADM also requested and received access to online NEO models and DOE2 input and output files, including 8760 hourly energy simulation outputs for all sampled projects and for several projects that are in various phases of construction. If the project includes significant energy savings from lighting, Willdan provides an itemized lighting calculation.

ADM reviewed the baseline and as-build simulation models and performed parallel calculations using TRM algorithms for sampled measures within each project. Energy savings for measures that have prescriptive counterparts in the TRM are consistent with TRM calculations, within reasonable tolerances associated with the NEO calculation representing one specific instance or application of a measure, and the TRM representing a typical application of a measure within a market segment. The NEO framework assigns baseline lighting power densities (LPDs) in a manner similar to the TRM's Appendix C lighting calculator. This appears to be a hybrid application of whole-building and space-by-space strategies. For new construction projects that are generally not dominated by savings from the lighting end-use, this is a reasonable and consistent approach. Based on the review findings, the evaluation approach is to use the simulation output unless significant variances are found for certain measures, in which case ADM would modify the energy and demand impacts with extrinsic calculations.

As a final step, ADM analysts determine the incremental material and labor costs. In estimating the material and labor costs, preference is given first to invoices, then to the SWE incremental cost database, and then to the cost values from the CA DEER database, then to the costs used in the EDCs' EE&C plans.

T.1.1.3 Custom Building Improvements and Retrocommissioning

Building Improvement projects are varied in nature. As a result, calculation methods used for evaluation ranged from application of engineering algorithms for wall insulation and high-speed doors, to engineering models and whole building interval meter data analysis. Commissioning projects typically involved adjustment of setpoints and operation schedules and were primarily evaluated through analysis of pre- and post-implementation current logger data.

T.1.1.4 Building Operator Certification

Evaluation activities for the Building Operator Certification program component consisted of calculation reviews, verification of training completion through surveys and interviews, and verifying the building energy usage history through utility billing data. ADM calculated verified impacts with the updated version of the interim measure protocol for the measure, dated November of 2023.

