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September 30, 2024

VIA ELECTRONIC FILING

Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
400 North Street
Harrisburg, PA 17120

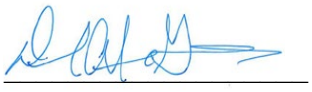
RE: Final Annual Report to the Pennsylvania Public Utility Commission and Act 129 Statewide Evaluator; Phase IV Program year Period June 1, 2023, to May 31, 2024, for Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company and West Penn Power Company;
Docket Nos. M-2020-3020820, M-2020-3020821, M-2020-3020822, and M-2020-3020823

Dear Secretary Chiavetta:

Enclosed please find the Final Annual Report to the Pennsylvania Public Utility Commission in the above-captioned matter for 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,



Daniel A. Garcia

DG/mlr

Enclosure

cc: Certificate of Service

Final Annual Report to the Pennsylvania Public Utility Commission

Phase IV of Act 129

Program Year 15

(June 1, 2023 – May 31, 2024)

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, 2024

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
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
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., PY15, from June 1, 2023, to May 31, 2024
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 15 (PY15) 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 PY15. 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

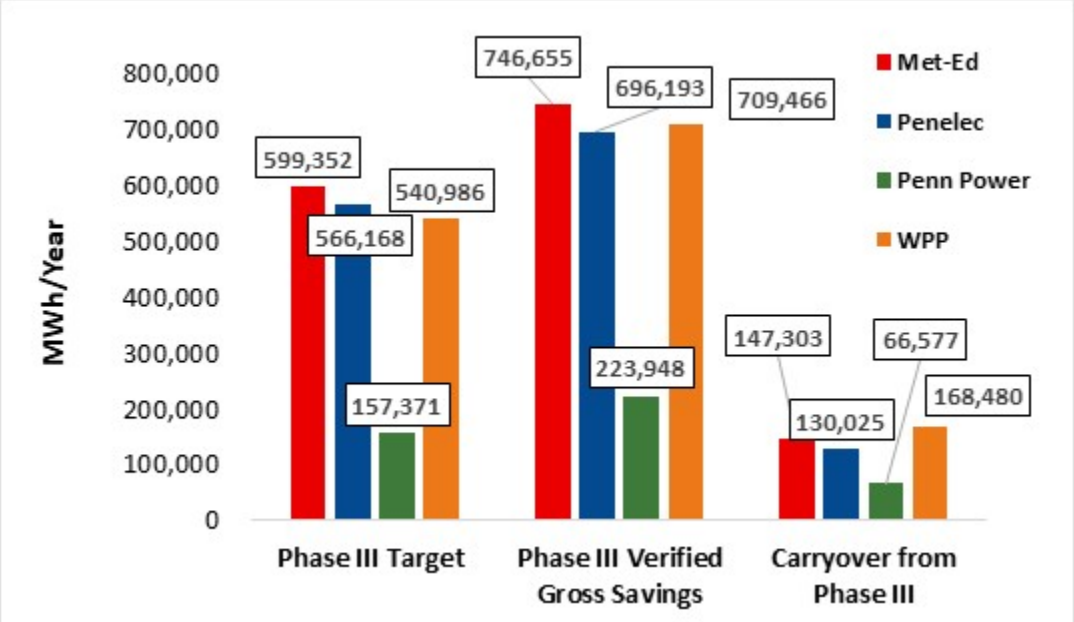
2.1 Carryover Savings from Phase III of Act 129

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

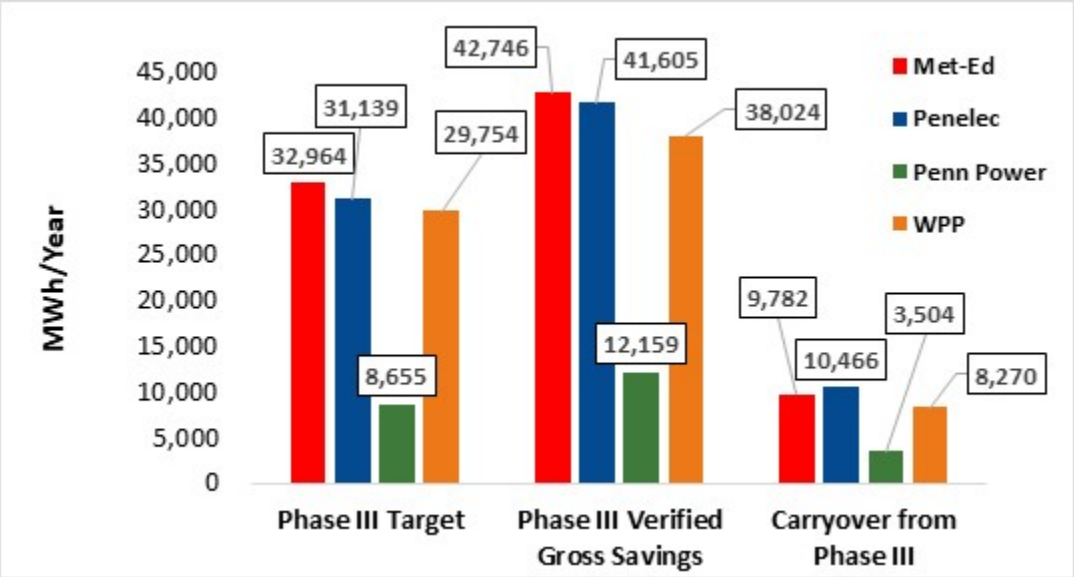
FirstEnergy EDC	Phase IV Carryover Savings (MWh/Year)	Phase IV Low-Income Carryover Savings (MWh/Year)
Met-Ed	147,303	9,782
Penelec	130,025	10,466
Penn Power	66,577	3,504
West Penn Power	168,480	8,270

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 15 on June 1, 2023, 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 PY15

EDC	PYRTD MWh	PYRTD MW	PYVTD MWh	PYVTD MW
Met-Ed	79,844	13.7	84,633	12.2
Penelec	80,365	12.9	71,173	11.8
Penn Power	26,812	4.3	25,188	4.4
West Penn Power	86,152	15.7	83,528	13.6

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	215,702	35.5	216,844	33.07
Penelec	186,814	33.1	179,539	31.12
Penn Power	62,967	10.9	59,407	10.03
West Penn Power	209,958	36.9	207,337	32.16

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	364,147	463,215	79%	33.1	76	44%
Penelec	309,564	437,676	71%	31.1	80	39%
Penn Power	125,984	128,909	98%	10.0	20	50%
West Penn Power	375,817	504,951	74%	32.2	86	37%

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

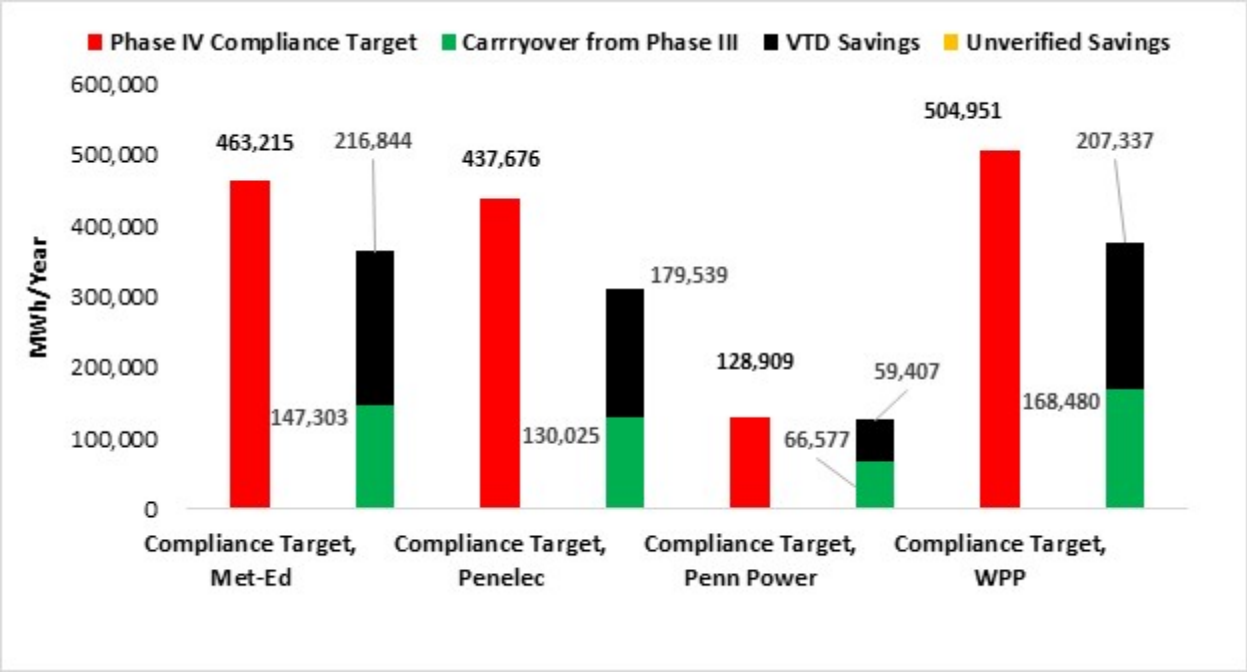
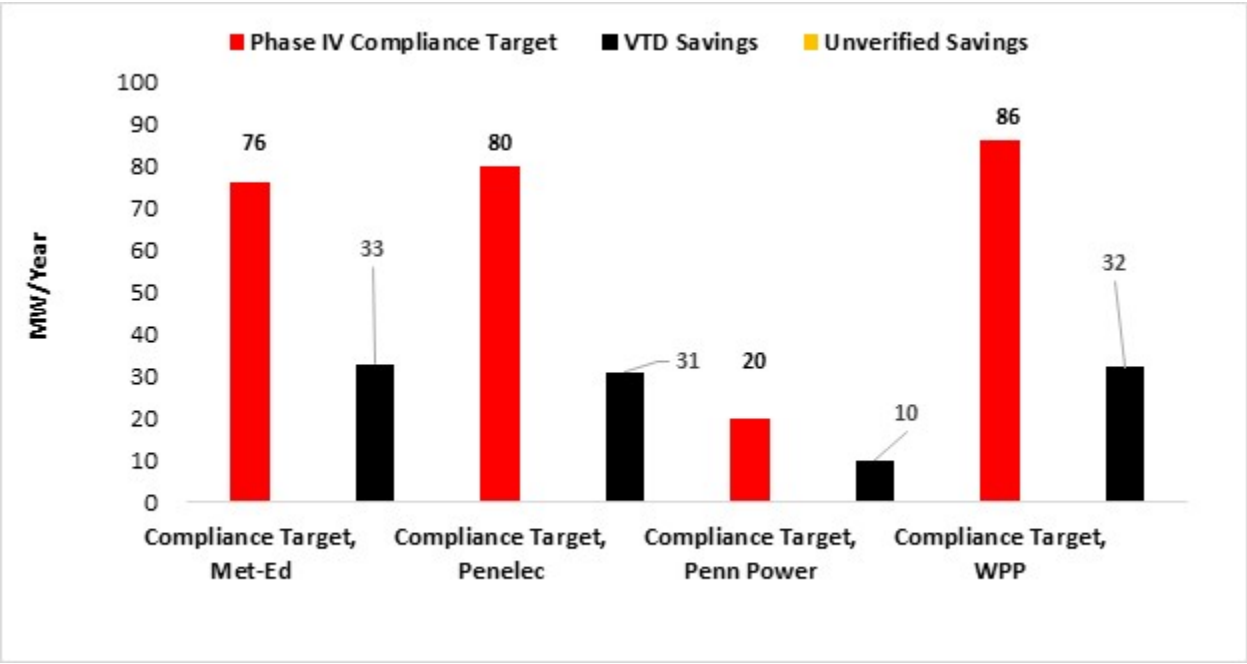


Figure 4: EE&C Plan Performance toward Phase IV Portfolio Compliance Target



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%	175	31	18%
Penelec	10%	175	31	18%
Penn Power	11%	175	31	18%
West Penn Power	9%	175	31	18%

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.

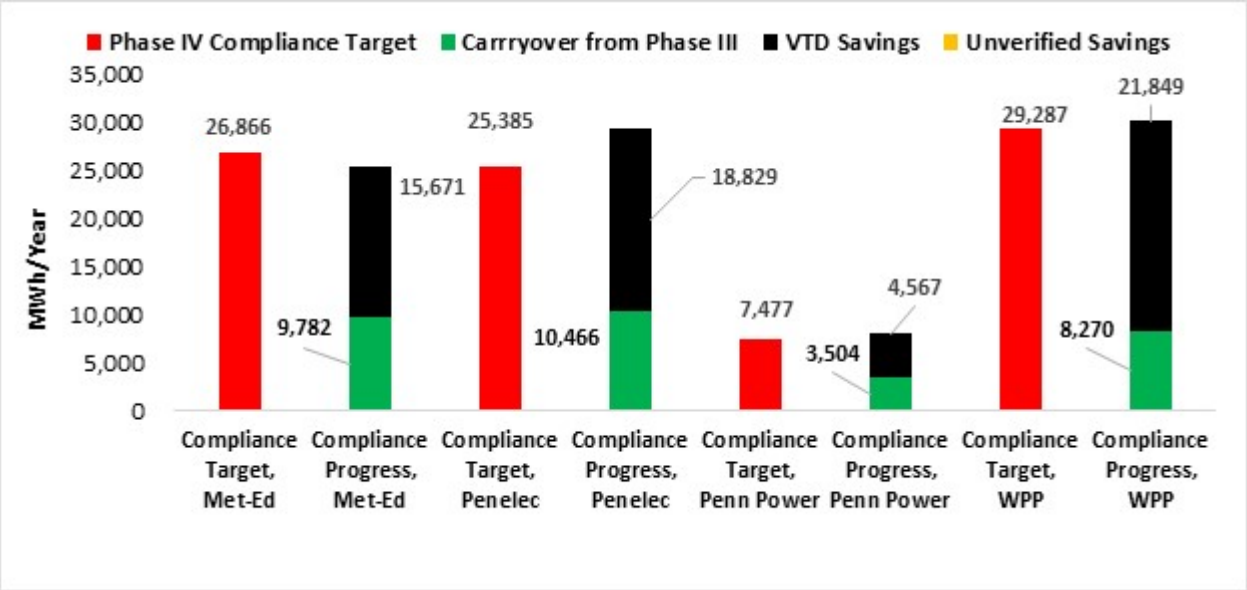
Table 6: Low-Income Program Energy Savings and Targets[5]

EDC	Compliance Target	LI VTD +CO MWh	Percent of Target to Date
Met-Ed	26,866	25,453	95%
Penelec	25,385	29,295	115%
Penn Power	7,477	8,070	108%
West Penn Power	29,287	30,119	103%

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	1,187	1,127	2,109	1,585
Penelec	1,353	1,257	2,677	2,513
Penn Power	67	61	241	234
West Penn Power	1,100	1,018	3,155	3,003

2.3 PHASE IV PERFORMANCE BY CUSTOMER SEGMENT

Table 8 presents the participation[6], savings, and spending by customer sector for PY15. 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. § 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

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

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 15 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	148,823	34,727	1,061	253	21	184,885
	PYVTD MWh/yr	24,813	6,382	31,521	21,191	725	84,633
	PYVTD MW/yr	3.33	0.83	5.12	2.79	0.11	12.17
	Incentives ($1000)	$3,632	$1,937	$8,004	$1,437	$188	$15,197
Penelec	# participants	153,720	25,195	1,183	188	28	180,314
	PYVTD MWh/yr	16,983	6,453	25,745	21,099	894	71,173
	PYVTD MW/yr	2.41	0.69	4.69	3.88	0.18	11.85
	Incentives ($1000)	$2,531	$2,932	$7,679	$1,912	$209	$15,263
Penn Power	# participants	44,663	10,253	282	92	6	55,296
	PYVTD MWh/yr	7,052	1,531	6,704	9,789	112	25,188
	PYVTD MW/yr	1.19	0.21	1.31	1.65	0.02	4.38
	Incentives ($1000)	$1,274	$654	$2,006	$948	$34	$4,916
West Penn Power	# participants	169,847	28,807	1,281	237	25	200,197
	PYVTD MWh/yr	20,272	7,676	30,903	23,686	991	83,528
	PYVTD MW/yr	3.02	0.88	5.66	3.86	0.17	13.59
	Incentives ($1000)	$3,266	$3,408	$8,030	$2,745	$339	$17,787

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	362,492	70,095	1,839	457	68	434,951
	VTD MWh/yr	72,723	14,492	53,569	73,848	2,211	216,844
	VTD MW	11.8	2.1	9	10	0	33.1
	Incentives ($1000)	11,912	4,423	11,171	3,270	476	31,252
Penelec	# participants	356,182	63,571	2,374	339	58	422,524
	VTD MWh/yr	59,156	17,040	59,841	41,887	1,614	179,539
	VTD MW	9.4	2.0	12	7	0	31.1
	Incentives ($1000)	8,218	6,121	13,067	2,775	299	30,480
Penn Power	# participants	114,269	21,744	542	133	27	136,715
	VTD MWh/yr	22,255	4,408	12,699	18,728	1,317	59,407
	VTD MW	4.0	0.6	2	3	0	10.0
	Incentives ($1000)	3,685	1,589	3,497	1,524	189	10,484
West Penn Power	# participants	386,442	64,248	2,499	423	42	453,654
	VTD MWh/yr	66,218	19,807	64,371	55,081	1,861	207,337
	VTD MW	10.7	2.4	11	8	0	32.2
	Incentives ($1000)	10,568	6,650	13,794	4,474	490	35,976

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 PY15 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	PY15 Participation	P4TD Participation
Met-Ed	Energy Efficient Homes	125,248	286,842
	Energy Efficient Products	23,575	75,650
	Low Income Energy Efficiency	34,727	70,095
	C&I Energy Solutions for Business - Small	1,076	1,889
	C&I Energy Solutions for Business - Large	259	475
	Portfolio Total	**184,885**	**434,951**
Penelec	Energy Efficient Homes	134,781	292,621
	Energy Efficient Products	18,939	63,561
	Low Income Energy Efficiency	25,195	63,571
	C&I Energy Solutions for Business - Small	1,208	2,427
	C&I Energy Solutions for Business - Large	191	344
	Portfolio Total	**180,314**	**422,524**
Penn Power	Energy Efficient Homes	37,442	89,011
	Energy Efficient Products	7,221	25,258
	Low Income Energy Efficiency	10,253	21,744
	C&I Energy Solutions for Business - Small	287	562
	C&I Energy Solutions for Business - Large	93	140
	Portfolio Total	**55,296**	**136,715**
West Penn Power	Energy Efficient Homes	149,211	317,879
	Energy Efficient Products	20,636	68,563
	Low Income Energy Efficiency	28,807	64,248
	C&I Energy Solutions for Business - Small	1,304	2,537
	C&I Energy Solutions for Business - Large	239	427
	Portfolio Total	**200,197**	**453,654**