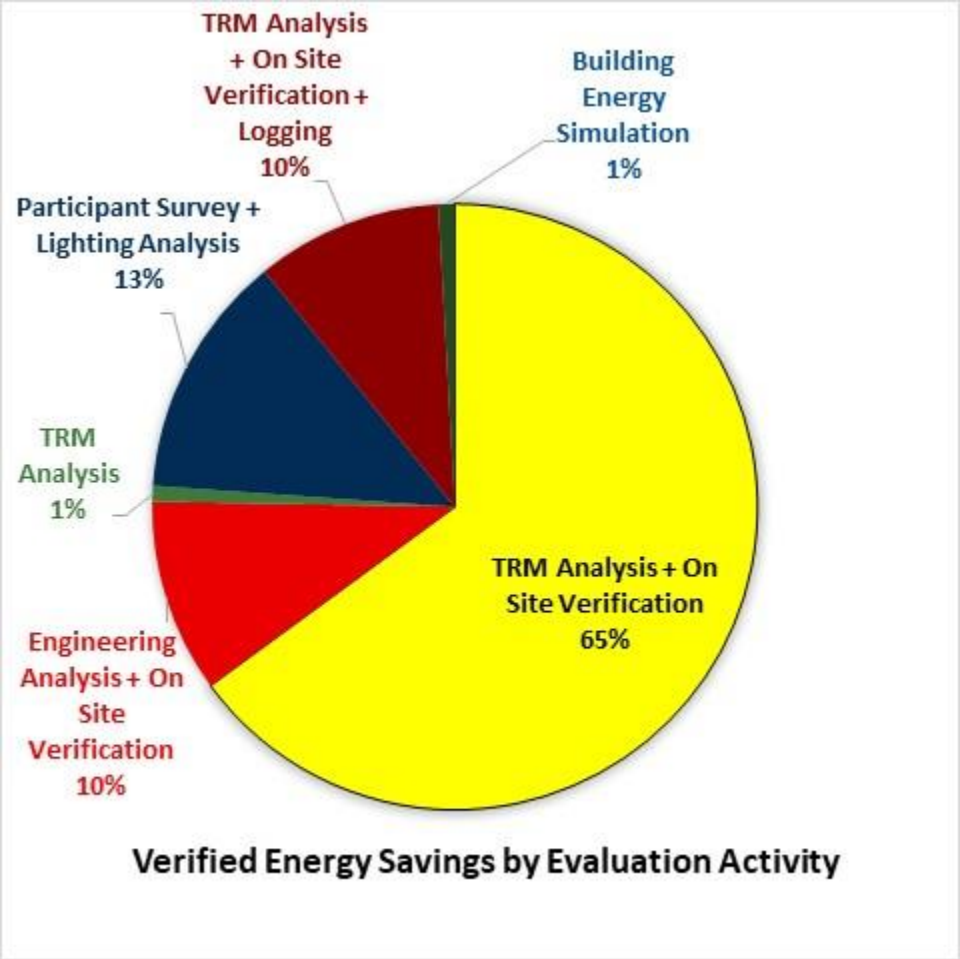
T.1.1.5 MODIFY

The MODIFY program component was evaluated through customer self-report surveys. For each EDC, ADM grouped customers by the outreach mode (e.g., door-to-door canvassing vs. outbound calls or emails/postcards),and then developed sample quotas for each group sufficient to reach ± 10% precision at the 85% confidence level. ADM conducted telephone surveys in June and July of 2025. The surveys confirmed the number of lamps that were installed, the baseline fixture types, and the lamp operation schedules. ADM then used data from the responses to compute energy and demand impacts.

T.1.1.6 Evaluation Activities Summary

Figure 11 shows the fraction of verified energy savings, as averaged over the four PA Companies, by primary evaluation activities.

Figure 11: Fraction of verified energy savings by evaluation activity.



T.1.2 Sampling

The sample designs for the four EDCs are shown in Table 372, Table 373, Table 374, and Table 375.

Table 372: CI Lighting Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-3	250	2	2	Desk Review; On-Site Verification
Building Tune-Ups-2	50	71	7	
Building Tune-Ups-1	0	237	6	
BOC-1	0	5	1	
CNC-1	0	1	1	
CBI-RCX-1	0	34	4	
EMNC-C	500	5	5	
MODIFY	0	2,329	67	
Program Total	**n/a**	**2,684**	**93**	

Table 373: CI EMNC Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-3	250	10	6	Desk Review; On-Site Verification
Building Tune-Ups-2	50	64	7	
Building Tune-Ups-1	0	204	8	
BOC-1	0	2	1	
CNC-1	0	1	1	
CBI-RCX-1	0	47	4	
EMNC-C	500	0	0	
MODIFY	0	2,493	71	
Program Total	**n/a**	**2,821**	**98**	

Table 374: CI EMNC Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-3	250	0	0	Desk Review; On-Site Verification
Building Tune-Ups-2	50	10	8	
Building Tune-Ups-1	0	39	8	
BOC-1	0	0	0	
CNC-1	0	2	2	
CBI-RCX-1	0	8	5	
EMNC-C	500	0	0	
MODIFY	0	0	0	
Program Total	**n/a**	**59**	**23**	

Table 375: CI EMNC Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-3	250	8	4	Desk Review; On-Site Verification
Building Tune-Ups-2	50	71	12	
Building Tune-Ups-1	0	174	9	
BOC-1	0	1	1	
CNC-1	0	3	2	
CBI-RCX-1	0	53	6	
EMNC-C	500	3	3	
MODIFY	0	0	0	
Program Total	**n/a**	**313**	**37**	

T.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 376, Table 377, Table 378, and Table 379 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 12 plots the verified energy savings against the reported energy savings for all evaluated EMNC projects for the program year. The figure includes data points from all four EDCs and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficient of variation of 0.5, but the actual error ratios are variable stratum by stratum, but overall tend to be somewhat lower than 0.4.

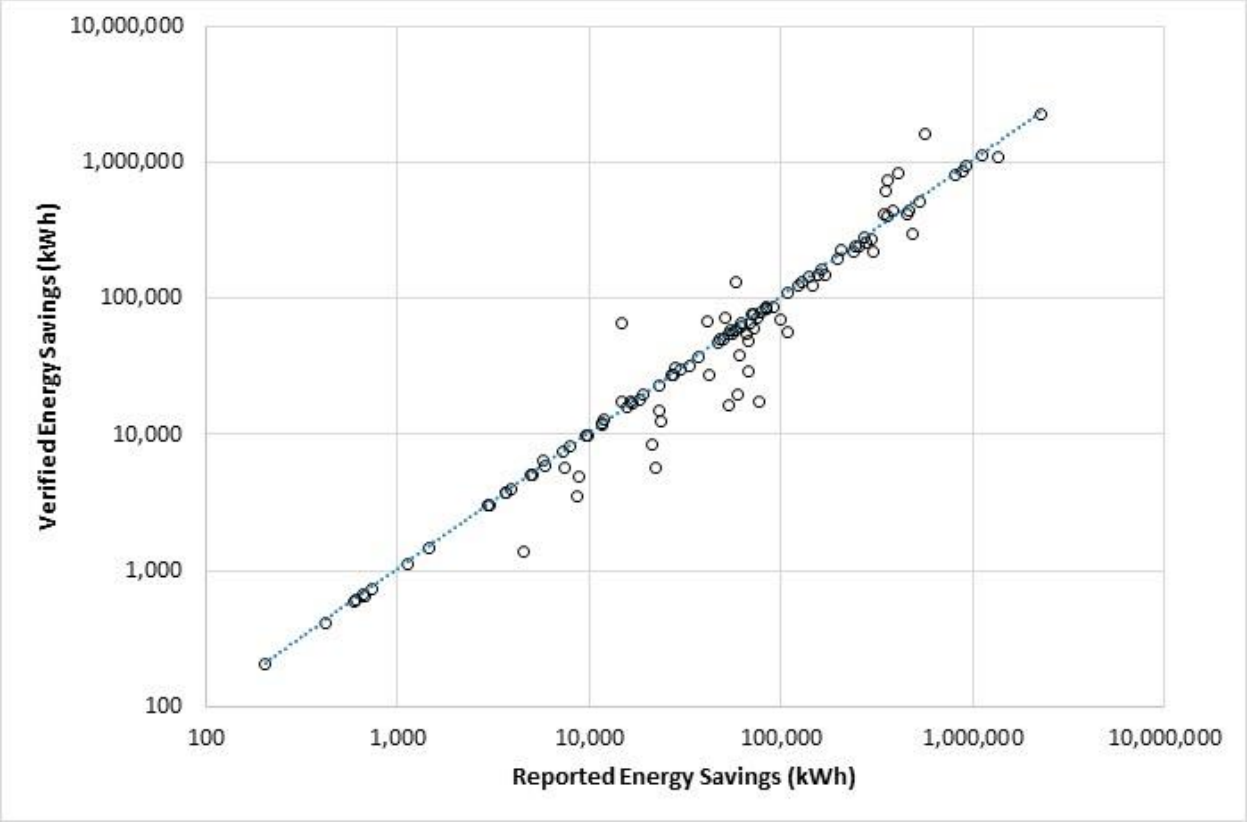


Figure 12: Verified vs. Reported Energy Savings for Sampled EMNC Projects.

Table 376: CI EMNC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-3	250	706	116.6%	0.5	0%
Building Tune-Ups-2	50	5,828	94.0%	0.5	26%
Building Tune-Ups-1	0	4,236	81.9%	0.5	29%
BOC-1	0	323	100.0%	0.5	64%
CNC-1	0	99	71.0%	0.5	0%
CBI-RCX-1	0	3,124	97.9%	0.5	34%
EMNC-C	500	5,430	94.0%	0.5	0%
MODIFY	0	4,572	35.7%	0.5	9%
Program Total	**n/a**	**24,318**	**82.1%**	**0.5**	**10.2%**

Table 377: CI EMNC Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-3	250	3,827	100.9%	0.5	19%
Building Tune-Ups-2	50	5,505	97.6%	0.5	26%
Building Tune-Ups-1	0	3,504	101.9%	0.5	25%
BOC-1	0	36	438.9%	0.5	51%
CNC-1	0	169	87.0%	0.5	0%
CBI-RCX-1	0	1,433	100.0%	0.5	34%
EMNC-C	500	0	100.0%	0.5	0%
MODIFY	0	4,598	50.7%	0.5	8%
Program Total	**n/a**	**19,072**	**88.5%**	**0.5**	**11.1%**