2.5 Summary of Impact Evaluation Results

During PY15 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 PY15, 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/ Initiative	Parent 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	88.6%	89.0%	82.1%	97.0%	96.5%	106.4%
Home Energy Reports	Energy Efficient Homes	80.6%	41.7%	100.0%	18.7%	108.1%	100.0%
Direct Install	Energy Efficient Homes	109.3%	73.7%	86.7%	114.7%	71.3%	99.1%
New Homes	Energy Efficient Homes	100.5%	106.8%	72.0%	101.4%	124.3%	72.0%
Multifamily	Energy Efficient Homes	109.4%	84.3%	99.5%	121.5%	95.7%	99.5%
Online Audits	Energy Efficient Homes	73.2%	114.4%	100.0%	81.4%	111.9%	100.0%
Appliance Recycling	Energy Efficient Products	109.2%	106.2%	39.0%	107.2%	102.4%	65.0%
Upstream Electronics	Energy Efficient Products	0.0%	0.0%	58.3%	0.0%	0.0%	58.3%
HVAC	Energy Efficient Products	151.8%	113.2%	50.6%	100.0%	164.0%	69.7%
Appliances	Energy Efficient Products	110.4%	106.0%	67.9%	102.3%	103.3%	49.4%
Midstream Appliances	Energy Efficient Products	103.0%	87.1%	47.2%	97.4%	85.3%	53.1%
Appliances	Low Income Program	110.4%	106.0%	100.0%	102.3%	103.3%	100.0%
Appliance Turn-In	Low Income Program	107.2%	102.4%	100.0%	103.2%	101.6%	100.0%
Direct Install	Low Income Program	100.9%	101.1%	100.0%	99.7%	99.2%	100.0%
Home Energy Reports	Low Income Program	156.6%	43.2%	100.0%	41.7%	-611.6%	100.0%
Kits	Low Income Program	91.0%	95.4%	100.0%	99.1%	100.4%	100.0%
New Homes	Low Income Program	100.5%	106.8%	100.0%	101.4%	124.3%	100.0%
Online Audits	Low Income Program	461.2%	647.4%	100.0%	508.0%	639.7%	100.0%
CI Prescriptive	C&I Solutions for Business Programs - Small and Large	123.4%	88.6%	61.7%	97.3%	94.6%	66.0%
CI Custom	C&I Solutions for Business Programs - Small and Large	100.4%	98.3%	57.1%	92.8%	84.6%	52.1%
CI EMNC	C&I Solutions for Business Programs - Small and Large	100.0%	96.5%	97.8%	89.3%	81.5%	83.8%
CI Multifamily	C&I Solutions for Business Program - Small	100.5%	92.2%	99.5%	100.5%	92.2%	99.5%
Appliance Recycling	C&I Solutions for Business Program - Small	109.2%	106.2%	39.0%	107.2%	102.4%	65.0%

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

Program/ Initiative	Parent 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	103.8%	102.1%	85.9%	80.3%	81.2%	96.3%
Home Energy Reports	Energy Efficient Homes	-3.5%	115.4%	100.0%	58.5%	25.2%	100.0%
Direct Install	Energy Efficient Homes	110.9%	78.3%	94.1%	112.3%	83.8%	91.3%
New Homes	Energy Efficient Homes	101.4%	112.7%	72.0%	105.6%	101.4%	72.0%
Multifamily	Energy Efficient Homes	113.2%	85.4%	99.5%	111.8%	83.9%	99.5%
Online Audits	Energy Efficient Homes	71.2%	104.8%	100.0%	70.5%	105.4%	100.0%
Appliance Recycling	Energy Efficient Products	99.3%	97.9%	38.0%	103.2%	101.6%	70.0%
Upstream Electronics	Energy Efficient Products	0.0%	0.0%	58.3%	0.0%	0.0%	58.3%
HVAC	Energy Efficient Products	163.1%	140.6%	54.7%	152.4%	133.5%	54.8%
Appliances	Energy Efficient Products	106.2%	106.5%	52.3%	106.8%	104.4%	52.2%
Midstream Appliances	Energy Efficient Products	97.0%	85.5%	44.0%	97.1%	83.3%	50.8%
Appliances	Low Income Program	106.2%	106.5%	100.0%	106.8%	104.4%	100.0%
Appliance Turn-In	Low Income Program	106.7%	97.8%	100.0%	112.5%	108.4%	100.0%
Direct Install	Low Income Program	100.9%	100.8%	100.0%	100.1%	100.1%	100.0%
Home Energy Reports	Low Income Program	60.4%	191.3%	100.0%	100.5%	-16.1%	100.0%
Kits	Low Income Program	103.8%	102.1%	100.0%	80.3%	81.2%	100.0%
New Homes	Low Income Program	101.4%	112.7%	100.0%	105.6%	101.4%	100.0%
Online Audits	Low Income Program	442.0%	607.4%	100.0%	486.8%	626.8%	100.0%
CI Prescriptive	C&I Solutions for Business Programs - Small and Large	100.5%	107.3%	80.6%	103.1%	98.6%	67.0%
CI Custom	C&I Solutions for Business Programs - Small and Large	95.1%	94.5%	100.0%	84.9%	51.8%	49.1%
CI EMNC	C&I Solutions for Business Programs - Small and Large	79.9%	83.1%	97.3%	102.1%	88.6%	110.0%
CI Multifamily	C&I Solutions for Business Program - Small	100.5%	92.2%	99.5%	100.5%	92.2%	99.5%
Appliance Recycling	C&I Solutions for Business Program - Small	99.3%	97.9%	38.0%	103.2%	101.6%	70.0%

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 15 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	19,000	16,656	14,283	52,053	42,075	35,650
Energy Efficient Products	7,259	8,157	4,025	27,888	30,648	14,202
Low Income Program	5,602	6,382	6,382	13,671	14,492	14,492
C&I Solutions for Business Program - Small	29,413	32,061	24,678	52,200	55,428	41,516
C&I Solutions for Business Program - Large	18,570	21,376	13,978	69,889	74,200	45,491
Portfolio Total	**79,844**	**84,633**	**63,346**	**215,702**	**216,844**	**151,351**

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	19,388	12,971	13,576	46,495	39,952	36,916
Energy Efficient Products	4,054	4,012	2,256	18,424	19,204	11,107
Low Income Program	6,258	6,453	6,453	16,053	17,040	17,040
C&I Solutions for Business Program - Small	28,195	26,431	19,436	63,224	61,081	45,957
C&I Solutions for Business Program - Large	22,470	21,306	14,044	42,617	42,261	28,147
Portfolio Total	**80,365**	**71,173**	**55,765**	**186,814**	**179,539**	**139,167**

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	5,591	5,427	4,478	15,783	14,731	12,417
Energy Efficient Products	1,518	1,624	763	7,194	7,524	3,314
Low Income Program	1,702	1,531	1,531	4,827	4,408	4,408
C&I Solutions for Business Program - Small	7,596	6,815	6,053	14,836	13,343	11,837
C&I Solutions for Business Program - Large	10,405	9,790	8,814	20,327	19,401	15,476
Portfolio Total	**26,812**	**25,188**	**21,639**	**62,967**	**59,407**	**47,453**

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	19,477	15,230	14,165	51,406	42,115	41,976
Energy Efficient Products	4,600	5,042	2,717	22,388	24,103	14,255
Low Income Program	7,260	7,676	7,676	18,460	19,807	19,807
C&I Solutions for Business Program - Small	31,119	31,756	27,338	64,421	66,002	53,124
C&I Solutions for Business Program - Large	23,696	23,824	18,774	53,284	55,311	38,997
Portfolio Total	**86,152**	**83,528**	**70,671**	**209,958**	**207,337**	**168,159**

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.

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

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	165,597	134,582	451,078	364,853
Energy Efficient Products	87,643	43,785	283,115	136,073
Low Income Energy Efficiency	41,500	41,500	115,785	115,785
C&I Energy Solutions for Business - Small	451,753	343,043	785,798	582,933
C&I Energy Solutions for Business - Large	304,733	197,215	1,085,383	663,050
Portfolio Total	**1,051,227**	**760,126**	**2,721,159**	**1,862,695**

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	145,061	152,886	440,750	401,169
Energy Efficient Products	43,584	24,617	173,511	97,184
Low Income Energy Efficiency	47,569	47,569	143,517	143,517
C&I Energy Solutions for Business - Small	375,651	273,836	876,256	655,138
C&I Energy Solutions for Business - Large	305,970	200,642	609,973	405,231
Portfolio Total	**917,834**	**699,551**	**2,244,007**	**1,702,239**

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	70,501	57,411	173,600	141,813
Energy Efficient Products	18,258	8,710	71,714	32,670
Low Income Energy Efficiency	7,309	7,309	33,012	33,012
C&I Energy Solutions for Business - Small	96,230	85,133	189,532	167,751
C&I Energy Solutions for Business - Large	135,829	121,530	278,476	220,199
Portfolio Total	**328,127**	**280,093**	**746,334**	**595,445**

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	156,198	141,394	462,486	457,760
Energy Efficient Products	55,955	29,727	215,274	120,080
Low Income Energy Efficiency	53,721	53,721	159,492	159,492
C&I Energy Solutions for Business - Small	451,642	383,663	948,333	754,330
C&I Energy Solutions for Business - Large	351,571	275,607	814,957	572,942
Portfolio Total	**1,069,087**	**884,111**	**2,600,542**	**2,064,603**

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	2.63	2.04	1.71	7.55	5.69	4.72
Energy Efficient Products	1.37	1.29	0.63	6.04	6.13	2.77
Low Income Energy Efficiency	0.99	0.83	0.83	2.08	2.11	2.11
C&I Energy Solutions for Business - Small	5.59	5.20	3.86	9.73	9.30	6.79
C&I Energy Solutions for Business - Large	3.10	2.82	1.88	10.08	9.83	6.14
Portfolio Total	**13.68**	**12.17**	**8.90**	**35.47**	**33.07**	**22.54**

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	1.61	1.60	1.65	5.32	5.08	4.73
Energy Efficient Products	0.87	0.80	0.45	4.35	4.36	2.54
Low Income Energy Efficiency	0.69	0.69	0.69	2.02	1.97	1.97
C&I Energy Solutions for Business - Small	5.37	4.83	3.42	13.58	12.55	9.45
C&I Energy Solutions for Business - Large	4.41	3.92	2.51	7.83	7.15	4.69
Portfolio Total	**12.95**	**11.85**	**8.73**	**33.10**	**31.12**	**23.38**

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	0.83	0.89	0.72	2.83	2.40	2.01
Energy Efficient Products	0.32	0.30	0.14	1.60	1.60	0.70
Low Income Energy Efficiency	0.16	0.21	0.21	0.58	0.61	0.61
C&I Energy Solutions for Business - Small	1.36	1.33	1.15	2.84	2.53	2.21
C&I Energy Solutions for Business - Large	1.66	1.65	1.45	3.03	2.89	2.35
Portfolio Total	**4.34**	**4.38**	**3.67**	**10.88**	**10.03**	**7.88**

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	3.38	2.11	1.90	8.29	5.57	5.35
Energy Efficient Products	0.97	0.91	0.49	5.10	5.12	3.07
Low Income Energy Efficiency	0.94	0.88	0.88	2.54	2.37	2.37
C&I Energy Solutions for Business - Small	6.18	5.81	4.70	12.40	11.30	8.76
C&I Energy Solutions for Business - Large	4.20	3.88	3.12	8.53	7.80	5.67
Portfolio Total	**15.67**	**13.59**	**11.08**	**36.87**	**32.16**	**25.23**

The previously reported VTD savings have not changed since the PY14 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 PY15 contributions reflected below are those that have been verified in time for the 2024/25 Post-Install report, which was due in early May 2024. The PY16 Annual Report will contain the full PJM contribution from PY15.

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	3.5 to 3.9				
PY14	3.2	2.5	3.2	3.1 to 3.4	3.1 to 3.4			
PY15	2.2		2.2	2.1 to 2.3	2.4 to 4.2	2.4 to 4.2		
PY16	2.4 to 4.2			2.4 to 4.2	2.4 to 4.2	2.4 to 4.2	2.4 to 4.2	
PY17	2.4 to 4.2				2.4 to 4.2	2.4 to 4.2	2.4 to 4.2	2.4 to 4.2
Phase IV Total	**12.0 to 21.0**	**6.3**	**9.2**	**11.1 to 13.8**	**10.3 to 16**	**7.2 to 12.6**	**4.8 to 8.4**	**2.4 to 4.2**

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	3 to 3.3				
PY14	3.9	1.8	3.9	3.7 to 4.1	3.5 to 4.3			
PY15	2.1		2.1	2 to 2.2	1.9 to 2.3	1.9 to 2.3		
PY16	2.8 to 4.2			2.8 to 4.2	2.8 to 4.2	2.8 to 4.2	2.8 to 4.2	
PY17	2.8 to 4.2				2.8 to 4.2	2.8 to 4.2	2.8 to 4.2	2.8 to 4.2
Phase IV Total	**14.0 to 21.0**	**4.2**	**9.2**	**12.0 to 18.0**	**11 to 15**	**7.5 to 10.7**	**5.6 to 8.4**	**2.8 to 4.2**

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	0.6 to 0.7				
PY14	0.7	0.4	0.7	0.6 to 0.7	0.6 to 0.7			
PY15	0.5		0.5	0.5 to 0.6	0.5 to 0.6	0.5 to 0.6		
PY16	0.8 to 1.2			0.8 to 1.2	0.8 to 1.2	0.8 to 1.2	0.8 to 1.2	
PY17	0.8 to 1.2				0.8 to 1.2	0.8 to 1.2	0.8 to 1.2	0.8 to 1.2
Phase IV Total	**4.0 to 6.0**	**1.2**	**1.8**	**3.2 to 4.8**	**2.7 to 3.7**	**2.1 to 3**	**1.6 to 2.4**	**0.8 to 1.2**

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	2.3 to 2.6				
PY14	3.8	2.6	3.8	3.6 to 4	3.4 to 4.1			
PY15	2.9		2.9	2.8 to 3.1	2.6 to 3.2	2.6 to 3.2		
PY16	2.3 to 4.1			2.3 to 4.1	2.3 to 4.1	2.3 to 4.1	2.3 to 4.1	
PY17	2.3 to 4.1				2.3 to 4.1	2.3 to 4.1	2.3 to 4.1	2.3 to 4.1
Phase IV Total	**11.5 to 20.5**	**6**	**9.2**	**9.2 to 16.4**	**10.6 to 15.5**	**7.2 to 11.4**	**4.6 to 8.2**	**2.3 to 4.1**

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 PY15 reflect preliminary measurement and verification results from the DY 23/24 and DY 24/25 Post-Install Measurement and Verification reports, although additional savings for PY15 will be verified and presented in the DY 25/26 report.

Actual EE offer values in future years may vary from the values provided above to reflect any anticipated performance variability from impacts such as COVID-19, supply chain issues, baseline changes from code changes as well as PJM capacity market rule changes. In recent months, PJM has expressed reservations related to the acceptance of certain EE resources in the forward capacity market. The Companies will continue to actively participate in PJM's FCM and will work with PJM and its Market Monitor to identify and resolve potential issues related to project eligibility and evaluation. However, the Companies express a concern that increased workload in this area may compete for administrative and evaluation resources with the overall Act 129 compliance effort.

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) and solar water heating are the only fuel switching measures offered by the Companies in Phase IV. There were no rebates approved for fuel-switching projects in PY15.

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 PY15	None	None	None	None
Fuel Switching Measures Implemented in Phase IV	CHP	CHP	None	None
PY15 Energy Savings Achieved via Fuel Switching (MWh/yr)	0	0	0	0
PY15 Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	0	0	0	0
PY15 Incentive Payments for Fuel Switching Measures ($1000)	0	0	0	0
VTD Energy Savings Achieved via Fuel Switching (MWh/yr)	19,144	2,878	0	0
P4TD Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	114,366	92,381	0	0
P4TD Incentive Payments for Fuel Switching Measures ($1000)	670	399	0	0

2.9 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 31, Table 32, Table 33, and Table 34. TRC benefits in these tables were calculated using gross verified impacts. Net present value (NPV) PY15 costs and benefits are expressed in 2023 dollars. Net present value costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 31: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)	
1	**IMCs**	30,155		66,148	
2	Rebates to Participants and Trade Allies	11,129		18,386	
3	Upstream / Midstream Incentives	1,640		2,904	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,196		6,342	
5	Direct Installation Program Materials and Labor	1,791		3,615	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	13,400		34,901	
		EDC	CSP	EDC	CSP
7	Program Design	0	4	5	39
8	Administration and Management	698	3,594	2,531	5,964
9	Marketing	0	459	84	1,271
10	Program Delivery	58	243	177	3,902
11	EDC Evaluation Costs	853		2,371	
12	SWE Audit Costs	338		801	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	6,247		17,147	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**36,402**		**83,295**	
15	Total NPV Lifetime Electric Energy Benefits	32,455		76,210	
16	Total NPV Lifetime Electric Capacity Benefits	17,510		40,674	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,161		-158	
18	Total NPV Lifetime Fossil Fuel Impacts	-110		-5,246	
19	Total NPV Lifetime Water Impacts	5,221		11,917	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**56,237**		**123,396**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.54**		**1.48**	

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

Table 32: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)	
1	**IMCs**	25,993		51,702	
2	Rebates to Participants and Trade Allies	10,659		16,158	
3	Upstream / Midstream Incentives	1,152		2,303	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,163		6,287	
5	Direct Installation Program Materials and Labor	2,854		5,730	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	9,165		21,222	
		EDC	CSP	EDC	CSP
7	Program Design	0	4	4	36
8	Administration and Management	695	3,374	2,435	5,484
9	Marketing	0	456	81	1,260
10	Program Delivery	52	180	161	3,503
11	EDC Evaluation Costs	782		2,178	
12	SWE Audit Costs	306		726	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	5,849		15,868	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**31,842**		**67,570**	
15	Total NPV Lifetime Electric Energy Benefits	28,298		63,028	
16	Total NPV Lifetime Electric Capacity Benefits	15,173		36,563	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,392		3,633	
18	Total NPV Lifetime Fossil Fuel Impacts	-733		-5,017	
19	Total NPV Lifetime Water Impacts	5,836		14,085	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**49,967**		**112,292**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.57**		**1.66**	

* 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 – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)	
1	**IMCs**	9,035		25,117	
2	Rebates to Participants and Trade Allies	3,727		6,570	
3	Upstream / Midstream Incentives	384		679	
4	Material Cost for Self-Install Programs (EE&C Kits)	565		1,666	
5	Direct Installation Program Materials and Labor	742		1,570	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	3,616		14,633	
		EDC	CSP	EDC	CSP
7	Program Design	0	1	1	10
8	Administration and Management	275	1,258	888	2,092
9	Marketing	0	145	24	403
10	Program Delivery	20	80	60	1,279
11	EDC Evaluation Costs	214		628	
12	SWE Audit Costs	95		225	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	2,087		5,612	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**11,123**		**30,728**	
15	Total NPV Lifetime Electric Energy Benefits	10,531		22,002	
16	Total NPV Lifetime Electric Capacity Benefits	3,775		7,682	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	363		5,076	
18	Total NPV Lifetime Fossil Fuel Impacts	-209		-267	
19	Total NPV Lifetime Water Impacts	1,490		3,166	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**15,952**		**37,660**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.43**		**1.23**	

* 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 – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)	
1	**IMCs**	31,509		63,078	
2	Rebates to Participants and Trade Allies	12,832		20,280	
3	Upstream / Midstream Incentives	1,279		2,322	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,153		6,462	
5	Direct Installation Program Materials and Labor	3,346		6,910	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	11,899		27,105	
		EDC	CSP	EDC	CSP
7	Program Design	0	4	5	38
8	Administration and Management	707	3,909	2,507	6,375
9	Marketing	0	440	96	1,206
10	Program Delivery	50	221	158	4,285
11	EDC Evaluation Costs	792		2,252	
12	SWE Audit Costs	317		751	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	6,440		17,673	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**37,949**		**80,751**	
15	Total NPV Lifetime Electric Energy Benefits	34,698		76,934	
16	Total NPV Lifetime Electric Capacity Benefits	10,657		22,652	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	2,238		3,992	
18	Total NPV Lifetime Fossil Fuel Impacts	-670		-1,964	
19	Total NPV Lifetime Water Impacts	3,843		12,285	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**50,766**		**113,899**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.34**		**1.41**	

* 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.