Table 378: CI EMNC Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-3	250	0	100.0%	0.5	0%
Building Tune-Ups-2	50	853	96.1%	0.5	11%
Building Tune-Ups-1	0	512	89.9%	0.5	23%
BOC-1	0	0	100.0%	0.5	0%
CNC-1	0	90	129.6%	0.5	0%
CBI-RCX-1	0	271	27.1%	0.5	20%
EMNC-C	500	0	100.0%	0.5	0%
MODIFY	0	0	0.0%	0.5	0%
Program Total	**n/a**	**1,726**	**85.2%**	**0.5**	**9.6%**

Table 379: CI EMNC Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-3	250	3,150	214.3%	0.5	25%
Building Tune-Ups-2	50	6,490	94.2%	0.5	19%
Building Tune-Ups-1	0	3,028	92.5%	0.5	23%
BOC-1	0	140	103.0%	0.5	0%
CNC-1	0	438	89.8%	0.5	29%
CBI-RCX-1	0	2,131	74.5%	0.5	28%
EMNC-C	500	2,951	99.3%	0.5	0%
MODIFY	0	0	0.0%	0.5	0%
Program Total	**n/a**	**18,328**	**113.1%**	**0.5**	**10.7%**

T.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 380, Table 381, Table 382, and Table 383 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 380: CI EMNC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-3	250	0.15	94.1%	0.5	0%
Building Tune-Ups-2	50	0.84	103.8%	0.5	26%
Building Tune-Ups-1	0	0.78	87.0%	0.5	29%
BOC-1	0	0.05	100.0%	0.5	64%
CNC-1	0	0.03	62.3%	0.5	0%
CBI-RCX-1	0	0.55	68.4%	0.5	34%
EMNC-C	500	1.01	94.6%	0.5	0%
MODIFY	0	1.20	39.3%	0.5	9%
Program Total	**n/a**	**4.61**	**77.3%**	**0.5**	**9.2%**

Table 381: CI EMNC Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-3	250	0.82	87.5%	0.5	19%
Building Tune-Ups-2	50	0.95	99.0%	0.5	26%
Building Tune-Ups-1	0	0.63	111.9%	0.5	25%
BOC-1	0	0.01	438.9%	0.5	51%
CNC-1	0	0.03	98.6%	0.5	0%
CBI-RCX-1	0	0.30	98.0%	0.5	34%
EMNC-C	500	0.00	100.0%	0.5	0%
MODIFY	0	1.20	61.5%	0.5	8%
Program Total	**n/a**	**3.94**	**87.8%**	**0.5**	**10.1%**

Table 382: CI EMNC Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-3	250	0.00	100.0%	0.5	0%
Building Tune-Ups-2	50	0.12	96.5%	0.5	11%
Building Tune-Ups-1	0	0.11	94.0%	0.5	23%
BOC-1	0	0.00	100.0%	0.5	0%
CNC-1	0	0.03	101.5%	0.5	0%
CBI-RCX-1	0	0.02	99.4%	0.5	20%
EMNC-C	500	0.00	100.0%	0.5	0%
MODIFY	0	0.00	0.0%	0.5	0%
Program Total	**n/a**	**0.28**	**96.3%**	**0.5**	**10.0%**

Table 383: CI EMNC Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-3	250	0.68	145.9%	0.5	25%
Building Tune-Ups-2	50	1.16	83.9%	0.5	19%
Building Tune-Ups-1	0	0.61	90.6%	0.5	23%
BOC-1	0	0.03	103.0%	0.5	0%
CNC-1	0	0.13	94.0%	0.5	29%
CBI-RCX-1	0	0.62	22.3%	0.5	28%
EMNC-C	500	0.50	100.0%	0.5	0%
MODIFY	0	0.00	0.0%	0.5	0%
Program Total	**n/a**	**3.73**	**88.8%**	**0.5**	**10.4%**

T.2 NET IMPACT EVALUATION

T.2.1 Net Impact Evaluation Methodology

In PY16, Tetra Tech assessed free-ridership through participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. The customer free-ridership portion captures two components: (1) intention to carry out the energy-efficient project without program funds, and (2) influence of the program in the decision to carry out the energy-efficient project. Customer-identified influential vendors were asked a series of questions assessing the program's influence on their recommendations to the customer(s) who identified them as being influential in their decision-making process to support the free-ridership assessment. Like the customer self-report methodology, an influence component score was calculated for each influential vendor specific to each project. If the vendor's influence score is greater than the customer's score from the participant survey, the vendor score replaced the customer score in the self-report free-ridership scoring algorithm, under the rationale that the vendor's recommendation was a program-attributable factor because the vendor, in turn, was influenced by the program.

In addition to free-ridership, the NTG evaluation also assessed both participant spillover and nonparticipant spillover. Participant spillover was assessed through participant customer self-reports. Nonparticipant spillover was estimated from vendor self-report surveys at the program component level (i.e., Custom and EMNC). According to the Pennsylvania Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates. Individual free-ridership and spillover rates from the customer and vendor surveys were weighted to adjust for proportional sampling differences, non-response, and claimed energy savings to calculate overall estimates.

The following sections provide information related to the net impact evaluation effort that informs the initiative's NTG values for PY16.

T.2.2 Sampling

The sample designs for the four EDCs are shown in Table 384, Table 385, Table 386, and Table 387 for Met-Ed, Penelec, Penn Power, and WPP respectively. Tetra Tech attempted outreach to the census of participants but it was not possible to achieve the desired quotas due to high refusal rates and high rates of partial survey completions. It was particularly difficult to reach and garner participation of Large C/I participants, although those that installed solar panels had higher response rates. Results from all four EDCs were combined as a remediation measure for the low response rates.

Table 384: CI EMNC Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Building Improvements	128	46	36%
New Construction	7	1	14%
BOC	8	5	63%
Building Tune-Ups	757	68	9%
MODIFY	2,329	67	3%
Program Total	**3,229**	**120**	**4%**

Table 385: CI EMNC Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Building Improvements	128	46	36%
New Construction	7	1	14%
BOC	8	5	63%
Building Tune-Ups	757	68	9%
MODIFY	2,493	69	3%
Program Total	**3,393**	**120**	**4%**

Table 386: CI EMNC Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Building Improvements	128	46	36%
New Construction	7	1	14%
BOC	8	5	63%
Building Tune-Ups	757	68	9%
MODIFY	0	0	na
Program Total	**900**	**120**	**13%**

Table 387: CI EMNC Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Building Improvements	128	46	36%
New Construction	7	1	14%
BOC	8	5	63%
Building Tune-Ups	757	68	9%
MODIFY	0	0	na
Program Total	**900**	**120**	**13%**

T.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 388, Table 389, Table 390, and Table 391 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 388: CI EMNC Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Building Tune-Ups	9,769	25.6%	3.5%	78.0%	8.5%
BOC	323	15.5%	0.0%	84.5%	66.7%
CNC-1	5,173	62.5%	0.0%	37.5%	19.7%
CBI-RCX-1	3,058	21.8%	0.3%	78.5%	8.3%
MODIFY	1,634	19.7%	0.0%	80.3%	8.7%
Program Total	**19,957**	**33.9%**	**1.8%**	**67.9%**	**6.0%**

Table 389: CI EMNC Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Building Tune-Ups	12,809	25.6%	3.5%	78.0%	8.5%
BOC	160	15.5%	0.0%	84.5%	66.7%
CNC-1	147	62.5%	0.0%	37.5%	19.7%
CBI-RCX-1	1,433	21.8%	0.3%	78.5%	8.3%
MODIFY	2,333	17.9%	0.0%	82.1%	8.5%
Program Total	**16,882**	**24.4%**	**2.7%**	**78.3%**	**6.6%**