2.10 Comparison of Performance to Approved EE&C Plan

Table 35 presents PY15 expenditures compared to the budget estimates set forth in the EE&C plan for PY15 and P4TD. PY15 values are presented in 2023 dollars and P4TD values are presented in 2021 dollars. Program-level comparisons of expenditures to plans are presented in Appendix D.

Table 35: 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	PY15 Portfolio	$ 25,147.00	$ 23,001.89	0.91
Met-Ed	P4TD	$ 74,103.00	$ 51,355.85	0.69
Penelec	PY15 Portfolio	$ 23,204.00	$ 22,676.52	0.98
Penelec	P4TD	$ 68,431.00	$ 49,235.60	0.72
Penn Power	PY15 Portfolio	$ 6,716.00	$ 7,506.80	1.12
Penn Power	P4TD	$ 19,891.00	$ 17,064.54	0.86
West Penn Power	PY15 Portfolio	$ 23,573.00	$ 26,049.95	1.11
West Penn Power	P4TD	$ 70,324.00	$ 56,969.46	0.81

Table 36 and Table 37 compare PY15 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 36: Comparison of Actual Portfolio Savings to Plan Projections

EDC	Savings	EE&C Plan Projections	Gross MWh Savings	Ratio (Actual/Plan)
Met-Ed	PY15 Portfolio MWh	94,935	84,633	0.89
Met-Ed	P4TD MWh	276,454	216,844	0.78
Penelec	PY15 Portfolio MWh	90,823	71,173	0.78
Penelec	P4TD MWh	266,061	179,539	0.67
Penn Power	PY15 Portfolio MWh	26,062	25,188	0.97
Penn Power	P4TD MWh	76,912	59,407	0.77
West Penn Power	PY15 Portfolio MWh	94,847	83,528	0.88
West Penn Power	P4TD MWh	279,086	207,337	0.74

Table 37: Comparison of Actual Portfolio Demand Reductions to Plan Projections

EDC	Savings	EE&C Plan Projections	Gross MW Savings	Ratio (Actual/Plan)
Met-Ed	PY15 Portfolio MW	17.1	12.2	0.71
Met-Ed	P4TD MW	50.1	33.1	0.66
Penelec	PY15 Portfolio MW	16.5	11.8	0.72
Penelec	P4TD MW	48.5	31.1	0.64
Penn Power	PY15 Portfolio MW	5.0	4.4	0.88
Penn Power	P4TD MW	14.8	10.0	0.68
West Penn Power	PY15 Portfolio MW	17.9	13.6	0.76
West Penn Power	P4TD MW	52.9	32.2	0.61

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. Overall, both energy and demand savings were higher in PY15 than PY14 or PY13, but demand reductions in particular were still, on average, 24% lower than corresponding values in the EE&C plan. 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. The Companies have expended considerable resources in developing new strategies and initiatives to increase demand reductions for the remaining duration of Phase IV. This is also reflected in the increased spending in PY15. As of this writing, these efforts are gaining momentum and demand reductions are trending higher in PY16 than in PY15.

2.11 FINDINGS AND RECOMMENDATIONS

The impact and process evaluation activities completed by the ADM team provided recommendations for program improvement. Table 38 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 38: Summary of Evaluation Recommendations

Evaluation Activity	Finding	Recommendation
General Evaluation	Since the start of Act 129, the Companies energy efficiency and demand reduction success has been highly dependent on the large commercial and industrial base. While participation has been low from this sector in Phase IV, the evaluation team is seeing some anecdotal evidence of increased investment in this sector.	Increase customer outreach efforts targeting the largest consumers to increase awareness and encourage participation.
General Evaluation	Projects involving solar power tend to have higher kW to kWh ratios and can particularly help the kW compliance effort.	Increase customer outreach efforts and reduce procedural barriers to participation for solar power projects.

3 Evaluation Results by Program

This section documents the gross impact, net impact, and process evaluation activities conducted in PY15 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	H	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	H
Residential	Multifamily - Res	Multifamily - Res	V	V	H	V	H
Residential	New Homes	New Homes	V	V	H	V	V
Residential	Online Audits	LI - Online Audit	V	V	V	V	H
Residential	Online Audits	On-Line Audit	V	V	V	V	H
Residential	Residential Audit and DI	Residential Audit and DI	V	V	H	V	H
Residential	Residential Downstream Appliances	Downstream Appliances	V	V	V	V	H
Residential	Residential Downstream HVAC	Downstream HVAC	V	V	V	V	H
Residential	Residential Midstream Appliances	Midstream Appliances	V	V	V	V	H
Residential	Residential Midstream Electronics	Midstream Electronics	NA	NA	NA	V	H
Nonresidential	CI Custom	CI Custom	V	V	V	H	V
Nonresidential	CI EMNC	Building Improvements	V	V	V	V	H
Nonresidential	CI EMNC	Building Operations Training	V	V	V	V	H
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	H
Nonresidential	CI Multifamily	CI Multifamily	V	V	H	V	H
Nonresidential	CI Prescriptve	Downstream Lighting	V	V	V	H	V
Nonresidential	CI Prescriptve	Midstream Lighting	V	V	V	V	V
Nonresidential	CI Prescriptve	Downstream Nonlighting	V	V	V	V	H
Nonresidential	CI Prescriptve	Midstream Nonlighting	V	V	H	V	H
Cross-Cutting	Appliance Recycling	Appliance Recycling	V	V	V	H	V
Cross-Cutting	Appliance Recycling	Midstream Appliance Recycling	NA	V	V	H	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, with the water heat fuel source 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 building shell measures. The participant count for this program component is equal to the number of rebate 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 39 presents the participation counts, reported energy and demand savings, and incentive payments for the Energy Efficient Homes Program in PY15 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 39: 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	125,248	134,781	37,442	149,211
PYRTD MWh/yr	19,000	19,388	5,591	19,477
PYRTD MW/yr	2.63	1.61	0.83	3.38
PYTD Incentives ($1000)	2,372	1,907	1,020	2,433

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 40 summarizes program verified impacts and realization rates for each EDC.

Table 40: EEH Program Gross Impact Evaluation Summary for PY15

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	EE Kits	10,008	1.08	88.6%	89.0%
Met-Ed	Home Energy Reports	3,735	0.34	80.6%	41.7%
Met-Ed	Direct Install	446	0.05	109.3%	73.7%
Met-Ed	New Homes	1,860	0.47	100.5%	106.8%
Met-Ed	Multifamily	27	0.00	109.4%	84.3%
Met-Ed	Online Audits	581	0.10	73.2%	114.4%
Met-Ed Total		**16,656**	**2.04**	**88%**	**78%**
Penelec	EE Kits	10,457	1.04	97.0%	96.5%
Penelec	Home Energy Reports	1,392	0.39	18.7%	108.1%
Penelec	Direct Install	372	0.04	114.7%	71.3%
Penelec	New Homes	220	0.07	101.4%	124.3%
Penelec	Multifamily	96	0.01	121.5%	95.7%
Penelec	Online Audits	433	0.07	81.4%	111.9%
Penelec Total		**12,971**	**1.60**	**67%**	**100%**
Penn Power	EE Kits	3,566	0.38	103.8%	102.1%
Penn Power	Home Energy Reports	-9	0.07	-3.5%	115.4%
Penn Power	Direct Install	169	0.02	110.9%	78.3%
Penn Power	New Homes	1,552	0.39	101.4%	112.7%
Penn Power	Multifamily	6	0.00	113.2%	85.4%
Penn Power	Online Audits	143	0.02	71.2%	104.8%
Penn Power Total		**5,427**	**0.89**	**97%**	**107%**
WPP	EE Kits	8,768	1.00	80.3%	81.2%
WPP	Home Energy Reports	2,892	0.35	58.5%	25.2%
WPP	Direct Install	425	0.05	112.3%	83.8%
WPP	New Homes	2,521	0.61	105.6%	101.4%
WPP	Multifamily	82	0.01	111.8%	83.9%
WPP	Online Audits	543	0.09	70.5%	105.4%
WPP Total		**15,230**	**2.11**	**78%**	**63%**

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 persistence impact adjustments (which are not present in reported data), and secondarily due to differences in data validation, modeling, and the 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 41 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 41: EEH Program Net Impact Evaluation Summary for PY15

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	EE Kits	10,008	82.1%	8,215	0.89
Met-Ed	Home Energy Reports	3,735	100.0%	3,735	0.34
Met-Ed	Direct Install	446	86.7%	387	0.04
Met-Ed	New Homes	1,860	72.0%	1,339	0.34
Met-Ed	Multifamily	27	99.5%	27	0.00
Met-Ed	Online Audits	581	100.0%	581	0.10
Met-Ed Total		**16,656**	**85.8%**	**14,283**	**1.71**
Penelec	EE Kits	10,457	106.4%	11,128	1.10
Penelec	Home Energy Reports	1,392	100.0%	1,392	0.39
Penelec	Direct Install	372	99.1%	369	0.04
Penelec	New Homes	220	72.0%	159	0.05
Penelec	Multifamily	96	99.5%	96	0.01
Penelec	Online Audits	433	100.0%	433	0.07
Penelec Total		**12,971**	**104.7%**	**13,576**	**1.65**
Penn Power	EE Kits	3,566	85.9%	3,061	0.33
Penn Power	Home Energy Reports	-9	100.0%	-9	0.07
Penn Power	Direct Install	169	94.1%	159	0.02
Penn Power	New Homes	1,552	72.0%	1,118	0.28
Penn Power	Multifamily	6	99.5%	6	0.00
Penn Power	Online Audits	143	100.0%	143	0.02
Penn Power Total		**5,427**	**82.5%**	**4,478**	**0.72**
WPP	EE Kits	8,768	96.3%	8,446	0.97
WPP	Home Energy Reports	2,892	100.0%	2,892	0.35
WPP	Direct Install	425	91.3%	388	0.05
WPP	New Homes	2,521	72.0%	1,815	0.44
WPP	Multifamily	82	99.5%	81	0.01
WPP	Online Audits	543	100.0%	543	0.09
WPP Total		**15,230**	**93.0%**	**14,165**	**1.90**

3.1.3.1 High-Impact Measure Research

The EE Kits initiative was identified as a HIM in PY15. The impact evaluation of the EE Kits Initiative is described in Appendix E.

3.1.4 Verified Savings Estimates

In Table 42 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 PY15. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 42: 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	19,000	2.63	19,388	1.61	5,591	0.83	19,477	3.38
PYVTD Gross	16,656	2.04	12,971	1.60	5,427	0.89	15,230	2.11
PYVTD Net	14,283	1.71	13,576	1.65	4,478	0.72	14,165	1.90
RTD	52,053	7.55	46,495	5.32	15,783	2.83	51,406	8.29
VTD Gross	42,075	5.69	39,952	5.08	14,731	2.40	42,115	5.57
VTD Net	35,650	4.72	36,916	4.73	12,417	2.01	41,976	5.35

3.1.5 Process Evaluation

Process evaluation activities were conducted for various components of this program in Phase IV, as summarized in in Table 43 below. PY15 process evaluation activities focused on the Residential Comprehensive Audits, Energy Efficiency Kits, School Education, and Multifamily program components. Findings and recommendations from the PY15 process evaluation effort are presented in Section 3.1.7.

Table 43: 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 43 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 44, Table 45, Table 46, and Table 47 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 2023 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 44: 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**	3,288		9,874		2,910		8,371	
2	Rebates to Participants and Trade Allies	566		1,746		566		1,746	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	1,813		5,261		1,813		5,261	
5	Direct Installation Program Materials and Labor	237		415		237		415	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	672		2,452		295		949	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	6	0	1	1	6
8	Administration and Management	101	678	422	1,146	101	678	422	1,146
9	Marketing	0	132	29	344	0	132	29	344
10	Program Delivery	9	143	31	879	9	143	31	879
11	EDC Evaluation Costs	142		432		142		432	
12	SWE Audit Costs	55		131		55		131	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,261		3,422		1,261		3,422	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**4,549**		**13,296**		**4,171**		**11,792**	
15	Total NPV Lifetime Electric Energy Benefits	5,192		12,985		4,230		10,510	
16	Total NPV Lifetime Electric Capacity Benefits	2,820		7,748		2,249		6,141	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	81		12		67		9	
19	Total NPV Lifetime Water Impacts	4,302		9,428		3,531		7,734	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**12,396**		**30,172**		**10,077**		**24,393**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**2.72**		**2.27**		**2.42**		**2.07**	

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

Table 45: 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**	2,237		5,911		2,180		5,602	
2	Rebates to Participants and Trade Allies	63		201		63		201	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	1,823		5,088		1,823		5,088	
5	Direct Installation Program Materials and Labor	217		313		217		313	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	134		308		77		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	5	0	1	1	5
8	Administration and Management	87	500	358	721	87	500	358	721
9	Marketing	0	135	28	300	0	135	28	300
10	Program Delivery	8	91	27	487	8	91	27	487
11	EDC Evaluation Costs	128		357		128		357	
12	SWE Audit Costs	44		105		44		105	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	993		2,388		993		2,388	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**3,230**		**8,298**		**3,173**		**7,990**	
15	Total NPV Lifetime Electric Energy Benefits	4,563		12,709		4,809		11,561	
16	Total NPV Lifetime Electric Capacity Benefits	1,773		5,145		1,839		4,651	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	217		-33		231		16	
19	Total NPV Lifetime Water Impacts	5,087		11,755		5,409		10,870	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**11,640**		**29,576**		**12,288**		**27,098**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**3.60**		**3.56**		**3.87**		**3.39**	

* 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 – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	1,691		4,378		1,396		3,548	
2	Rebates to Participants and Trade Allies	467		950		467		950	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	565		1,506		565		1,506	
5	Direct Installation Program Materials and Labor	93		175		93		175	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	566		1,748		271		918	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	0	2	0	0	0	2
8	Administration and Management	57	283	191	467	57	283	191	467
9	Marketing	0	52	9	114	0	52	9	114
10	Program Delivery	4	39	14	317	4	39	14	317
11	EDC Evaluation Costs	44		143		44		143	
12	SWE Audit Costs	20		47		20		47	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	500		1,305		500		1,305	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**2,191**		**5,683**		**1,896**		**4,853**	
15	Total NPV Lifetime Electric Energy Benefits	2,310		5,275		1,884		4,314	
16	Total NPV Lifetime Electric Capacity Benefits	786		1,815		619		1,446	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-25		-68		-20		-57	
19	Total NPV Lifetime Water Impacts	1,420		2,820		1,219		2,393	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**4,491**		**9,842**		**3,702**		**8,096**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**2.05**		**1.73**		**1.95**		**1.67**	

* 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 – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	3,701		10,493		3,195		9,315	
2	Rebates to Participants and Trade Allies	736		1,652		736		1,652	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	1,720		5,194		1,720		5,194	
5	Direct Installation Program Materials and Labor	226		475		226		475	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	1,018		3,171		512		1,993	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	7	0	1	1	7
8	Administration and Management	122	871	489	1,378	122	871	489	1,378
9	Marketing	0	124	30	296	0	124	30	296
10	Program Delivery	11	151	38	997	11	151	38	997
11	EDC Evaluation Costs	149		485		149		485	
12	SWE Audit Costs	62		148		62		148	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,490		3,868		1,490		3,868	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**5,191**		**14,361**		**4,685**		**13,182**	
15	Total NPV Lifetime Electric Energy Benefits	5,086		13,931		4,611		13,795	
16	Total NPV Lifetime Electric Capacity Benefits	1,498		4,056		1,301		3,845	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	7		13		6		15	
19	Total NPV Lifetime Water Impacts	2,719		9,048		2,619		9,645	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**9,310**		**27,048**		**8,537**		**27,301**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.79**		**1.88**		**1.82**		**2.07**	

* 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

The process evaluation activities in PY15 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' previous annual reports.

3.1.7.1 School Education Program

Finding #1: *Program roles are well-defined, and communication is going well.* FirstEnergy, AM Conservation, and NEF staff agree that they receive the information they need to deliver the program and receive support if necessary. They also feel comfortable discussing ideas to improve the program as they roll out the new design. School coordinators and teachers also found communication to be efficient and effective.

Finding #2: *School coordinators found program participation easy and beneficial.* They thought it was easy to work with the program and were happy with the presentation, teacher materials, and student kits. Many were appreciative of how the kits would help their low-income families.

Finding #3: *Teachers and households were very satisfied with the kit.* A few teachers mentioned that the kit quality exceeded their expectations. The kit contents also received high satisfaction ratings from households.

Finding #4: *The presentations were highly engaging.* Coordinators and teachers gave the presentation good reviews for interaction with the students. They liked the game-show-style questions and how engaging and energetic the presenters were.

Finding #5: *Students responded with increased engagement.* Teachers reported that student engagement with the curriculum related to energy increased after they participated in the presentation. They suggested that the kits also helped increase interest and discussion regarding all energy topics.

Finding #6: *Installation rates are high for most measures.* Nearly all households installed at least some of the *LED bulbs* and *LED night lights*, and about 80 percent installed the *smart power strips*. Households were less likely to install all the *switch* or *outlet gaskets* that came in packs of ten. *Furnace whistles* were the least-used kit item. Households also reported that installed measures remain installed.

Finding #7: *The program helps refocus energy-saving actions after receipt of the kit.* Although significant energy-saving activity was reported before households received the kits, behavioral actions were high after the kit receipt. Almost eight in ten households feel like they are doing *most things* or *everything they can* to save energy.

Finding #8: *Satisfaction with the program is very high*. Households reported high satisfaction with their utility, and 38 percent felt that the program increased that satisfaction. Low-Income program households had slightly higher satisfaction with the kits than Residential households. Almost no one expressed being not at all satisfied with various aspects of the kit.

Finding #9: *There were very few suggestions for improvements.* Satisfaction was so high that teachers and households provided limited feedback on program improvements. A couple of teachers were concerned about younger students getting their kits home in one piece; a few others mentioned technical issues with sound during the presentation. Teachers mentioned increasing engagement by splitting the presentation into smaller groups, having more tablets available for students to take turns, reducing the technical terms for the youngest attendees, and updating the video.

Finding #10: *The participant survey resulted in an NTG ratio of 136.6 percent for the PY15 Residential School Education subprogram.* The free-ridership score was 19.3 percent, with spillover of 55.9 percent. Spillover was driven by households reporting installing ENERGY STAR® appliances. Respondents also purchased lighting, electric water heating equipment, HVAC equipment, electronics, and insulation. Savings from these measures were typically high compared to savings claimed for individual kits, leading to a high proportion of spillover.

Recommendation #1: *Continue to leverage strong relationships with AM Conservation and NEF as their subcontractor for continuous improvement.* While no significant or systematic issues were identified through any of the research activities, teachers and households provided minor suggestions. FirstEnergy can benefit from the strong relationship with AM Conservation and their relationship with NEF to continue to explore subprogram upgrades. A few ideas are listed below:

- Increase engagement and interaction during the presentation through more tablets, smaller groups, more game-show-style questions, or more age-appropriate content, as discussed in the later sections of this report.
- Investigate options to help the youngest students get their kits home easily and safely. Teachers offered ideas, including bags, handles, or sealing the boxes.
- Continue to encourage household completion of the Home Energy Worksheets (HEW) with the gift card drawing, expanded timeline, and online options. Stress the importance of completing the HEWs regardless of whether they installed or used any of the kit contents.
- Test the logistics and technology for the presentation to minimize distractions or difficulty hearing the full presentation message.

EDC Status Report #1: Recommendation accepted.

3.1.7.2 Energy Efficiency Kits

Finding #1: *Shipping to multifamily addresses was problematic.* Shipping to individual residences has been working, but interviews with the program implementation contractor (PIM), CSP, and tracking data review showed that some kits were shipped to property managers or a central delivery point and may not have gotten to customers. As a result, FirstEnergy halted the kit delivery to property managers.