Table 390 CI EMNC Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Building Tune-Ups	1,280	25.6%	3.5%	78.0%	8.5%
BOC	0	15.5%	0.0%	84.5%	66.7%
CNC-1	116	62.5%	0.0%	37.5%	19.7%
CBI-RCX-1	74	21.8%	0.3%	78.5%	8.3%
MODIFY	0	0.0%	0.0%	0.0%	0.0%
Program Total	**1,470**	**28.3%**	**3.1%**	**74.8%**	**7.8%**

Table 391 CI EMNC Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Building Tune-Ups	15,666	25.6%	3.5%	78.0%	8.5%
BOC	144	15.5%	0.0%	84.5%	66.7%
CNC-1	3,325	62.5%	0.0%	37.5%	19.7%
CBI-RCX-1	1,587	21.8%	0.3%	78.5%	8.3%
MODIFY	0	0.0%	0.0%	0.0%	0.0%
Program Total	**20,722**	**31.1%**	**2.7%**	**71.6%**	**7.2%**

Appendix U Evaluation Detail – Commercial and Master-Metered Multifamily Direct Install Initiative

The Commercial Master-Metered Multifamily Direct Install (CI MF) Initiative targets master-metered communities that house income-qualified tenants. A participant in this program is defined as a unique address in the program, multiple projects can be installed at one address. This program consists of brief energy audits performed by CLEAResult along with energy efficiency measures directly installed in customers' dwelling units and in common areas. The audit is used to identify low-cost energy savings opportunities, with associated energy savings measures directly installed in the unit during the audit. Low-cost measures installed in PY16 included light bulbs, refrigerator replacement, nightlights, smart power strips, energy saving showerheads and aerators, LED exit signs, and common area lighting. Refrigerator replacement and lighting upgrades were the two most significant measures.

U.1 Gross Impact Evaluation

U.1.1.1 Gross Impact Evaluation Activities.

Each sampled project first undergoes a desk review. The desk review includes reconciliation of invoices with fixture or equipment specification sheets (cut sheets), re-calculating reported savings using TRM algorithms and/or ex-ante assumptions, and identifying key parameters to be researched in the M&V plan. ADM opted for on-site inspections for about two-third of sampled projects, as weighted by reported savings. The following sections describe the previous evaluation activities that informed the PY16 realization rates.

U.1.2 Sampling

Table 392, Table 393, Table 394, and Table 395 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 392: CI MF Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	11	9	Desk Review,
Program Total	**n/a**	**11**	9	On-Site Verification,

Table 393: CI MF Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	9	7	Desk Review,
Program Total	**n/a**	9	7	On-Site Verification,

Table 394: CI MF Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	3	3	Desk Review, On-Site Verification,
Program Total	**n/a**	**3**	**3**	

Table 395: CI MF Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	4	4	Desk Review, On-Site Verification,
Program Total	**n/a**	**4**	**4**	

U.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 396, Table 397, Table 398, and Table 399 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 13 plots the verified energy savings against the reported energy savings for all projects evaluated in the program year. The figure includes data points from all four EDCs and is designed to show the reader the correspondence between reported and verified impacts.