Finding #2: *Program roles are well-defined, and parties feel communication is going well.* FirstEnergy and AM Conservation staff agree that they receive the information they need to deliver the program and receive support if necessary. They also feel comfortable discussing ideas to improve the program.

Finding #3*: Opt-in participants were interested in reducing bills and found it easy to get the kit.* Most opt-in customers thought the kit was *very easy* to order; only one thought it was *somewhat difficult.* Almost one-half requested the kit because they were interested in the kit items. *Saving energy* and *reducing bills* were reasons mentioned by at least one-third of those requesting a kit.

Finding #4: *Kit documentation was useful to recipients.* Overall, respondents found the kit information, including the instructions, *100 Ways to Save Energy* tips, and information about other energy-saving programs useful. Usefulness ratings were not as high for the information on

other energy-saving programs as they were for installation instructions and energy-saving tips. Kit documentation recall was greater than 74 percent and highest for opt-ins (88 percent each).

Finding #5: *Installation rates varied across equipment types and were high for smart power strips, LED nightlights, and LED bulbs but low for switch and outlet gaskets.* Overall, *smart power strips* were the most installed item, followed by *LED nightlights,* with 56 to 96 percent reporting usage. On the other hand, the *switch and outlet gaskets*, which come in packs of ten, were installed the least of all items, with 20 to 30 percent saying they installed *all* of the gaskets and over one-half of respondents reporting they installed *none* of them. In the middle were the *low-flow showerheads*, *faucet aerators*, and *furnace whistles* that saw moderate installation rates (ranging from 18 percent to 56 percent of respondents across groups and equipment). Common reasons for not using the equipment were because they already had similar equipment installed, they had not gotten around to it, they did not feel it was needed, or they did not know how to install the equipment.

Finding #5: *Respondents noticed changes from kit item installation.* Survey respondents were asked if they had noticed specific changes in their homes since installing measures from the kit. Respondents most commonly noticed a change in the quality of lighting (55 percent overall). Other frequently noticed changes were in utility bills, drafts, and water pressure. Low-Income respondents were more likely to notice changes in water pressure than fewer drafts near outlets compared with Residential respondents.

Finding #6: *Satisfaction with the program is very high.* Households reported high satisfaction with their utility and about one-third across all strata felt the program increased that satisfaction. Satisfaction with the type of items, appearance of items, and quality of items in the kit was high. Satisfaction was highest with the *ease of item installation*, where no respondents said they were *not at all satisfied*.

Finding #7: *The participant survey resulted in an NTG ratio for the EE Kit subprogram of 91 percent for new movers and 101 percent for opt-ins.* The free-ridership score was 19 percent for new movers with spillover of 9 percent and free-ridership of 16 percent for opt-ins with spillover of 17 percent. Spillover was driven by households reporting installing ENERGY STAR® appliances. Respondents also purchased lighting, electric water heating equipment, HVAC equipment, electronics, and insulation.

Finding #8: *The new movers' strata were challenging to reach for feedback and also had some of the most unique respondents.* New movers averaged almost three times as many respondents who did not recall receiving the kit as opt-in cases. New movers also averaged almost 4.5 times as many cases with bad phone numbers compared with opt-in cases. When looking specifically at the Low-Income new movers group, they were the most unique. This group was the hardest to reach, with only a seven percent response rate after multiple outreach efforts and the addition of more sample. They also have a high rate of renters (63 percent) while the other strata have far more single-family homeowners. However, this group has higher install rates for most items than the Residential new movers and notices more changes in their

environment after the kit. Additionally, the Low-Income new mover respondents, with a high proportion of renters, are doing what they can to save, given the restrictions of being renters.

Recommendation #1: *Continue to improve kit shipping accuracy.* Shipping to multifamily addresses was problematic, but FirstEnergy and AM Conservation program staff have been working on resolving shipping issues to increase the likelihood that kits will reach their intended recipient.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Consider additional analysis on the Low-Income new mover group.* Given the high proportion of renters and the potential for frequent moves for this group, it may be worth reviewing service data to see how often these customers change residences. The Low-Income new mover group saw high installation rates among the different strata, so it is an effective group to continue targeting.

EDC Status Report #2: Recommendation accepted.

3.1.7.3 In-Home Audits

Finding #1: *Customers express high satisfaction with the program. Eighty-one percent reported being very satisfied or extremely satisfied with the program overall.* Satisfaction with all aspects of the program is high, ranging from 79 percent who are *very satisfied* or *extremely satisfied* with the information and suggestions they received to 93 percent *very satisfied* or *extremely satisfied* with the interactions with the energy auditor. In addition, 97 percent were satisfied with their service provider.

Finding #2: *Bill inserts continue to be the most common source of program information.* Approximately 42 percent of survey respondents cited bill inserts as the method by which they learned about the program. Another 23 percent of survey respondents heard about the program through an email or electronic newsletter from their utility.

Finding #3: *Almost two-thirds (63 percent) called the toll-free number to schedule an audit.* The most common reasons participants were interested in the audit were to save money, be more energy efficient, and identify problem areas.

Finding #4: *One-half of the audits were reported as taking less than one hour*. Compared with the previous evaluation—where 81 percent of respondents said the audit took more than one hour, and PY14 auditor feedback indicated they spent two hours on audits (including paperwork)—one-half of the PY15 respondents remembered their audits taking an hour or less. Most (42 percent) said it took between 31 and 60 minutes.

Finding #5: *There is a high recall of audit reports and discussions of results.* Almost all respondents remember receiving an audit report (90 percent overall) and the auditor discussing the audit results (95 percent overall).

Finding #6: *Almost all the participants interviewed found the energy audit suggestions useful, with the highest proportion (45 percent) finding them very useful*. About one-half of the respondents remembered at least four suggestions from the audit, usually sealing drafty

windows, installing additional insulation, pre-season checks of HVAC equipment, and adding or replacing weatherstripping.

Finding #7: *A high proportion of respondents reported acting on some of the simpler suggestions.* Those who did not act reported reasons such as not having gotten to it, the cost being too high, or not feeling they needed to.

Finding #8: *A high proportion of equipment remains installed.* Auditors identify and install needed items for respondents. For the most commonly installed items, light-emitting diode (LED) bulbs had the lowest rate of removal (13 percent), and smart power strips had the highest rate of removal (26 percent).

Finding #9: The participant survey resulted in an overall NTG ratio of 92.0 percent for the PY15 program. NTG values for individual FirstEnergy electric distribution companies range from 86.7 to 99.1 percent; this is lower than the last evaluation in PY10 (101 percent overall), but the difference stems entirely from higher program-induced spillover.

Finding #10: *The most commonly purchased items since participating in the program were ENERGY STAR® appliances.* Respondents also purchased lighting, HVAC equipment, insulation, electric water heaters, and windows and doors.

Recommendation #1: *Continue to market the program through bill inserts and email to promote program participation.* Per participant feedback, email is still a secondary source to bill inserts.
EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Continue to focus on the direct installation of only needed measures in each household.* Persistence rates for installed measures are high. However, a few customers reported receiving more items than needed, and a few reported not receiving any, which could be a recall issue or individual auditors not following program requirements.

EDC Status Report #2: Recommendation accepted.

Recommendation #3: *Monitor both the internal auditor and subcontractor audit quality.* Due to (1) the high proportion of respondents reporting audits lasting less than an hour, (2) a few reporting the auditors did not have the necessary equipment or measures, and (3) a few saying they did not have measures installed, additional monitoring of individual auditors may be needed.

EDC Status Report #3: Recommendation accepted.

3.1.7.4 Multifamily

Finding #1*: The one-stop-shop redesign of the Multifamily program has been successful in easing participation for tenants and owners/managers*. 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. Yet, a few owners/managers would like to see the time commitment required of owners/managers reduced further.

Finding #2*: Customers express high satisfaction with the program. Eighty-six percent of owners/managers and 59 percent of tenants reported being very satisfied or extremely satisfied with the program overall.* Satisfaction with all aspects of the program is high. More than 60 percent of tenants were *very satisfied* or *extremely satisfied* with six of the nine program aspects assessed, and more than 60 percent of owners/managers shared similar levels of satisfaction with nine of ten program aspects. In addition, 80 percent of tenants and 92 percent of owners/managers were *very* or *extremely satisfied* with FirstEnergy as their service provider.

Finding #3: *Utility telephone calls and landlords are the most common source of program information.* Approximately 75 percent of tenants cited landlords as the method by which they learned about the program. Twenty-five percent of owners/managers heard about the program through a telephone call from their utility.

Finding #4: *There is a high recall of audit reports and discussions of results.* Almost three-quarters of the tenants and 67 percent of owners/managers remember receiving an audit report. Eighty-five percent of tenants and 63 percent of owners/managers remember the auditor discussing the audit results.

Finding #5: *Almost all the participants interviewed found the energy audit suggestions at least moderately useful, with the highest proportion, 75 percent for owners/managers and almost 63 percent of tenants finding them very or extremely useful*. Eighty-two percent of owners/managers are *very satisfied* or *extremely satisfied* with the thoroughness of the audit report and its suggestions. However, almost 15 percent of tenants are only *slightly satisfied* with the audit report

Finding #6: *The owner/manager survey resulted in an overall NTG ratio of 99.5 percent for the PY15 program.* The overall NTG ratio for the residential sector was 98 percent, while the commercial sector's overall NTG ratio was 100 percent.

Finding #7: *The most commonly purchased items by owners/managers since participating in the program were LED lights.* They also purchased HVAC equipment, ENERGY STAR® appliances, and LED exit signs.

Recommendation #1: *Continue to utilize the one-stop-shop design of the program to market the program and promote program participation.* Per participant feedback, owners appreciate the single point of contact.
EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Investigate what improvements tenants believe would make the audit report and its suggestions to save energy more useful.* Per tenant feedback, auditors are not sharing reports or discussing suggestions on ways to save energy in a manner that is useful to tenants.

EDC Status Report #2: Recommendation accepted.

Recommendation #3: *Look for opportunities to reduce the time commitment required of owners/managers.* Owners/managers are *very satisfied* with the program. Still, their other commitments frequently overburden them and their limited staff, making it very difficult to allot time to participate in energy efficiency programs. Therefore, review program processes and requirements from scheduling to the installation of energy-saving items to minimize the amount

of time/oversight required from participating owners/managers. Quality assurance (QA) and quality control (QC) (QA/QC) efforts seemed to be areas of lower satisfaction.

EDC Status Report #3: Recommendation accepted. While QA inspections cannot be eliminated since they are necessary for measurement and verification, the Companies will look for ways to reduce or offset the participation burden.

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 appliance 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 downstream appliance recycling component of the program, the participant count is equal to the number of unique account numbers of participants, while for the midstream component, the participant count equals the number of recycled appliances.

3.2.1 Participation and Reported Savings by Customer Segment

This program serves primarily the residential customer segment. Table 48, Table 49, Table 50, and Table 51 present the participation counts, reported energy and demand savings, and incentive payments for the EEP Program in PY15 by customer segment and EDC.

Table 48: EEP Program Participation and Reported Impacts for Met-Ed

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	23,575	0	0	23,575
PYRTD MWh/yr	7,259	0	0	7,259
PYRTD MW/yr	1.37	0.00	0.00	1
PYTD Incentives ($1000)	1,260	0.00	0.00	1,260

Table 49: EEP Program Participation and Reported Impacts for Penelec

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	18,939	0	0	18,939
PYRTD MWh/yr	4,054	0	0	4,054
PYRTD MW/yr	0.87	0.00	0.00	1
PYTD Incentives ($1000)	623	0.00	0.00	623

Table 50: EEP Program Participation and Reported Impacts for Penn Power

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	7,221	0	0	7,221
PYRTD MWh/yr	1,518	0	0	1,518
PYRTD MW/yr	0.32	0.00	0.00	0
PYTD Incentives ($1000)	254	0.00	0.00	254

Table 51: EEP Program Participation and Reported Impacts for WPP

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	20,636	0	0	20,636
PYRTD MWh/yr	4,600	0	0	4,600
PYRTD MW/yr	0.97	0.00	0.00	1
PYTD Incentives ($1000)	833	0.00	0.00	833

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 52 summarizes program verified impacts and realization rates for each EDC.

Table 52: EEP Program Gross Impact Evaluation Summary for PY15

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliance Recycling	616	0.12	109.2%	106.2%
Met-Ed	Upstream Electronics	0	0.00	0.0%	0.0%
Met-Ed	HVAC	1,847	0.22	151.8%	113.2%
Met-Ed	Appliances	787	0.11	110.4%	106.0%
Met-Ed	Midstream Appliances	4,907	0.84	103.0%	87.1%
Met-Ed Total		**8,157**	**1.29**	**112%**	**94%**
Penelec	Appliance Recycling	343	0.07	107.2%	102.4%
Penelec	Upstream Electronics	0	0.00	0.0%	0.0%
Penelec	HVAC	585	0.09	100.0%	164.0%
Penelec	Appliances	343	0.05	102.3%	103.3%
Penelec	Midstream Appliances	2,741	0.59	97.4%	85.3%
PenelecTotal		**4,012**	**0.80**	**99%**	**93%**
Penn Power	Appliance Recycling	84	0.02	99.3%	97.9%
Penn Power	Upstream Electronics	0	0.00	0.0%	0.0%
Penn Power	HVAC	323	0.05	163.1%	140.6%
Penn Power	Appliances	223	0.03	106.2%	106.5%
Penn Power	Midstream Appliances	994	0.21	97.0%	85.5%
Penn PowerTotal		**1,624**	**0.30**	**107%**	**94%**
WPP	Appliance Recycling	484	0.09	103.2%	101.6%
WPP	Upstream Electronics	0	0.00	0.0%	0.0%
WPP	HVAC	1,330	0.17	152.4%	133.5%
WPP	Appliances	704	0.10	106.8%	104.4%
WPP	Midstream Appliances	2,523	0.55	97.1%	83.3%
WPP Total		**5,042**	**0.91**	**110%**	**94%**

The gross realization rates for energy savings were driven primarily by the realization rates of the midstream appliances and HVAC components.

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 PY15 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 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. %he Appliance Recycling initiative was evaluated for NTG in PY13, the Appliance Rebate initiative was evaluated for NTG in PY14, and the HVAC rebate initiative was evaluated for NTG in PY15. Historical NTG values from research in Phase III were applied to other initiatives as shown in

Table 53, which summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 53: EEP Program Net Impact Evaluation Summary for PY15

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	Appliance Recycling	616	39.0%	240	0.05
Met-Ed	Upstream Electronics	0	58.3%	0	0.00
Met-Ed	HVAC	1,847	50.6%	935	0.11
Met-Ed	Appliances	787	67.9%	534	0.08
Met-Ed	Midstream Appliances	4,907	47.2%	2,316	0.39
Met-Ed Total		**8,157**	**49.3%**	**4,025**	**0.63**
Penelec	Appliance Recycling	343	65.0%	223	0.04
Penelec	Upstream Electronics	0	58.3%	0	0.00
Penelec	HVAC	585	69.7%	408	0.06
Penelec	Appliances	343	49.4%	169	0.03
Penelec	Midstream Appliances	2,741	53.1%	1,456	0.32
Penelec Total		**4,012**	**56.2%**	**2,256**	**0.45**
Penn Power	Appliance Recycling	84	38.0%	32	0.01
Penn Power	Upstream Electronics	0	58.3%	0	0.00
Penn Power	HVAC	323	54.7%	177	0.03
Penn Power	Appliances	223	52.3%	117	0.02
Penn Power	Midstream Appliances	994	44.0%	437	0.09
Penn Power Total		**1,624**	**47.0%**	**763**	**0.14**
WPP	Appliance Recycling	484	70.0%	339	0.06
WPP	Upstream Electronics	0	58.3%	0	0.00
WPP	HVAC	1,330	54.8%	729	0.09
WPP	Appliances	704	52.2%	368	0.05
WPP	Midstream Appliances	2,523	50.8%	1,282	0.28
WPP Total		**5,042**	**53.9%**	**2,717**	**0.49**

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 PY13. 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 is 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 54 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 PY15. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 54: 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	7,259	1.37	4,054	0.87	1,518	0.32	4,600	0.97
PYVTD Gross	8,157	1.29	4,012	0.80	1,624	0.30	5,042	0.91
PYVTD Net	4,025	0.63	2,256	0.45	763	0.14	2,717	0.49
RTD	27,888	6.04	18,424	4.35	7,194	1.60	22,388	5.10
VTD Gross	30,648	6.13	19,204	4.36	7,524	1.60	24,103	5.12
VTD Net	14,202	2.77	11,107	2.54	3,314	0.70	14,255	3.07

3.2.5 Process Evaluation

In PY15, Tetra Tech completed a process evaluation for the downstream HVAC program component. The sample design for Phase IV process evaluation research conducted to date is shown in Table 55 below.

Table 55: 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 (PY13) Customer Surveys (PY13)	139	151	21.7%
Penelec	Appliance Recyding		123	177	28.9%
Penn Power	Appliance Recyding		68	95	28.0%
WPP	Appliance Recyding		130	163	25.2%
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			**2,187**	**1,453**	**23.0%**

Process evaluation efforts for each program component are summarized below. Findings and recommendations from the PY15 process evaluation are described in Section 3.2.7.

3.2.5.1 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 listed in the Companies' PY13 annual report.

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 upcoming 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.

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.

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 56, Table 57, Table 58, and Table 59 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 2023 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 56: 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**	5,380		14,932		2,824		7,638	
2	Rebates to Participants and Trade Allies	529		2,615		529		2,615	
3	Upstream / Midstream Incentives	859		1,871		859		1,871	
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)	3,992		10,447		1,435		3,152	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	6	0	1	1	6
8	Administration and Management	105	544	390	1,258	105	544	390	1,258
9	Marketing	0	95	55	370	0	95	55	370
10	Program Delivery	6	9	21	1,155	6	9	21	1,155
11	EDC Evaluation Costs	106		284		106		284	
12	SWE Audit Costs	53		126		53		126	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	919		3,665		919		3,665	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**6,299**		**18,597**		**3,742**		**11,303**	
15	Total NPV Lifetime Electric Energy Benefits	2,857		8,350		1,428		4,017	
16	Total NPV Lifetime Electric Capacity Benefits	1,777		6,459		879		3,049	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	293		859		171		459	
19	Total NPV Lifetime Water Impacts	173		452		117		286	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**5,099**		**16,119**		**2,596**		**7,811**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.81**		**0.87**		**0.69**		**0.69**	

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

Table 57: 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**	3,178		10,364		2,040		5,842	
2	Rebates to Participants and Trade Allies	250		1,550		250		1,550	
3	Upstream / Midstream Incentives	437		1,064		437		1,064	
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)	2,491		7,749		1,353		3,228	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	6	0	1	1	6
8	Administration and Management	111	278	389	774	111	278	389	774
9	Marketing	0	52	53	292	0	52	53	292
10	Program Delivery	7	5	21	813	7	5	21	813
11	EDC Evaluation Costs	94		260		94		260	
12	SWE Audit Costs	51		122		51		122	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	598		2,730		598		2,730	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**3,776**		**13,094**		**2,638**		**8,573**	
15	Total NPV Lifetime Electric Energy Benefits	1,378		5,007		782		2,809	
16	Total NPV Lifetime Electric Capacity Benefits	992		4,051		552		2,272	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	232		678		120		356	
19	Total NPV Lifetime Water Impacts	105		277		52		144	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**2,708**		**10,013**		**1,506**		**5,581**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.72**		**0.76**		**0.57**		**0.65**	

* 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 – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	1,156		3,191		601		1,604	
2	Rebates to Participants and Trade Allies	113		644		113		644	
3	Upstream / Midstream Incentives	167		410		167		410	
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)	876		2,136		322		550	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	0	2	0	0	0	2
8	Administration and Management	47	110	148	297	47	110	148	297
9	Marketing	0	20	16	99	0	20	16	99
10	Program Delivery	3	2	8	279	3	2	8	279
11	EDC Evaluation Costs	28		78		28		78	
12	SWE Audit Costs	16		38		16		38	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	225		965		225		965	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**1,381**		**4,156**		**827**		**2,569**	
15	Total NPV Lifetime Electric Energy Benefits	621		2,207		297		1,008	
16	Total NPV Lifetime Electric Capacity Benefits	247		1,042		115		468	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	177		482		82		224	
19	Total NPV Lifetime Water Impacts	53		143		27		76	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**1,098**		**3,875**		**522**		**1,775**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.79**		**0.93**		**0.63**		**0.69**	

* 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 – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	IMCs	4,050		11,696		2,181		6,315	
2	Rebates to Participants and Trade Allies	479		2,251		479		2,251	
3	Upstream / Midstream Incentives	439		993		439		993	
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)	3,132		8,452		1,263		3,071	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	7	0	1	1	7
8	Administration and Management	131	389	461	1,046	131	389	461	1,046
9	Marketing	0	77	65	323	0	77	65	323
10	Program Delivery	8	7	25	1,101	8	7	25	1,101
11	EDC Evaluation Costs	115		318		115		318	
12	SWE Audit Costs	61		146		61		146	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	790		3,493		790		3,493	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**4,840**		**15,189**		**2,971**		**9,808**	
15	Total NPV Lifetime Electric Energy Benefits	1,901		6,639		1,011		3,706	
16	Total NPV Lifetime Electric Capacity Benefits	655		2,682		346		1,515	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	330		871		170		457	
19	Total NPV Lifetime Water Impacts	201		516		105		283	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**3,088**		**10,709**		**1,632**		**5,961**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.64**		**0.71**		**0.55**		**0.61**	

* 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 PY15 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 HVAC

Finding #1: *The shift to an open contractor network has been a success this far in Phase IV.* The PIM, Franklin Energy Services, has developed and maintains relationships with contractors, following a shift to an open contractor network that does not require formal agreements. Positive reactions from contractors reiterate the successful transition.

Finding #2: *The program is meeting its participation goals*. While still reaching its targets, participation is lower in the Penelec service territory, which may reflect a larger, more sparsely populated area with fewer contractors. Franklin Energy continues to work on building its network in this territory.

Finding #3: *The participant survey resulted in an overall NTG of 56 percent for the program overall.* This is higher than 52 percent reported in PY8 and PY11, with the increase due largely to program-induced spillover. NTG values for individual electrical distribution companies (EDC) ranges from 51 to 70 percent, with the highest (Penelec) due to a combination of lower free-ridership and a small number of customers pursuing high-savings, but unrebated, equipment influenced by the program.

Finding #4: *Customers express high satisfaction with the program.* Eighty-six percent reported being *very satisfied* or *extremely satisfied* with the program overall. Satisfaction with all aspects of the program is high, with 80 percent or more *very satisfied* or *extremely satisfied* with seven of nine program aspects. The *application process* and *rebate amount* had the lowest ratings but still achieved high levels of satisfaction (76 and 78 percent, respectively, were at least *very satisfied*).

Finding #5: *Most customers learn about the program from their contractor, underscoring the critical role that contractors play in program success*. Customers also tend to purchase equipment recommended by their contractor (45 percent), and more than one-third rely at least partially on their contractor to complete the rebate application.

Finding #6: *Customers prefer direct communication channels to hear about energy efficiency programs*. Although more than one-half first learned about the program from a contractor, customers prefer to learn about energy-efficiency offerings through other channels—email (44 percent), direct mail (32 percent), and bill insert (14 percent) ranked highest. Of the 68 respondents who offered suggestions to improve the program, one-third (23 respondents) mentioned advertising to increase awareness (e.g., bill inserts, direct mail).

Finding #7: *Customers report benefits of participation beyond energy-savings and the financial incentive*. More than three-quarters of customers reported their homes are more comfortable following equipment installation or service, and 69 percent noticed the equipment performed better. These are benefits of program participation independent of the financial rebate, which is often viewed as low relative to the cost of new, high-efficiency equipment.

Finding #8: *Contractors express high satisfaction with the program overall.* Seven of ten contractors providing feedback were *very satisfied* or *extremely satisfied* with the program. All nine contractors who participated in a full interview discuss the program with their customers and believe it is a valued and appreciated resource by customers.

Finding #9: *Contractors speak highly of the new online portal implemented by Franklin Energy.* The portal is easy to learn and well-supported. They find that applications are processed much faster than previously, and any issues are flagged promptly so they can be corrected. The only sources of dissatisfaction came from two contractors who preferred that their customers submit applications or said that their customers preferred paper forms.

Finding #10: *Some participating contractors indicated that rebate amounts are relatively low for some equipment types.* While contractors are generally satisfied and customers appreciate the rebates, two contractors point to higher rebates for selected equipment by other Pennsylvania utilities or in neighboring Maryland. Rebates for heat pumps were cited as lagging the market. Customers pursuing sizeable investments like geothermal systems are motivated by factors other than the relatively small rebate.

Finding #11: *Contractors report that communication with Franklin Energy is good and responses to questions are prompt.* Most contractors indicated the frequency of communication was fine and similar to the past. They received prompt answers when they had questions. None of the contractors interviewed received marketing materials; while not cited as a problem, contractors noted that the lack of marketing materials differed from the past, and three said it would be helpful.

Recommendation #1: *Continue to develop relationships with contractors, especially in the Penelec territory.* FirstEnergy and Franklin Energy recognize the Penelec territory presents different challenges than the other EDCs. Franklin Energy should continue to expand and strengthen relationships with contractors who can deliver services to these customers.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Build upon the positive relationships with contractors by providing program marketing they can use to assist sales and educate customers.* Contractors did not feel the absence of marketing materials hindered their efforts but felt it could be helpful and would be appreciated.

EDC Status Report #2: Recommendation accepted.

Recommendation #3: *Continue to use multiple channels to increase customer awareness of the program.* A majority of customers were unaware of the program until speaking with a contractor. Promotions through bill inserts, email, and direct mail could raise awareness and enhance the likelihood that customers will pursue HVAC upgrades prior to failure.

EDC Status Report #3: Recommendation accepted.

Recommendation #4: *Explore promotional messaging that emphasizes energy and non-energy benefits not related to the financial rebate, such as greater home comfort.* Customers and contractors alike stated the rebate amount can be small relative to the financial outlay for high-efficiency HVAC equipment. Yet, large percentages of customers recognize the benefits of new or serviced equipment, including more consistent temperatures, less humidity, better performance, or decreased utility bills. Promoting benefits of participation such as these can help overcome relatively smaller rebates, promote equipment upgrades, and reduce free-ridership.

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

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 60 presents the participation counts, reported energy and demand savings, and incentive payments for the Low-Income Energy Efficiency Program in PY15 by customer segment and EDC. This program serves only the low-income residential customer segment.

Table 60: LIEEP Participation and Reported Impacts

Parameter	Met-Ed LI Residential	Penelec LI Residential	Penn Power LI Residential	WPP LI Residential
PYTD # Participants	34,727	25,195	10,253	28,807
PYRTD MWh/yr	5,602	6,258	1,702	7,260
PYRTD MW/yr	0.99	0.69	0.16	0.94
PYTD Incentives ($1000)	1,937	2,932	654	3,408

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 61 summarizes program verified impacts and realization rates for each EDC.

Table 61: LIEEP Gross Impact Evaluation Summary for PY15

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliances	1,177	0.14	110.4%	106.0%
Met-Ed	Appliance Turn-In	54	0.01	107.2%	102.4%
Met-Ed	Direct Install	1,087	0.21	100.9%	101.1%
Met-Ed	Home Energy Reports	1,602	0.16	156.6%	43.2%
Met-Ed	Kits	2,044	0.24	91.0%	95.4%
Met-Ed	New Homes	62	0.01	100.5%	106.8%
Met-Ed	Online Audits	356	0.05	461.2%	647.4%
Met-Ed Total		**6,382**	**0.83**	**114%**	**84%**
Penelec	Appliances	1,639	0.21	102.3%	103.3%
Penelec	Appliance Turn-In	45	0.01	103.2%	101.6%
Penelec	Direct Install	2,032	0.25	99.7%	99.2%
Penelec	Home Energy Reports	203	-0.06	41.7%	-611.6%
Penelec	Kits	1,953	0.20	99.1%	100.4%
Penelec	New Homes	2	0.00	101.4%	124.3%
Penelec	Online Audits	579	0.08	508.0%	639.7%
PenelecTotal		**6,453**	**0.69**	**103%**	**100%**
Penn Power	Appliances	472	0.06	106.2%	106.5%
Penn Power	Appliance Turn-In	11	0.00	106.7%	97.8%
Penn Power	Direct Install	504	0.06	100.9%	100.8%
Penn Power	Home Energy Reports	437	0.07	60.4%	191.3%
Penn Power	Kits	0	0.00	100.0%	100.0%
Penn Power	New Homes	0	0.00	101.4%	112.7%
Penn Power	Online Audits	107	0.02	442.0%	607.4%
Penn PowerTotal		**1,531**	**0.21**	**90%**	**131%**
WPP	Appliances	1,365	0.17	106.8%	104.4%
WPP	Appliance Turn-In	33	0.01	112.5%	108.4%
WPP	Direct Install	2,546	0.36	100.1%	100.1%
WPP	Home Energy Reports	765	-0.02	100.5%	-16.1%
WPP	Kits	2,594	0.31	100.9%	103.4%
WPP	New Homes	0	0.00	105.6%	101.4%
WPP	Online Audits	373	0.05	486.8%	626.8%
WPP Total		**7,676**	**0.88**	**106%**	**94%**

The gross realization rates for energy savings were driven primarily by the three largest components: Kits, Home Energy Reports and Direct Install.

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 PY15.

3.3.3 Net Impact Evaluation

Net impact evaluation was not formally conducted for this program in PY15, 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 62 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 PY15. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 62: 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	5,602	0.99	6,258	0.69	1,702	0.16	7,260	0.94
PYVTD Gross	6,382	0.83	6,453	0.69	1,531	0.21	7,676	0.88
PYVTD Net	6,382	0.83	6,453	0.69	1,531	0.21	7,676	0.88
RTD	13,671	2.08	16,053	2.02	4,827	0.58	18,460	2.54
VTD Gross	14,492	2.11	17,040	1.97	4,408	0.61	19,807	2.37
VTD Net	14,492	2.11	17,040	1.97	4,408	0.61	19,807	2.37

3.3.5 Process Evaluation

Two initiatives within the Low-Income Energy Efficiency Program underwent process evaluation in PY15. Evaluation activities from PY15 and past years in Phase IV are summarized in Table 63 and described below. Findings and recommendations from the PY15 process evaluation are described in Section 3.3.7.

Table 63: 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 64, Table 65, Table 66, and Table 67 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 2023 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 64: 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**	2,196		4,676		2,196		4,676	
2	Rebates to Participants and Trade Allies	199		381		199		381	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	383		1,081		383		1,081	
5	Direct Installation Program Materials and Labor	1,554		2,961		1,554		2,961	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	61		253		61		253	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	0	4	0	0	0	4
8	Administration and Management	74	393	300	702	74	393	300	702
9	Marketing	0	40	0	138	0	40	0	138
10	Program Delivery	3	46	11	452	3	46	11	452
11	EDC Evaluation Costs	69		229		69		229	
12	SWE Audit Costs	33		77		33		77	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	658		1,914		658		1,914	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**2,855**		**6,590**		**2,855**		**6,590**	
15	Total NPV Lifetime Electric Energy Benefits	1,303		3,341		1,303		3,341	
16	Total NPV Lifetime Electric Capacity Benefits	817		1,995		817		1,995	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-6		-79		-6		-79	
19	Total NPV Lifetime Water Impacts	746		2,017		746		2,017	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**2,860**		**7,274**		**2,860**		**7,274**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.00**		**1.10**		**1.00**		**1.10**	

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

Table 65: 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**	3,286		6,312		3,286		6,312	
2	Rebates to Participants and Trade Allies	257		396		257		396	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	340		1,199		340		1,199	
5	Direct Installation Program Materials and Labor	2,636		4,526		2,636		4,526	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	53		191		53		191	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	0	4	0	0	0	4
8	Administration and Management	91	484	365	807	91	484	365	807
9	Marketing	0	66	0	228	0	66	0	228
10	Program Delivery	3	25	13	421	3	25	13	421
11	EDC Evaluation Costs	71		263		71		263	
12	SWE Audit Costs	35		84		35		84	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	777		2,185		777		2,185	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**4,064**		**8,497**		**4,064**		**8,497**	
15	Total NPV Lifetime Electric Energy Benefits	1,499		4,174		1,499		4,174	
16	Total NPV Lifetime Electric Capacity Benefits	643		1,814		643		1,814	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-35		-154		-35		-154	
19	Total NPV Lifetime Water Impacts	643		2,050		643		2,050	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**2,751**		**7,883**		**2,751**		**7,883**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.68**		**0.93**		**0.68**		**0.93**	

* 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 – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	735		1,611		735		1,611	
2	Rebates to Participants and Trade Allies	71		101		71		101	
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	650		1,328		650		1,328	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	14		22		14		22	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	0	1	0	0	0	1
8	Administration and Management	31	159	117	291	31	159	117	291
9	Marketing	0	6	0	54	0	6	0	54
10	Program Delivery	1	21	5	210	1	21	5	210
11	EDC Evaluation Costs	19		79		19		79	
12	SWE Audit Costs	11		27		11		27	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	250		783		250		783	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**984**		**2,394**		**984**		**2,394**	
15	Total NPV Lifetime Electric Energy Benefits	245		1,018		245		1,018	
16	Total NPV Lifetime Electric Capacity Benefits	73		297		73		297	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-1		-52		-1		-52	
19	Total NPV Lifetime Water Impacts	18		202		18		202	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**334**		**1,466**		**334**		**1,466**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.34**		**0.61**		**0.34**		**0.61**	

* 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 – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	IMCs	3,805		6,738		3,805		6,738	
2	Rebates to Participants and Trade Allies	205		338		205		338	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	432		1,267		432		1,267	
5	Direct Installation Program Materials and Labor	3,120		5,044		3,120		5,044	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	48		88		48		88	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	0	4	0	0	0	4
8	Administration and Management	82	503	328	765	82	503	328	765
9	Marketing	0	65	0	225	0	65	0	225
10	Program Delivery	3	17	12	434	3	17	12	434
11	EDC Evaluation Costs	74		245		74		245	
12	SWE Audit Costs	34		82		34		82	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	780		2,096		780		2,096	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**4,585**		**8,834**		**4,585**		**8,834**	
15	Total NPV Lifetime Electric Energy Benefits	1,784		4,864		1,784		4,864	
16	Total NPV Lifetime Electric Capacity Benefits	459		1,299		459		1,299	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-38		-169		-38		-169	
19	Total NPV Lifetime Water Impacts	923		2,667		923		2,667	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**3,127**		**8,661**		**3,127**		**8,661**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**0.68**		**0.98**		**0.68**		**0.98**	

* 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 PY15 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 School Education Program

Findings and recommendations from the PY15 evaluation are presented in Section 3.1.7.1.

3.3.7.2 Energy Efficiency Kits

Findings and recommendations from the PY15 evaluation are presented in Section 3.1.7.2.

3.3.7.3 Multifamily Direct Install

Findings and recommendations from the PY15 evaluation are presented in Section 3.1.7.4.

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 PY15. 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 PY15. CLEAResult staff conduct most of the audits and direct installations for the CI Multifamily initiative. ARCA administered the Appliance Recycling program component, which, will be administered by CLEAResult in PY16.

3.4.1 Participation and Reported Savings by Customer Segment

Table 68 and Table 69 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Small Program in PY15 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 68: 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	1,061	15	1,076	1,183	25	1,208
PYRTD MWh/yr	28,879	534	29,413	27,433	762	28,195
PYRTD MW/yr	5.13	0.08	5.22	4.84	0.17	5.01
PYTD Incentives ($1000)	8,004	156	8,161	7,679	157	7,836

Table 69: 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	282	5	287	1,281	23	1,304
PYRTD MWh/yr	7,466	131	7,596	30,284	835	31,119
PYRTD MW/yr	1.27	0.02	1.29	5.56	0.17	5.73
PYTD Incentives ($1000)	2,006	31	2,038	8,030	324	8,354

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 describe 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 70 summarizes program verified impacts and realization rates for each EDC.

Table 70: ESB-Small Program Gross Impact Evaluation Summary for PY15

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	CI Prescriptive	13,853	2.28	123%	88.6%
Met-Ed	CI Custom	4,149	1.01	100%	98.3%
Met-Ed	CI EMNC	13,040	1.78	100%	96.5%
Met-Ed	CI Multifamily	1,005	0.13	100%	92.2%
Met-Ed	Appliance Recycling	14	0.00	109%	106.2%
Met-Ed Total		**32,061**	**5.20**	**109%**	**93%**
Penelec	CI Prescriptive	13,532	3.11	97%	95%
Penelec	CI Custom	1,359	0.27	93%	85%
Penelec	CI EMNC	10,688	1.34	89%	81%
Penelec	CI Multifamily	848	0.11	100%	92%
Penelec	Appliance Recycling	5	0.00	107%	102%
PenelecTotal		**26,431**	**4.83**	**94%**	**90%**
Penn Power	CI Prescriptive	3,465	0.89	101%	107%
Penn Power	CI Custom	152	0.01	95%	94%
Penn Power	CI EMNC	3,151	0.43	80%	83%
Penn Power	CI Multifamily	39	0.00	100%	92%
Penn Power	Appliance Recycling	8	0.00	99%	98%
Penn PowerTotal		**6,815**	**1.33**	**90%**	**98%**
WPP	CI Prescriptive	16,355	3.82	103%	99%
WPP	CI Custom	864	0.07	85%	52%
WPP	CI EMNC	14,275	1.88	102%	89%
WPP	CI Multifamily	259	0.03	100%	92%
WPP	Appliance Recycling	4	0.00	103%	102%
WPP Total		**31,756**	**5.81**	**102%**	**94%**

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.

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 PY15, 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, and the CI Multifamily initiative was evaluated in PY15, with results shown in Table 71.

Table 71: ESB-Small Program Net Impact Evaluation Summary for PY15

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	CI Prescriptive	13,853	61.7%	8,549	1.41
Met-Ed	CI Custom	4,149	57.1%	2,371	0.58
Met-Ed	CI EMNC	13,040	97.8%	12,753	1.74
Met-Ed	CI Multifamily	1,005	99.5%	1,000	0.13
Met-Ed	Appliance Recycling	14	39.0%	6	0.00
Met-Ed Total		**32,061**	**77.0%**	**24,678**	**3.86**
Penelec	CI Prescriptive	13,532	66.0%	8,925	2.05
Penelec	CI Custom	1,359	52.1%	708	0.14
Penelec	CI EMNC	10,688	83.8%	8,956	1.13
Penelec	CI Multifamily	848	99.5%	844	0.11
Penelec	Appliance Recycling	5	65.0%	3	0.00
Penelec Total		**26,431**	**73.5%**	**19,436**	**3.42**
Penn Power	CI Prescriptive	3,465	80.6%	2,794	0.72
Penn Power	CI Custom	152	100.0%	152	0.01
Penn Power	CI EMNC	3,151	97.3%	3,066	0.42
Penn Power	CI Multifamily	39	99.5%	39	0.00
Penn Power	Appliance Recycling	8	38.0%	3	0.00
Penn Power Total		**6,815**	**88.8%**	**6,053**	**1.15**
WPP	CI Prescriptive	16,355	67.0%	10,952	2.56
WPP	CI Custom	864	49.1%	424	0.04
WPP	CI EMNC	14,275	110.0%	15,702	2.07
WPP	CI Multifamily	259	99.5%	258	0.03
WPP	Appliance Recycling	4	70.0%	2	0.00
WPP Total		**31,756**	**86.1%**	**27,338**	**4.70**

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 72 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 PY15. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 72: PYTD and P4TD Savings Summary

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	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	29,413	5.59	28,195	5.37	7,596	1.36	31,119	6.18
PYVTD Gross	32,061	5.20	26,431	4.83	6,815	1.33	31,756	5.81
PYVTD Net	24,678	3.86	19,436	3.42	6,053	1.15	27,338	4.70
RTD	52,200	9.73	63,224	13.58	14,836	2.84	64,421	12.40
VTD Gross	55,428	9.30	61,081	12.55	13,343	2.53	66,002	11.30
VTD Net	41,516	6.79	45,957	9.45	11,837	2.21	53,124	8.76

3.4.5 Process Evaluation

The Nonresidential Multifamily Initiative underwent process evaluation in PY15. Evaluation activities from PY15 and past years in Phase IV are summarized in Table 73 and are described below. Key findings and recommendations from the PY15 process evaluation are described in Section 3.4.7.