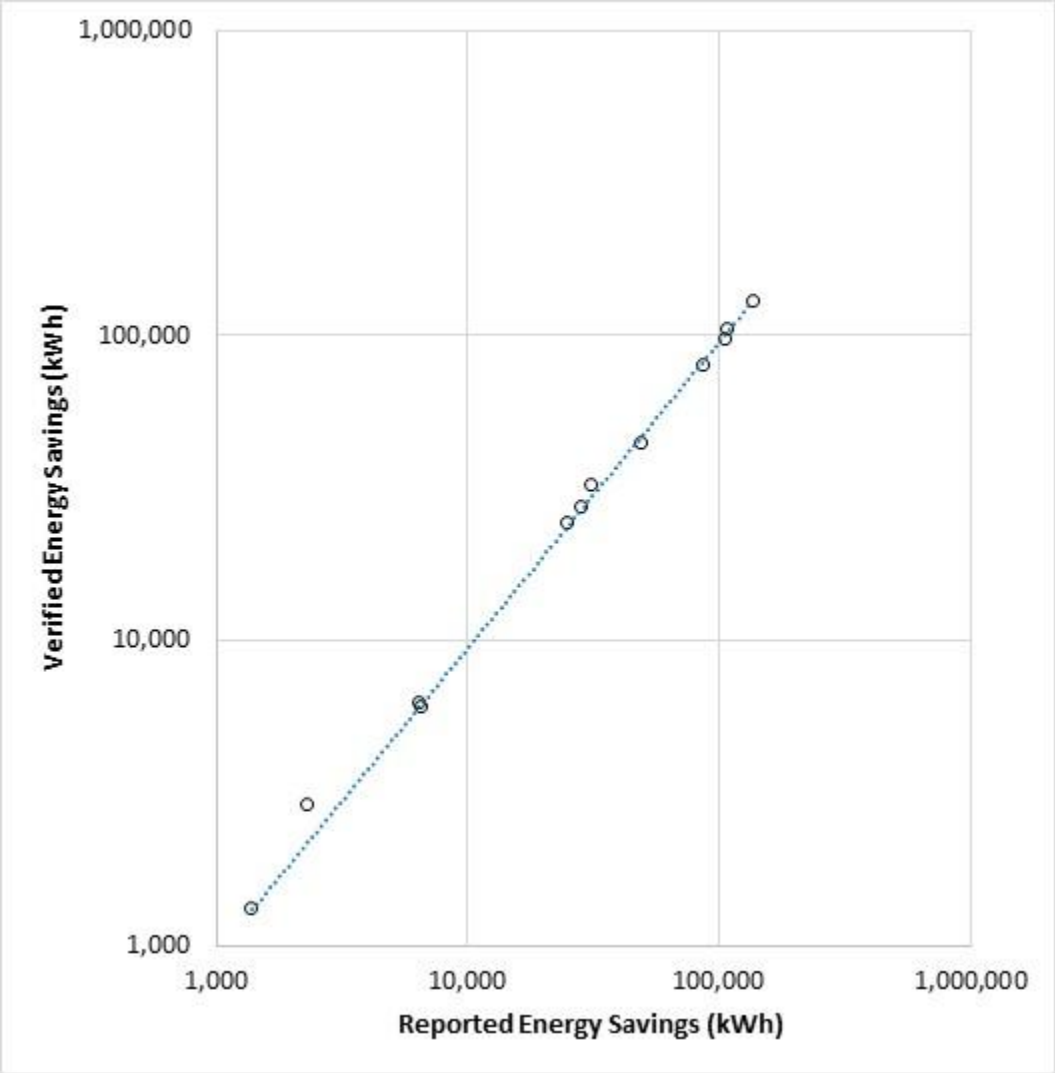


Figure 13: Verified vs. Reported Energy Savings for Sampled Multifamily Projects.

Table 396: CI MF Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	712	104.2%	0.5	10%
Program Total	**n/a**	**712**	**104.2%**	**0.5**	**10.7%**

Table 397: CI MF Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	834	92.8%	0.5	13%
Program Total	**n/a**	**834**	**92.8%**	**0.5**	**11.9%**

Table 398: CI MF Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	38	102.4%	0.5	0%
Program Total	**n/a**	**38**	**102.4%**	**0.5**	**0.0%**

Table 399: CI MF Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	40	101.1%	0.5	0%
Program Total	**n/a**	**40**	**101.1%**	**0.5**	**0.0%**

U.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 400, Table 401, Table 402, and Table 403 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 400: CI MF Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	0.10	112.3%	0.5	10%
Program Total	**n/a**	**0.10**	**112.3%**	**0.5**	**11.5%**

Table 401: CI MF Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	0.11	102.7%	0.5	13%
Program Total	**n/a**	**0.11**	**102.7%**	**0.5**	**13.2%**

Table 402: CI MF Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	0.01	103.1%	0.5	0%
Program Total	**n/a**	**0.01**	**103.1%**	**0.5**	**0.0%**

Table 403: CI MF Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	0.00	105.3%	0.5	0%
Program Total	**n/a**	**0.00**	**105.3%**	**0.5**	**0.0%**