Table 73: Combined C&I Program Process Evaluation Sample Design

Stratum	Population Size	Sample Size (Census Att	Response Rate
Met-Ed Custom (PY14)	10	7	70%
Met-Ed Prescriptive (PY14)	161	41	25%
Met-Ed Midstream (PY14)	64	16	25%
Met-Ed EMNC (PY14)	79	34	43%
Penelec Custom (PY14)	21	13	62%
Penelec Prescriptive (PY14)	200	70	35%
Penelec Midstream (PY14)	162	39	24%
Penelec EMNC (PY14)	98	32	33%
Penn Power Custom (PY14)	5	4	80%
Penn Power Prescriptive (PY14)	91	35	38%
Penn Power Midstream (PY14)	8	1	13%
Penn Power EMNC (PY14)	42	11	26%
WPP Custom (PY14)	18	12	67%
WPP Prescriptive (PY14)	272	97	36%
WPP Midstream (PY14)	93	20	22%
WPP EMNC (PY14)	120	35	29%
Trade Ally Surveys	165	51	31%
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	**1,921**	**533**	**28%**

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 73 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 73 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.

3.4.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 74, Table 75, Table 76, and Table 77 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 2023 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 74: 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**	11,248		18,270		8,800		13,770	
2	Rebates to Participants and Trade Allies	8,531		10,801		8,531		10,801	
3	Upstream / Midstream Incentives	466		558		466		558	
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)	2,251		6,671		-197		2,172	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	10	0	1	1	10
8	Administration and Management	182	1,475	627	1,923	182	1,475	627	1,923
9	Marketing	0	131	0	271	0	131	0	271
10	Program Delivery	20	40	58	815	20	40	58	815
11	EDC Evaluation Costs	247		657		247		657	
12	SWE Audit Costs	86		204		86		204	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	2,182		4,566		2,182		4,566	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**13,431**		**22,836**		**10,982**		**18,336**	
15	Total NPV Lifetime Electric Energy Benefits	13,803		21,721		10,509		16,148	
16	Total NPV Lifetime Electric Capacity Benefits	9,444		15,574		6,914		11,285	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	434		1,419		366		1,057	
18	Total NPV Lifetime Fossil Fuel Impacts	-275		-1,163		-215		-830	
19	Total NPV Lifetime Water Impacts	0		20		0		20	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**23,406**		**37,572**		**17,574**		**27,680**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.74**		**1.65**		**1.60**		**1.51**	

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

Table 75: 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**	9,980		18,061		7,699		13,955	
2	Rebates to Participants and Trade Allies	8,103		11,125		8,103		11,125	
3	Upstream / Midstream Incentives	536		889		536		889	
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)	1,341		5,155		-940		1,049	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	11	0	1	1	11
8	Administration and Management	220	1,400	722	2,094	220	1,400	722	2,094
9	Marketing	0	142	0	315	0	142	0	315
10	Program Delivery	21	49	61	1,460	21	49	61	1,460
11	EDC Evaluation Costs	272		727		272		727	
12	SWE Audit Costs	95		225		95		225	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	2,201		5,616		2,201		5,616	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**12,181**		**23,677**		**9,900**		**19,571**	
15	Total NPV Lifetime Electric Energy Benefits	11,544		24,444		8,428		18,281	
16	Total NPV Lifetime Electric Capacity Benefits	7,726		18,759		5,443		14,086	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	902		2,425		619		1,727	
18	Total NPV Lifetime Fossil Fuel Impacts	-571		-4,448		-392		-3,766	
19	Total NPV Lifetime Water Impacts	0		3		0		3	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**19,601**		**41,182**		**14,098**		**30,331**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.61**		**1.74**		**1.42**		**1.55**	

* 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 – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	3,244		5,476		2,987		4,956	
2	Rebates to Participants and Trade Allies	2,116		3,390		2,116		3,390	
3	Upstream / Midstream Incentives	130		160		130		160	
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)	997		1,859		740		1,339	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	0	3	0	0	0	3
8	Administration and Management	78	372	238	551	78	372	238	551
9	Marketing	0	38	0	78	0	38	0	78
10	Program Delivery	7	12	19	331	7	12	19	331
11	EDC Evaluation Costs	71		187		71		187	
12	SWE Audit Costs	26		61		26		61	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	603		1,469		603		1,469	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**3,847**		**6,945**		**3,589**		**6,424**	
15	Total NPV Lifetime Electric Energy Benefits	3,077		5,517		2,725		4,888	
16	Total NPV Lifetime Electric Capacity Benefits	1,371		2,391		1,177		2,089	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	269		532		225		456	
18	Total NPV Lifetime Fossil Fuel Impacts	-118		-247		-102		-210	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**4,600**		**8,192**		**4,025**		**7,223**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.20**		**1.18**		**1.12**		**1.12**	

* 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 – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	IMCs	12,566		21,496		12,201		18,812	
2	Rebates to Participants and Trade Allies	8,635		11,992		8,635		11,992	
3	Upstream / Midstream Incentives	575		883		575		883	
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)	3,356		7,230		2,991		4,547	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	10	0	1	1	10
8	Administration and Management	193	1,344	646	2,090	193	1,344	646	2,090
9	Marketing	0	122	0	254	0	122	0	254
10	Program Delivery	17	39	50	1,295	17	39	50	1,295
11	EDC Evaluation Costs	245		650		245		650	
12	SWE Audit Costs	82		196		82		196	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	2,043		5,192		2,043		5,192	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**14,609**		**26,688**		**14,244**		**24,004**	
15	Total NPV Lifetime Electric Energy Benefits	14,613		27,861		12,449		22,228	
16	Total NPV Lifetime Electric Capacity Benefits	5,472		9,839		4,379		7,557	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,478		2,813		1,215		2,189	
18	Total NPV Lifetime Fossil Fuel Impacts	-204		-1,080		-255		-874	
19	Total NPV Lifetime Water Impacts	0		54		0		54	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**21,358**		**39,488**		**17,788**		**31,153**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.46**		**1.48**		**1.25**		**1.30**	

* 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 PY15 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 Multifamily Direct Install

Findings and recommendations from the PY15 evaluation are presented in Section 3.1.7.4.

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 PY15. 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 PY15.

3.5.1 Participation and Reported Savings by Customer Segment

Table 78 and Table 79 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Large Program in PY15 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 78: 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	253	6	259	188	3	191
PYRTD MWh/yr	18,388	182	18,570	22,238	232	22,470
PYRTD MW/yr	2.86	0.03	2.89	4.07	0.05	4.12
PYTD Incentives ($1000)	1,437	31	1,468	1,912	52	1,964

Table 79: 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	92	1	93	237	2	239
PYRTD MWh/yr	10,403	2	10,405	23,560	136	23,696
PYRTD MW/yr	1.57	0.00	1.57	3.87	0.02	3.90
PYTD Incentives ($1000)	948	3	950	2,745	14	2,759

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 80 summarizes program verified impacts and realization rates for each EDC.

Table 80: ESB-Large Program Gross Impact Evaluation Summary for PY15

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	CI Prescriptive	14,735	2.02	123%	89%
Met-Ed	CI Custom	3,962	0.35	100%	98%
Met-Ed	CI EMNC	2,679	0.44	100%	96%
Met-Ed	Appliance Recycling	0	0.00	109%	106%
Met-Ed Total		**21,376**	**2.82**	**115.1%**	**90.9%**
Penelec	CI Prescriptive	13,000	1.97	97%	95%
Penelec	CI Custom	4,700	1.32	93%	85%
Penelec	CI EMNC	3,606	0.63	89%	81%
Penelec	Appliance Recycling	0	0.00	107%	102%
PenelecTotal		**21,306**	**3.92**	**94.8%**	**88.8%**
Penn Power	CI Prescriptive	4,774	0.98	101%	107%
Penn Power	CI Custom	3,111	0.39	95%	94%
Penn Power	CI EMNC	1,905	0.27	80%	83%
Penn Power	Appliance Recycling	0	0.00	99%	98%
Penn PowerTotal		**9,790**	**1.65**	**94.1%**	**99.3%**
WPP	CI Prescriptive	13,741	2.50	103%	99%
WPP	CI Custom	2,495	0.13	85%	52%
WPP	CI EMNC	7,589	1.25	102%	89%
WPP	Appliance Recycling	0	0.00	103%	102%
WPP Total		**23,824**	**3.88**	**100.5%**	**92.4%**

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.

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 PY15, 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. 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, and the CI Multifamily initiative was evaluated in PY15, with results shown in Table 81.

Table 81: ESB-Large Program Net Impact Evaluation Summary for PY15

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	CI Prescriptive	14,735	61.7%	9,094	1.25
Met-Ed	CI Custom	3,962	57.1%	2,264	0.20
Met-Ed	CI EMNC	2,679	97.8%	2,620	0.43
Met-Ed	Appliance Recycling	0	39.0%	0	0.00
Met-Ed Total		**21,376**	**65.4%**	**13,978**	**1.88**
Penelec	CI Prescriptive	13,000	66.0%	8,574	1.30
Penelec	CI Custom	4,700	52.1%	2,449	0.69
Penelec	CI EMNC	3,606	83.8%	3,022	0.53
Penelec	Appliance Recycling	0	65.0%	0	0.00
Penelec Total		**21,306**	**65.9%**	**14,044**	**2.51**
Penn Power	CI Prescriptive	4,774	80.6%	3,849	0.79
Penn Power	CI Custom	3,111	100.0%	3,111	0.39
Penn Power	CI EMNC	1,905	97.3%	1,854	0.27
Penn Power	Appliance Recycling	0	38.0%	0	0.00
Penn Power Total		**9,790**	**90.0%**	**8,814**	**1.45**
WPP	CI Prescriptive	13,741	67.0%	9,201	1.67
WPP	CI Custom	2,495	49.1%	1,225	0.06
WPP	CI EMNC	7,589	110.0%	8,348	1.38
WPP	Appliance Recycling	0	70.0%	0	0.00
WPP Total		**23,824**	**78.8%**	**18,774**	**3.12**

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 PY15.

3.5.4 Verified Savings Estimates

In Table 82 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 PY15. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 82: 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	18,570	3.10	22,470	4.41	10,405	1.66	23,696	4.20
PYVTD Gross	21,376	2.82	21,306	3.92	9,790	1.65	23,824	3.88
PYVTD Net	13,978	1.88	14,044	2.51	8,814	1.45	18,774	3.12
RTD	69,889	10.08	42,617	7.83	20,327	3.03	53,284	8.53
VTD Gross	74,200	9.83	42,261	7.15	19,401	2.89	55,311	7.80
VTD Net	45,491	6.14	28,147	4.69	15,476	2.35	38,997	5.67

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 83, Table 84, Table 85, and Table 86 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 2023 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 83: 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**	8,042		18,396		5,435		11,399	
2	Rebates to Participants and Trade Allies	1,303		2,844		1,303		2,844	
3	Upstream / Midstream Incentives	315		475		315		475	
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)	6,424		15,077		3,817		8,080	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	2	13	0	1	2	13
8	Administration and Management	236	504	792	935	236	504	792	935
9	Marketing	0	61	0	149	0	61	0	149
10	Program Delivery	19	4	56	601	19	4	56	601
11	EDC Evaluation Costs	289		770		289		770	
12	SWE Audit Costs	111		263		111		263	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,226		3,580		1,226		3,580	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**9,269**		**21,976**		**6,661**		**14,978**	
15	Total NPV Lifetime Electric Energy Benefits	9,300		29,813		6,020		18,218	
16	Total NPV Lifetime Electric Capacity Benefits	2,651		8,898		1,753		5,529	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	727		-1,577		441		-816	
18	Total NPV Lifetime Fossil Fuel Impacts	-203		-4,874		-126		-2,824	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**12,475**		**32,259**		**8,089**		**20,107**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.35**		**1.47**		**1.21**		**1.34**	

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

Table 84: 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**	7,311		11,054		4,946		7,626	
2	Rebates to Participants and Trade Allies	1,987		2,885		1,987		2,885	
3	Upstream / Midstream Incentives	179		350		179		350	
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)	5,146		7,820		2,781		4,391	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	9	0	1	1	9
8	Administration and Management	187	712	602	1,087	187	712	602	1,087
9	Marketing	0	61	0	126	0	61	0	126
10	Program Delivery	13	10	39	322	13	10	39	322
11	EDC Evaluation Costs	215		572		215		572	
12	SWE Audit Costs	81		191		81		191	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,279		2,949		1,279		2,949	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**8,591**		**14,004**		**6,226**		**10,575**	
15	Total NPV Lifetime Electric Energy Benefits	9,314		16,695		6,114		11,098	
16	Total NPV Lifetime Electric Capacity Benefits	4,038		6,794		2,578		4,451	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	491		1,208		397		885	
18	Total NPV Lifetime Fossil Fuel Impacts	-577		-1,060		-396		-727	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**13,266**		**23,638**		**8,693**		**15,707**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.54**		**1.69**		**1.40**		**1.49**	

* 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 – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	2,211		10,461		2,033		7,461	
2	Rebates to Participants and Trade Allies	961		1,485		961		1,485	
3	Upstream / Midstream Incentives	87		109		87		109	
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)	1,163		8,867		985		5,868	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	0	2	0	0	0	2
8	Administration and Management	62	333	195	486	62	333	195	486
9	Marketing	0	29	0	58	0	29	0	58
10	Program Delivery	5	5	14	142	5	5	14	142
11	EDC Evaluation Costs	53		141		53		141	
12	SWE Audit Costs	22		51		22		51	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	509		1,089		509		1,089	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**2,720**		**11,550**		**2,542**		**8,551**	
15	Total NPV Lifetime Electric Energy Benefits	4,278		7,985		3,823		6,307	
16	Total NPV Lifetime Electric Capacity Benefits	1,298		2,137		1,138		1,721	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	95		4,544		84		2,878	
18	Total NPV Lifetime Fossil Fuel Impacts	-242		-382		-208		-331	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**5,429**		**14,284**		**4,837**		**10,575**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**2.00**		**1.24**		**1.90**		**1.24**	

* 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 – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P4TD ($1,000)		Net PYTD ($1,000)		Net P4TD ($1,000)	
1	**IMCs**	7,387		12,656		6,281		9,464	
2	Rebates to Participants and Trade Allies	2,776		4,047		2,776		4,047	
3	Upstream / Midstream Incentives	266		445		266		445	
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)	4,345		8,163		3,239		4,972	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	1	1	9	0	1	1	9
8	Administration and Management	179	802	584	1,096	179	802	584	1,096
9	Marketing	0	52	0	107	0	52	0	107
10	Program Delivery	12	6	34	458	12	6	34	458
11	EDC Evaluation Costs	209		554		209		554	
12	SWE Audit Costs	76		181		76		181	
13	**Program Overhead Costs (Sum of rows 7 through 12)**	1,336		3,024		1,336		3,024	
14	**Total NPV TRC Costs (Sum of rows 1 and 13)**	**8,724**		**15,679**		**7,618**		**12,488**	
15	Total NPV Lifetime Electric Energy Benefits	11,314		23,637		8,883		16,638	
16	Total NPV Lifetime Electric Capacity Benefits	2,572		4,775		2,056		3,452	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	761		1,180		604		871	
18	Total NPV Lifetime Fossil Fuel Impacts	-765		-1,598		-637		-1,175	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	**Total NPV TRC Benefits (Sum of rows 15 through 19)**	**13,883**		**27,993**		**10,907**		**19,786**	
21	**TRC Benefit-Cost Ratio (Row 20 divided by Row 14)**	**1.59**		**1.79**		**1.43**		**1.58**	

* 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

Findings and recommendations for the Multifamily Direct Install program component are listed in Section 3.1.7.4. 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 PY15 are shown in Table 87, Table 88, Table 89, and Table 90 for Met-Ed, Penelec, Penn Power, and WPP. The columns in these tables Table 87 through Table 94 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 87 through Table 94 are based on EDC tracking of expenditures with no adjustments to account for inflation.[9]

Table 87: Met-Ed PY15 Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	2,615	1,206	3,821
Energy Efficient Products	1,389	865	2,254
Low Income Energy Efficiency	2,136	626	2,761
C&I Energy Solutions for Business - Small	8,997	2,097	11,094
C&I Energy Solutions for Business - Large	1,618	1,115	2,734
Common Portfolio Costs[1]		0	0
Portfolio Total	**16,755**	**5,909**	**22,664**
SWE Costs[2]	**N/A**	**N/A**	**338**
Total	**16,755**	**5,909**	**23,002**

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 88: Penelec PY15 Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	2,103	949	3,051
Energy Efficient Products	687	547	1,234
Low Income Energy Efficiency	3,233	742	3,975
C&I Energy Solutions for Business - Small	8,639	2,106	10,745
C&I Energy Solutions for Business - Large	2,165	1,199	3,364
Common Portfolio Costs[1]		0	0
Portfolio Total	**16,828**	**5,542**	**22,370**
SWE Costs[2]	**N/A**	**N/A**	**306**
Total	**16,828**	**5,542**	**22,677**

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 89: Penn Power PY15 Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	1,125	480	1,605
Energy Efficient Products	280	209	489
Low Income Energy Efficiency	721	238	959
C&I Energy Solutions for Business - Small	2,247	577	2,824
C&I Energy Solutions for Business - Large	1,048	488	1,536
Common Portfolio Costs[1]		0	0
Portfolio Total	**5,419**	**1,992**	**7,412**
SWE Costs[2]	**N/A**	**N/A**	**95**
Total	**5,419**	**1,992**	**7,507**

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: WPP PY15 Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	2,683	1,428	4,111
Energy Efficient Products	918	729	1,646
Low Income Energy Efficiency	3,757	746	4,503
C&I Energy Solutions for Business - Small	9,210	1,961	11,171
C&I Energy Solutions for Business - Large	3,042	1,260	4,303
Common Portfolio Costs[1]		0	0
Portfolio Total	**19,610**	**6,123**	**25,733**
SWE Costs[2]	**N/A**	**N/A**	**317**
Total	**19,610**	**6,123**	**26,050**

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.

Program-specific and portfolio total finances since the inception of Phase IV are shown in Table 91, Table 92, Table 93, and Table 94 for Met-Ed, Penn Power, Penelec, and WPP.

Table 91: Met-Ed P4TD Program and Portfolio total Finances ($1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	7,806	3,463	11,269
Energy Efficient Products	4,714	3,691	8,405
Low Income Energy Efficiency	4,696	1,927	6,623
C&I Energy Solutions for Business - Small	12,578	4,625	17,202
C&I Energy Solutions for Business - Large	3,531	3,482	7,013
Common Portfolio Costs[1]		0	0
Portfolio Total	**33,324**	**17,187**	**50,511**
SWE Costs[2]	**N/A**	**N/A**	**845**
Total	**33,324**	**17,187**	**51,356**

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

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	5,914	2,411	8,325
Energy Efficient Products	2,739	2,714	5,454
Low Income Energy Efficiency	6,506	2,205	8,711
C&I Energy Solutions for Business - Small	13,919	5,673	19,592
C&I Energy Solutions for Business - Large	3,471	2,917	6,388
Common Portfolio Costs[1]		0	0
Portfolio Total	**32,549**	**15,921**	**48,470**
SWE Costs[2]	**N/A**	**N/A**	**766**
Total	**32,549**	**15,921**	**49,236**

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

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	2,785	1,324	4,109
Energy Efficient Products	1,103	965	2,069
Low Income Energy Efficiency	1,682	791	2,473
C&I Energy Solutions for Business - Small	3,893	1,486	5,379
C&I Energy Solutions for Business - Large	1,700	1,097	2,797
Common Portfolio Costs[1]		0	0
Portfolio Total	**11,163**	**5,664**	**16,827**
SWE Costs[2]	**N/A**	**N/A**	**238**
Total	**11,163**	**5,664**	**17,065**

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

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	7,708	3,920	11,628
Energy Efficient Products	3,402	3,485	6,887
Low Income Energy Efficiency	7,109	2,119	9,228
C&I Energy Solutions for Business - Small	15,332	5,269	20,601
C&I Energy Solutions for Business - Large	4,829	3,005	7,834
Common Portfolio Costs[1]		0	0
Portfolio Total	**38,379**	**17,799**	**56,177**
SWE Costs[2]	**N/A**	**N/A**	**792**
Total	**38,379**	**17,799**	**56,969**

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 five 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 95, Table 96, Table 97, and Table 98.

Table 95: 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	$8,978	$26,649
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	$11,143	$17,366
Large C&I	Rate GS-Large, Rate GP and Rate TP	$2,845	$7,290
Street Lighting	Street Lighting Service, LED Street Lighting Service and Ornamental Street Lighting Service	$37	$52
Portfolio Total		**$23,002**	**$51,356**

Table 96: 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	$8,391	$22,817
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	$10,831	$19,807
Large C&I	Rate GS-Large, Rate GP, and Rate LP	$3,445	$6,589
Street Lighting	Street Lighting Service, LED Street Lighting Service, and Ornamental Street Lighting Service	$9	$23
Portfolio Total		**$22,677**	**$49,236**

Table 97: 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	$3,100	$8,770
Small C&I	Rate GS, GS Special Rider GSDS, Rate GM, Rate GS-Large and POL	$2,848	$5,437
Large C&I	Rate GP, and Rate GT	$1,557	$2,851
Street Lighting	Rate Schedules SV, SVD, SM and LED	$1	$7
Portfolio Total		**$7,507**	**$17,065**

[10] Includes SWE costs
[11] Includes SWE costs
[12] Includes SWE costs

Table 98: 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	$10,418	$28,138
Small C&I	Rate GS 20, Rate GS 30	$11,250	$20,799
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	$4,379	$8,024
Street Lighting	Rate Schedules 51 through 58, 71, 72	$3	$8
Portfolio Total		**$26,050**	**$56,969**

[13] Includes SWE costs

Appendix A Site Inspection Summary

Table 99: PY15 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 Homes Program - New Construction	PSD	34	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	4	0		
Penelec		ADM	8	0		
Penn Power		PSD	37	0		
Penn Power		ADM	0	0		
WPP		PSD	41	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	34	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	23	0		
Penn Power	C/I Programs	ADM	17	0		
WPP	C/I Programs	ADM	27	0		
TOTAL	**TOTAL**		**577**	**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 2024 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.

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 100 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 100: 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 101 below.

Table 101: 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 102 below.

Table 102: 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 103: Dual participation correction results by EDC and participation wave

Wave	Treat	Control	Delta	Wave	Treat	Control	Delta
ME-2	511	496	15	PN-2-LI	135	136	-1
ME-3	14,349	13,560	790	PP-2	81	59	22
ME-2-LI	318	302	16	PP-2-LI	170	153	17
ME-3-LI	927	936	-9	WP-2	721	642	79
ME-4-LI	180	183	-3	WP-3	3,791	3,677	114
PN-2	17,041	16,091	949	WP-4	219	221	-2
PN-3	292	283	9	WP-2-LI	262	273	-11
PN-4	90	59	31				

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 104: 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 PY14, the 2012 standard residential cohort for Penelec began receiving treatment after previously being inactive for PY13. AMI had yet to be established at the time this 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 the 2012 Penelec standard residential cohort.

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. Four cohorts required featured such an adjustment in PY15 (these cohorts are identified as ME-3, ME-3-LI, PN-2, and WP-3 in following tables). 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:

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

  - 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 105 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 105: PY15 Participation Bill Counts by Month and Cohort

Wave	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23	Jan-24	Feb-24	Mar-24	Apr-24	May-24
ME-2	24,330	24,138	23,899	23,689	23,530	23,322	23,182	23,047	22,910	22,760	22,628	22,501
ME-3	37,316	37,185	37,034	36,892	36,774	36,641	36,539	36,426	36,336	36,252	36,161	36,065
ME-2-LI	8,226	8,085	7,940	7,774	7,629	7,483	7,379	7,292	7,212	7,144	7,052	6,916
ME-3-LI	1,367	1,360	1,354	1,345	1,339	1,330	1,325	1,322	1,319	1,315	1,306	1,291
ME-4-LI	11,319	11,068	10,812	10,540	10,288	9,988	9,815	9,656	9,497	9,353	9,193	8,921
PN-2	39,867	39,757	39,664	39,549	39,422	39,293	39,189	39,121	39,035	38,953	38,886	38,792
PN-3	13,098	12,916	12,749	12,596	12,470	12,308	12,208	12,127	12,058	11,990	11,898	11,781
PN-4	20,435	20,188	19,894	19,654	19,445	19,226	19,050	18,908	18,732	18,603	18,480	18,333
PN-2-LI	9,360	9,139	8,926	8,690	8,500	8,295	8,144	8,021	7,914	7,812	7,684	7,471
PP-2	17,719	17,610	17,393	17,208	17,052	16,910	16,785	16,704	16,601	16,493	16,402	16,268
PP-2-LI	8,353	8,297	8,148	7,972	7,819	7,684	7,599	7,525	7,445	7,368	7,274	7,120
WP-2	32,359	32,085	31,690	31,364	31,156	30,900	30,705	30,545	30,375	30,204	30,026	29,830
WP-3	14,304	14,263	14,222	14,177	14,148	14,111	14,084	14,046	14,010	13,984	13,960	13,919
WP-4	41,758	41,294	40,557	39,911	39,576	39,250	38,966	38,726	38,487	38,286	38,006	37,760
WP-2-LI	11,886	11,615	11,346	11,066	10,839	10,606	10,434	10,287	10,145	9,997	9,847	9,610

B.1.3 Results

The reported and verified energy savings are shown in Table 106 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 107 shows the reported and verified demand reduction for each EDC and initiative.

Table 106: 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-2	1,828	981	0.43%	0.27%
Met-Ed	ME-3	2,804	2,754	0.60%	0.36%
Met-Ed	**Total for EEH Program**	**4,633**	**3,735**	**0.56%**	**0.09%**
Met-Ed	ME-2-LI	402	341	0.38%	0.39%
Met-Ed	ME-3-LI	67	565	2.70%	1.26%
Met-Ed	ME-4-LI	554	696	0.59%	0.34%
Met-Ed	**Total for LI Program**	**1,023**	**1,602**	**1.29%**	**0.28%**
Penelec	PN-2	4,049	200	0.05%	0.26%
Penelec	PN-3	1,330	958	0.94%	0.35%
Penelec	PN-4	2,075	233	0.14%	0.24%
Penelec	**Total for EEH Program**	**7,455**	**1,392**	**0.68%**	**0.54%**
Penelec	PN-2-LI	486	203	0.24%	0.37%
Penelec	**Total for LI Program**	**486**	**203**	**0.24%**	**0.37%**
Penn Power	PP-2	267	-9	-0.01%	0.21%
Penn Power	**Total for EEH Program**	**267**	**-9**	**-0.01%**	**0.21%**
Penn Power	PP-2-LI	724	437	0.51%	0.33%
Penn Power	**Total for LI Program**	**724**	**437**	**0.51%**	**0.33%**
WPP	WP-2	1,809	696	0.23%	0.25%
WPP	WP-3	800	581	0.26%	0.46%
WPP	WP-4	2,334	1,615	0.44%	0.19%
WPP	**Total for EEH Program**	**4,943**	**2,892**	**0.35%**	**0.09%**
WPP	WP-2-LI	761	765	0.61%	0.31%
WPP	**Total for LI Program**	**761**	**765**	**0.61%**	**0.31%**

Table 107: Reported and verified demand reductions for the HER Initiative

Operating Company	Experimental Cohort	PYRTD (MW)	PYVTD (MW)	Demand Realization Rate
Met-Ed	ME-2	0.32	0.11	32.48%
Met-Ed	ME-3	0.50	0.24	47.63%
Met-Ed	**Total for EEH Program**	**0.82**	**0.34**	**41.65%**
Met-Ed	ME-2-LI	0.14	0.07	49.74%
Met-Ed	ME-3-LI	0.02	-0.03	-125.64%
Met-Ed	ME-4-LI	0.20	0.12	58.83%
Met-Ed	**Total for LI Program**	**0.36**	**0.16**	**43.20%**
Penelec	PN-2	0.20	0.22	113.87%
Penelec	PN-3	0.06	0.10	149.49%
Penelec	PN-4	0.10	0.07	70.26%
Penelec	**Total for EEH Program**	**0.36**	**0.39**	**108.08%**
Penelec	PN-2-LI	0.01	-0.06	-611.62%
Penelec	**Total for LI Program**	**0.01**	**-0.06**	**-611.62%**
Penn Power	PP-2	0.06	0.07	115.36%
Penn Power	**Total for EEH Program**	**0.06**	**0.07**	**115.36%**
Penn Power	PP-2-LI	0.04	0.07	191.30%
Penn Power	**Total for LI Program**	**0.04**	**0.07**	**191.30%**
WPP	WP-2	0.51	0.02	4.76%
WPP	WP-3	0.22	0.19	83.36%
WPP	WP-4	0.65	0.14	21.21%
WPP	**Total for EEH Program**	**1.38**	**0.35**	**25.24%**
WPP	WP-2-LI	0.11	-0.02	-16.12%
WPP	**Total for LI Program**	**0.11**	**-0.02**	**-16.12%**

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

Table 108 presents a summary of the programs, components / initiatives and customer segments that contribute to the low-income carveout in PY15 and P4TD.

Table 108: 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	1,177	1,223
Met-Ed	Low Income Energy Efficiency	Appliance Turn-In	Residential	54	1,286
Met-Ed	Low Income Energy Efficiency	Direct Install	Residential	1,087	2,909
Met-Ed	Low Income Energy Efficiency	Home Energy Reports	Residential	1,602	2,069
Met-Ed	Low Income Energy Efficiency	Kits	Residential	2,044	6,155
Met-Ed	Low Income Energy Efficiency	New Homes	Residential	62	222
Met-Ed	Low Income Energy Efficiency	Online Audits	Residential	356	628
Met-Ed	C&I ESB - Small	CI Multifamily	Master Metered MF	1,005	1,179
Met-Ed Total				**7,386**	**15,671**
Penelec	Low Income Energy Efficiency	Appliances	Residential	1,639	1,682
Penelec	Low Income Energy Efficiency	Appliance Turn-In	Residential	45	1,285
Penelec	Low Income Energy Efficiency	Direct Install	Residential	2,032	4,695
Penelec	Low Income Energy Efficiency	Home Energy Reports	Residential	203	1,404
Penelec	Low Income Energy Efficiency	Kits	Residential	1,953	7,095
Penelec	Low Income Energy Efficiency	New Homes	Residential	2	11
Penelec	Low Income Energy Efficiency	Online Audits	Residential	579	869
Penelec	C&I ESB - Small	CI Multifamily	Master Metered MF	848	1,789
Penelec Total				**7,301**	**18,829**
Penn Power	Low Income Energy Efficiency	Appliances	Residential	472	489
Penn Power	Low Income Energy Efficiency	Appliance Turn-In	Residential	11	294
Penn Power	Low Income Energy Efficiency	Direct Install	Residential	504	1,517
Penn Power	Low Income Energy Efficiency	Home Energy Reports	Residential	437	1,047
Penn Power	Low Income Energy Efficiency	Kits	Residential	0	891
Penn Power	Low Income Energy Efficiency	New Homes	Residential	0	0
Penn Power	Low Income Energy Efficiency	Online Audits	Residential	107	169
Penn Power	C&I ESB - Small	CI Multifamily	Master Metered MF	39	159
Penn Power Total				**1,570**	**4,567**
WPP	Low Income Energy Efficiency	Appliances	Residential	1,365	1,428
WPP	Low Income Energy Efficiency	Appliance Turn-In	Residential	33	1,202
WPP	Low Income Energy Efficiency	Direct Install	Residential	2,546	5,470
WPP	Low Income Energy Efficiency	Home Energy Reports	Residential	765	3,033
WPP	Low Income Energy Efficiency	Kits	Residential	2,594	8,094
WPP	Low Income Energy Efficiency	New Homes	Residential	0	3
WPP	Low Income Energy Efficiency	Online Audits	Residential	373	576
WPP	C&I ESB - Small	CI Multifamily	Master Metered MF	259	2,042
WPP Total				**7,935**	**21,849**

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 PY15 is presented in Table 109, Table 110, Table 111, andTable 112.

Table 109: 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	11,291	10,008	8,215	34,031	25,925	21,267
Energy Efficient Homes	Home Energy Reports	4,633	3,735	3,735	8,767	8,071	8,071
Energy Efficient Homes	Direct Install	408	446	387	765	836	757
Energy Efficient Homes	New Homes	1,851	1,860	1,339	6,072	6,084	4,402
Energy Efficient Homes	Multifamily	25	27	27	54	59	53
Energy Efficient Homes	Online Audits	793	581	581	2,364	1,099	1,099
Energy Efficient Products	Appliance Recycling	564	616	240	8,840	9,656	3,766
Energy Efficient Products	Upstream Electronics	0	0	0	0	0	0
Energy Efficient Products	HVAC	1,216	1,847	935	3,145	4,305	2,181
Energy Efficient Products	Appliances	713	787	534	2,008	2,222	1,428
Energy Efficient Products	Midstream Appliances	4,765	4,907	2,316	13,895	14,465	6,828
Low Income Program	Appliances	1,066	1,177	1,177	1,108	1,223	1,223
Low Income Program	Appliance Turn-In	50	54	54	1,097	1,286	1,286
Low Income Program	Direct Install	1,077	1,087	1,087	2,882	2,909	2,909
Low Income Program	Home Energy Reports	1,023	1,602	1,602	1,542	2,069	2,069
Low Income Program	Kits	2,246	2,044	2,044	6,609	6,155	6,155
Low Income Program	New Homes	61	62	62	223	222	222
Low Income Program	Online Audits	77	356	356	210	628	628
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	23,177	28,589	17,643	54,957	62,184	40,493
C&I Solutions for Business Programs - Small and Large	CI Custom	8,078	8,111	4,635	44,956	45,631	25,654
C&I Solutions for Business Programs - Small and Large	CI EMNC	15,715	15,719	15,373	20,806	20,500	19,634
C&I Solutions for Business Program - Small	CI Multifamily	1,000	1,005	1,000	1,247	1,179	1,174
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	13	14	6	123	135	53
Portfolio Total		**79,844**	**84,633**	**63,346**	**215,702**	**216,844**	**151,351**

Table 110: 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	10,780	10,457	11,128	31,415	31,700	28,869
Energy Efficient Homes	Home Energy Reports	7,455	1,392	1,392	12,226	6,258	6,258
Energy Efficient Homes	Direct Install	324	372	369	501	575	578
Energy Efficient Homes	New Homes	217	220	159	713	723	522
Energy Efficient Homes	Multifamily	79	96	96	118	143	135
Energy Efficient Homes	Online Audits	532	433	433	1,522	553	553
Energy Efficient Products	Appliance Recycling	320	343	223	6,607	7,081	4,602
Energy Efficient Products	Upstream Electronics	0	0	0	0	0	0
Energy Efficient Products	HVAC	585	585	408	1,649	1,826	1,057
Energy Efficient Products	Appliances	335	343	169	922	926	471
Energy Efficient Products	Midstream Appliances	2,814	2,741	1,456	9,246	9,372	4,976
Low Income Program	Appliances	1,602	1,639	1,639	1,646	1,682	1,682
Low Income Program	Appliance Turn-In	43	45	45	1,205	1,285	1,285
Low Income Program	Direct Install	2,038	2,032	2,032	4,709	4,695	4,695
Low Income Program	Home Energy Reports	486	203	203	1,089	1,404	1,404
Low Income Program	Kits	1,972	1,953	1,953	7,104	7,095	7,095
Low Income Program	New Homes	2	2	2	10	11	11
Low Income Program	Online Audits	114	579	579	290	869	869
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	27,282	26,532	17,500	63,960	64,860	43,300
C&I Solutions for Business Programs - Small and Large	CI Custom	6,529	6,059	3,157	16,746	16,317	12,061
C&I Solutions for Business Programs - Small and Large	CI EMNC	16,006	14,293	11,978	23,030	20,277	16,893
C&I Solutions for Business Program - Small	CI Multifamily	844	848	844	2,013	1,789	1,785
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	4	5	3	93	100	65
Portfolio Total		**80,365**	**71,173**	**55,765**	**186,814**	**179,539**	**139,167**

Table 111: 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	3,435	3,566	3,061	9,518	8,949	7,583
Energy Efficient Homes	Home Energy Reports	267	-9	-9	2,068	1,868	1,868
Energy Efficient Homes	Direct Install	153	169	159	295	327	317
Energy Efficient Homes	New Homes	1,530	1,552	1,118	3,372	3,376	2,438
Energy Efficient Homes	Multifamily	6	6	6	6	6	6
Energy Efficient Homes	Online Audits	201	143	143	524	206	206
Energy Efficient Products	Appliance Recycling	85	84	32	2,173	2,158	820
Energy Efficient Products	Upstream Electronics	0	0	0	0	0	0
Energy Efficient Products	HVAC	198	323	177	556	776	425
Energy Efficient Products	Appliances	210	223	117	550	592	310
Energy Efficient Products	Midstream Appliances	1,025	994	437	3,915	3,998	1,759
Low Income Program	Appliances	444	472	472	460	489	489
Low Income Program	Appliance Turn-In	11	11	11	278	294	294
Low Income Program	Direct Install	500	504	504	1,504	1,517	1,517
Low Income Program	Home Energy Reports	724	437	437	1,613	1,047	1,047
Low Income Program	Kits	0	0	0	914	891	891
Low Income Program	New Homes	0	0	0	0	0	0
Low Income Program	Online Audits	24	107	107	59	169	169
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	8,195	8,239	6,643	14,858	14,230	11,562
C&I Solutions for Business Programs - Small and Large	CI Custom	3,431	3,263	3,263	9,795	9,630	7,196
C&I Solutions for Business Programs - Small and Large	CI EMNC	6,328	5,056	4,919	10,287	8,674	8,377
C&I Solutions for Business Program - Small	CI Multifamily	39	39	39	171	159	159
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	8	8	3	51	52	20
Portfolio Total		**26,812**	**25,188**	**21,639**	**62,967**	**59,407**	**47,453**

Table 112: 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	10,925	8,768	8,446	33,782	27,323	28,939
Energy Efficient Homes	Home Energy Reports	4,943	2,892	2,892	8,855	6,834	6,834
Energy Efficient Homes	Direct Install	378	425	388	670	752	728
Energy Efficient Homes	New Homes	2,388	2,521	1,815	5,837	6,111	4,415
Energy Efficient Homes	Multifamily	73	82	81	223	249	215
Energy Efficient Homes	Online Audits	770	543	543	2,039	846	846
Energy Efficient Products	Appliance Recycling	469	484	339	9,409	9,710	6,797
Energy Efficient Products	Upstream Electronics	0	0	0	0	0	0
Energy Efficient Products	HVAC	873	1,330	729	2,557	3,710	1,967
Energy Efficient Products	Appliances	660	704	368	1,847	1,976	1,068
Energy Efficient Products	Midstream Appliances	2,599	2,523	1,282	8,575	8,706	4,423
Low Income Program	Appliances	1,279	1,365	1,365	1,338	1,428	1,428
Low Income Program	Appliance Turn-In	29	33	33	1,069	1,202	1,202
Low Income Program	Direct Install	2,543	2,546	2,546	5,464	5,470	5,470
Low Income Program	Home Energy Reports	761	765	765	2,596	3,033	3,033
Low Income Program	Kits	2,572	2,594	2,594	7,806	8,094	8,094
Low Income Program	New Homes	0	0	0	3	3	3
Low Income Program	Online Audits	77	373	373	184	576	576
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	29,185	30,096	20,153	72,895	78,043	51,768
C&I Solutions for Business Programs - Small and Large	CI Custom	3,956	3,358	1,649	12,347	11,665	6,352
C&I Solutions for Business Programs - Small and Large	CI EMNC	21,413	21,864	24,050	29,850	29,454	31,884
C&I Solutions for Business Program - Small	CI Multifamily	258	259	258	2,508	2,042	2,041
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	3	4	2	104	108	76
Portfolio Total		**86,152**	**83,528**	**70,671**	**209,958**	**207,337**	**168,159**

Table 113, Table 114, Table 115, and Table 116 present summaries of the peak demand impacts by energy efficiency program and initiative through the current reporting period.