U.2 NET IMPACT EVALUATION

Tetra Tech conducted a net impact evaluation for the CI MF initiative in PY15. The NTG evaluation relies on the survey of building owners/managers, who can report on behalf of multiple buildings because they are the decision-makers for what services and energy-saving upgrades can be provided to tenants or in common areas. Survey questions to estimate free-ridership and spillover and analysis algorithms follow the standardized self-report methodology described in the evaluation framework. Due to the small population size and a limited number of respondents, NTG ratios are estimated across the Multifamily subprograms (combining the residential and C&I components) and across EDCs. The population sizes, achieved sample sizes, and response rates from the study are shown in Table 211 in Appendix H.2. Although sample sizes were small – limited by the small number of distinct property managers or apartment owners – both freeridership and spillover estimates were consistently low among EDC-specific subpopulations. A total of 14 owners/managers responded to the NTG survey (a response rate of 30.4%). The average freeridership was 0.6%, the average spillover was 0%, and the average NTG ratio was 99.5%.

Appendix V Evaluation Detail – C&I Appliance Recycling Sub-Initiative

V.1 Gross Impact Evaluation

Gross impact evaluation for the C&I Appliance Recycling sub-initiative consisted of applying realization rates from the broader initiative-level evaluation which includes the dominant residential and low-income residential components.

V.1.1 Sampling

Table 404, Table 405, Table 406, and Table 407 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively. A census of sites was not selected for customer surveys. Rather, tracking and reporting data were reviewed for consistency in formulation with the residential components so that the realization rates from the residential surveys could be applied. Note that the overall precision for the ATI initiative is the combined precision of the low income, non-low-income, and nonresidential components. The combined precisions for each EDC are shown in Table 230 in Appendix J. The sample size is set to equal the population size because the main evaluation activities - reviewing tracking data and deeming realization rates from residential and low-income ATI projects - applied to the census of sites.

Table 404: C&I ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	57	57	T&R Review, Deem RR from ATI
Program Total	**57**	**57**	

Table 405: C&I ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	44	44	T&R Review, Deem RR from ATI
Program Total	**44**	**44**	

Table 406: C&I ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	10	10	T&R Review, Deem RR from ATI
Program Total	**10**	**10**	

Table 407: C&I ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	51	51	T&R Review, Deem RR from ATI
Program Total	**51**	**51**	

V.1.2 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 408, Table 409, Table 410, Table 411, and for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 408: C&I ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	63	108.5%	0.5	0.0%
Program Total	**63**	**108.5%**	**0.5**	**0.0%**

Table 409: C&I ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	46	103.4%	0.5	0.0%
Program Total	**46**	**103.4%**	**0.5**	**0.0%**

Table 410: C&I ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	12	108.4%	0.5	0.0%
Program Total	**12**	**108.4%**	**0.5**	**0.0%**

Table 411: C&I ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	51	109.2%	0.5	0.0%
Program Total	**51**	**109.2%**	**0.5**	**0.0%**

V.1.3 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 412, Table 413, Table 414, and Table 415 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 412: C&I ATI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0.01	113.7%	0.5	0.0%
Program Total	**0.01**	**113.7%**	**0.5**	**0.0%**

Table 413: C&I ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0.02	103.4%	0.5	0.0%
Program Total	**0.02**	**103.4%**	**0.5**	**0.0%**

Table 414: C&I ATI Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0.00	108.7%	0.5	0.0%
Program Total	**0.00**	**108.7%**	**0.5**	**0.0%**

Table 415: C&I ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0.01	108.7%	0.5	0.0%
Program Total	**0.01**	**108.7%**	**0.5**	**0.0%**

V.2 Net Impact Evaluation

V.2.1 Net Impact Evaluation Methodology

An independent net impact evaluation was not conducted for this initiative because the initiative accounts for less than 0.1% of portfolio impacts, as averaged for the four PA Companies. The Net-to-Gross ratios for the C&I Appliance Recycling program were taken to be the same as the Net-to-Gross ratios for the residential component of the Appliance Recycling program.

Appendix W Report Validation

W.1 LINKED IMAGES

Most tables and charts in this report are images that are generated within an excel file. The last image should reflect the time and date of report compilation.

Table 416: Report Update Timestamp

Tables and Charts Updated on 09/26/25, at 15:17