Table 113: 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	1.21	1.08	0.89	3.66	2.87	2.35
Energy Efficient Homes	Home Energy Reports	0.82	0.34	0.34	1.46	0.90	0.90
Energy Efficient Homes	Direct Install	0.07	0.05	0.04	0.13	0.10	0.09
Energy Efficient Homes	New Homes	0.44	0.47	0.34	2.12	1.63	1.18
Energy Efficient Homes	Multifamily	0.00	0.00	0.00	0.01	0.01	0.01
Energy Efficient Homes	Online Audits	0.09	0.10	0.10	0.18	0.20	0.20
Energy Efficient Products	Appliance Recycling	0.11	0.12	0.05	2.32	2.46	0.96
Energy Efficient Products	Upstream Electronics	0.00	0.00	0.00	0.00	0.00	0.00
Energy Efficient Products	HVAC	0.19	0.22	0.11	0.52	0.60	0.30
Energy Efficient Products	Appliances	0.11	0.11	0.08	0.33	0.37	0.24
Energy Efficient Products	Midstream Appliances	0.96	0.84	0.39	2.87	2.70	1.27
Low Income Program	Appliances	0.14	0.14	0.14	0.14	0.15	0.15
Low Income Program	Appliance Turn-In	0.01	0.01	0.01	0.29	0.34	0.34
Low Income Program	Direct Install	0.21	0.21	0.21	0.44	0.44	0.44
Low Income Program	Home Energy Reports	0.36	0.16	0.16	0.43	0.33	0.33
Low Income Program	Kits	0.25	0.24	0.24	0.72	0.72	0.72
Low Income Program	New Homes	0.01	0.01	0.01	0.04	0.03	0.03
Low Income Program	Online Audits	0.01	0.05	0.05	0.02	0.10	0.10
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	4.86	4.30	2.65	10.70	10.22	6.68
C&I Solutions for Business Programs - Small and Large	CI Custom	1.38	1.36	0.78	5.73	5.72	3.21
C&I Solutions for Business Programs - Small and Large	CI EMNC	2.31	2.23	2.18	3.16	3.04	2.90
C&I Solutions for Business Program - Small	CI Multifamily	0.14	0.13	0.13	0.18	0.15	0.15
C&I Solutions for Business Program - Small	Appliance Recycling	0.00	0.00	0.00	0.03	0.03	0.01
Portfolio Total		**13.68**	**12.17**	**8.90**	**35.47**	**33.09**	**22.56**

Table 114: 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	1.07	1.04	1.10	3.13	3.21	2.92
Energy Efficient Homes	Home Energy Reports	0.36	0.39	0.39	1.70	1.51	1.51
Energy Efficient Homes	Direct Install	0.05	0.04	0.04	0.08	0.06	0.06
Energy Efficient Homes	New Homes	0.05	0.07	0.05	0.28	0.20	0.15
Energy Efficient Homes	Multifamily	0.01	0.01	0.01	0.01	0.01	0.01
Energy Efficient Homes	Online Audits	0.06	0.07	0.07	0.11	0.08	0.08
Energy Efficient Products	Appliance Recycling	0.07	0.07	0.04	1.71	1.75	1.14
Energy Efficient Products	Upstream Electronics	0.00	0.00	0.00	0.00	0.00	0.00
Energy Efficient Products	HVAC	0.05	0.09	0.06	0.16	0.25	0.14
Energy Efficient Products	Appliances	0.05	0.05	0.03	0.15	0.16	0.08
Energy Efficient Products	Midstream Appliances	0.70	0.59	0.32	2.33	2.21	1.17
Low Income Program	Appliances	0.20	0.21	0.21	0.21	0.22	0.22
Low Income Program	Appliance Turn-In	0.01	0.01	0.01	0.34	0.33	0.33
Low Income Program	Direct Install	0.25	0.25	0.25	0.57	0.57	0.57
Low Income Program	Home Energy Reports	0.01	-0.06	-0.06	0.14	-0.02	-0.02
Low Income Program	Kits	0.20	0.20	0.20	0.73	0.75	0.75
Low Income Program	New Homes	0.00	0.00	0.00	0.00	0.00	0.00
Low Income Program	Online Audits	0.01	0.08	0.08	0.02	0.12	0.12
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	5.36	5.07	3.35	12.63	11.98	8.00
C&I Solutions for Business Programs - Small and Large	CI Custom	1.88	1.59	0.83	5.04	4.75	3.63
C&I Solutions for Business Programs - Small and Large	CI EMNC	2.42	1.97	1.65	3.44	2.71	2.26
C&I Solutions for Business Program - Small	CI Multifamily	0.12	0.11	0.11	0.28	0.24	0.24
C&I Solutions for Business Program - Small	Appliance Recycling	0.00	0.00	0.00	0.02	0.02	0.02
Portfolio Total		**12.95**	**11.85**	**8.73**	**33.10**	**31.12**	**23.38**

Table 115: 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	0.38	0.33	1.03	0.94	0.79
Energy Efficient Homes	Home Energy Reports	0.06	0.07	0.07	0.52	0.50	0.50
Energy Efficient Homes	Direct Install	0.02	0.02	0.02	0.05	0.04	0.04
Energy Efficient Homes	New Homes	0.35	0.39	0.28	1.19	0.89	0.65
Energy Efficient Homes	Multifamily	0.00	0.00	0.00	0.00	0.00	0.00
Energy Efficient Homes	Online Audits	0.02	0.02	0.02	0.04	0.03	0.03
Energy Efficient Products	Appliance Recycling	0.02	0.02	0.01	0.50	0.49	0.19
Energy Efficient Products	Upstream Electronics	0.00	0.00	0.00	0.00	0.00	0.00
Energy Efficient Products	HVAC	0.03	0.05	0.03	0.10	0.13	0.07
Energy Efficient Products	Appliances	0.03	0.03	0.02	0.09	0.10	0.05
Energy Efficient Products	Midstream Appliances	0.24	0.21	0.09	0.91	0.88	0.39
Low Income Program	Appliances	0.06	0.06	0.06	0.06	0.06	0.06
Low Income Program	Appliance Turn-In	0.00	0.00	0.00	0.07	0.07	0.07
Low Income Program	Direct Install	0.06	0.06	0.06	0.19	0.19	0.19
Low Income Program	Home Energy Reports	0.04	0.07	0.07	0.15	0.16	0.16
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	0.02	0.02	0.00	0.03	0.03
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	1.74	1.87	1.51	3.09	2.90	2.36
C&I Solutions for Business Programs - Small and Large	CI Custom	0.42	0.40	0.40	1.12	1.10	0.84
C&I Solutions for Business Programs - Small and Large	CI EMNC	0.85	0.71	0.69	1.64	1.48	1.43
C&I Solutions for Business Program - Small	CI Multifamily	0.01	0.00	0.00	0.02	0.02	0.02
C&I Solutions for Business Program - Small	Appliance Recycling	0.00	0.00	0.00	0.01	0.01	0.00
Portfolio Total		**4.34**	**4.38**	**3.67**	**10.88**	**10.12**	**7.97**

Table 116: 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	1.24	1.00	0.97	3.83	3.22	3.42
Energy Efficient Homes	Home Energy Reports	1.38	0.35	0.35	2.09	0.60	0.60
Energy Efficient Homes	Direct Install	0.06	0.05	0.05	0.11	0.09	0.09
Energy Efficient Homes	New Homes	0.60	0.61	0.44	2.07	1.47	1.06
Energy Efficient Homes	Multifamily	0.01	0.01	0.01	0.04	0.03	0.03
Energy Efficient Homes	Online Audits	0.08	0.09	0.09	0.16	0.14	0.14
Energy Efficient Products	Appliance Recycling	0.09	0.09	0.06	2.32	2.36	1.65
Energy Efficient Products	Upstream Electronics	0.00	0.00	0.00	0.00	0.00	0.00
Energy Efficient Products	HVAC	0.13	0.17	0.09	0.40	0.46	0.24
Energy Efficient Products	Appliances	0.10	0.10	0.05	0.29	0.32	0.17
Energy Efficient Products	Midstream Appliances	0.66	0.55	0.28	2.09	1.98	1.01
Low Income Program	Appliances	0.16	0.17	0.17	0.17	0.18	0.18
Low Income Program	Appliance Turn-In	0.01	0.01	0.01	0.30	0.33	0.33
Low Income Program	Direct Install	0.36	0.36	0.36	0.75	0.75	0.75
Low Income Program	Home Energy Reports	0.11	-0.02	-0.02	0.40	0.07	0.07
Low Income Program	Kits	0.30	0.31	0.31	0.90	0.96	0.96
Low Income Program	New Homes	0.00	0.00	0.00	0.00	0.00	0.00
Low Income Program	Online Audits	0.01	0.05	0.05	0.01	0.08	0.08
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	6.41	6.32	4.23	14.47	13.47	8.94
C&I Solutions for Business Programs - Small and Large	CI Custom	0.40	0.21	0.10	1.27	1.06	0.58
C&I Solutions for Business Programs - Small and Large	CI EMNC	3.54	3.14	3.45	4.84	4.30	4.64
C&I Solutions for Business Program - Small	CI Multifamily	0.04	0.03	0.03	0.33	0.25	0.25
C&I Solutions for Business Program - Small	Appliance Recycling	0.00	0.00	0.00	0.02	0.02	0.02
Portfolio Total		**15.67**	**13.59**	**11.08**	**36.87**	**32.16**	**25.23**

D.2 PROGRAM-LEVEL COST-EFFECTIVENESS SUMMARY

Table 117, Table 118, Table 119, and Table 120 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 PY15, cost and benefits are expressed in 2023 dollars.

Table 117: PY15 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	$12,396	$4,549	2.72	$7,847
Energy Efficient Products	$5,099	$6,299	0.81	-$1,200
Low Income Energy Efficiency	$2,860	$2,855	1.00	$6
Residential Subtotal	**$20,355**	**$13,703**	**1.49**	**$6,653**
C&I Energy Solutions for Business - Small	$23,406	$13,431	1.74	$9,976
C&I Energy Solutions for Business - Large	$12,475	$9,269	1.35	$3,207
Non-Residential Subtotal	**$35,882**	**$22,699**	**1.58**	**$13,183**
Portfolio Total	**$56,237**	**$36,402**	**1.54**	**$19,835**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 118: PY15 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	$11,640	$3,230	3.60	$8,410
Energy Efficient Products	$2,708	$3,776	0.72	-$1,068
Low Income Energy Efficiency	$2,751	$4,064	0.68	-$1,313
Residential Subtotal	**$17,099**	**$11,070**	**1.54**	**$6,029**
C&I Energy Solutions for Business - Small	$19,601	$12,181	1.61	$7,420
C&I Energy Solutions for Business - Large	$13,266	$8,591	1.54	$4,676
Non-Residential Subtotal	**$32,867**	**$20,771**	**1.58**	**$12,096**
Portfolio Total	**$49,967**	**$31,842**	**1.57**	**$18,125**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 119: PY15 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	$4,491	$2,191	2.05	$2,300
Energy Efficient Products	$1,098	$1,381	0.79	-$283
Low Income Energy Efficiency	$334	$984	0.34	-$650
Residential Subtotal	**$5,923**	**$4,556**	**1.30**	**$1,367**
C&I Energy Solutions for Business - Small	$4,600	$3,847	1.20	$753
C&I Energy Solutions for Business - Large	$5,429	$2,720	2.00	$2,709
Non-Residential Subtotal	**$10,029**	**$6,567**	**1.53**	**$3,462**
Portfolio Total	**$15,952**	**$11,123**	**1.43**	**$4,829**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 120: PY15 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	$9,310	$5,191	1.79	$4,120
Energy Efficient Products	$3,088	$4,840	0.64	-$1,752
Low Income Energy Efficiency	$3,127	$4,585	0.68	-$1,458
Residential Subtotal	**$15,525**	**$14,616**	**1.06**	**$909**
C&I Energy Solutions for Business - Small	$21,358	$14,609	1.46	$6,749
C&I Energy Solutions for Business - Large	$13,883	$8,724	1.59	$5,159
Non-Residential Subtotal	**$35,241**	**$23,333**	**1.51**	**$11,908**
Portfolio Total	**$50,766**	**$37,949**	**1.34**	**$12,817**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 121, Table 122, Table 123, and Table 124 present PY15 cost-effectiveness for Met-Ed, Penelec, Penn Power, and WPP respectively, using net verified savings to calculate benefits.

Table 121: PY15 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	$10,077	$4,171	2.42	$5,906
Energy Efficient Products	$2,596	$3,742	0.69	-$1,147
Low Income Energy Efficiency	$2,860	$2,855	1.00	$6
Residential Subtotal	**$15,533**	**$10,768**	**1.44**	**$4,765**
C&I Energy Solutions for Business - Small	$17,574	$10,982	1.60	$6,592
C&I Energy Solutions for Business - Large	$8,089	$6,661	1.21	$1,428
Non-Residential Subtotal	**$25,663**	**$17,644**	**1.45**	**$8,019**
Portfolio Total	**$41,197**	**$28,412**	**1.45**	**$12,785**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 122: PY15 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	$12,288	$3,173	3.87	$9,115
Energy Efficient Products	$1,506	$2,638	0.57	-$1,132
Low Income Energy Efficiency	$2,751	$4,064	0.68	-$1,313
Residential Subtotal	**$16,545**	**$9,875**	**1.68**	**$6,670**
C&I Energy Solutions for Business - Small	$14,098	$9,900	1.42	$4,198
C&I Energy Solutions for Business - Large	$8,693	$6,226	1.40	$2,468
Non-Residential Subtotal	**$22,791**	**$16,126**	**1.41**	**$6,665**
Portfolio Total	**$39,337**	**$26,001**	**1.51**	**$13,336**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 123: PY15 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	$3,702	$1,896	1.95	$1,806
Energy Efficient Products	$522	$827	0.63	-$304
Low Income Energy Efficiency	$334	$984	0.34	-$650
Residential Subtotal	**$4,559**	**$3,707**	**1.23**	**$851**
C&I Energy Solutions for Business - Small	$4,025	$3,589	1.12	$436
C&I Energy Solutions for Business - Large	$4,837	$2,542	1.90	$2,295
Non-Residential Subtotal	**$8,863**	**$6,131**	**1.45**	**$2,731**
Portfolio Total	**$13,421**	**$9,838**	**1.36**	**$3,583**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 124: PY15 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	$8,537	$4,685	1.82	$3,852
Energy Efficient Products	$1,632	$2,971	0.55	-$1,339
Low Income Energy Efficiency	$3,127	$4,585	0.68	-$1,458
Residential Subtotal	**$13,297**	**$12,241**	**1.09**	**$1,055**
C&I Energy Solutions for Business - Small	$17,788	$14,244	1.25	$3,543
C&I Energy Solutions for Business - Large	$10,907	$7,618	1.43	$3,289
Non-Residential Subtotal	**$28,694**	**$21,862**	**1.31**	**$6,832**
Portfolio Total	**$41,991**	**$34,103**	**1.23**	**$7,887**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 125, Table 126, Table 127, and Table 128 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 125: 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	$30,172	$13,296	2.27	$16,876
Energy Efficient Products	$16,119	$18,597	0.87	-$2,478
Low Income Energy Efficiency	$7,274	$6,590	1.10	$684
Residential Subtotal	**$53,565**	**$38,484**	**1.39**	**$15,082**
C&I Energy Solutions for Business - Small	$37,572	$22,836	1.65	$14,736
C&I Energy Solutions for Business - Large	$32,259	$21,976	1.47	$10,284
Non-Residential Subtotal	**$69,831**	**$44,811**	**1.56**	**$25,020**
Portfolio Total	**$123,396**	**$83,295**	**1.48**	**$40,102**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 126: 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	$29,576	$8,298	3.56	$21,277
Energy Efficient Products	$10,013	$13,094	0.76	-$3,081
Low Income Energy Efficiency	$7,883	$8,497	0.93	-$614
Residential Subtotal	**$47,472**	**$29,889**	**1.59**	**$17,583**
C&I Energy Solutions for Business - Small	$41,182	$23,677	1.74	$17,505
C&I Energy Solutions for Business - Large	$23,638	$14,004	1.69	$9,634
Non-Residential Subtotal	**$64,820**	**$37,681**	**1.72**	**$27,139**
Portfolio Total	**$112,292**	**$67,570**	**1.66**	**$44,722**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 127: 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	$9,842	$5,683	1.73	$4,159
Energy Efficient Products	$3,875	$4,156	0.93	-$281
Low Income Energy Efficiency	$1,466	$2,394	0.61	-$928
Residential Subtotal	**$15,183**	**$12,233**	**1.24**	**$2,950**
C&I Energy Solutions for Business - Small	$8,192	$6,945	1.18	$1,247
C&I Energy Solutions for Business - Large	$14,284	$11,550	1.24	$2,734
Non-Residential Subtotal	**$22,477**	**$18,495**	**1.22**	**$3,982**
Portfolio Total	**$37,660**	**$30,728**	**1.23**	**$6,931**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 128: 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	$27,048	$14,361	1.88	$12,687
Energy Efficient Products	$10,709	$15,189	0.71	-$4,480
Low Income Energy Efficiency	$8,661	$8,834	0.98	-$172
Residential Subtotal	**$46,418**	**$38,384**	**1.21**	**$8,035**
C&I Energy Solutions for Business - Small	$39,488	$26,688	1.48	$12,800
C&I Energy Solutions for Business - Large	$27,993	$15,679	1.79	$12,314
Non-Residential Subtotal	**$67,481**	**$42,367**	**1.59**	**$25,114**
Portfolio Total	**$113,899**	**$80,751**	**1.41**	**$33,149**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 129, Table 130, Table 131, and Table 132 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 129: 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	$24,393	$11,792	2.07	$12,601
Energy Efficient Products	$7,811	$11,303	0.69	-$3,491
Low Income Energy Efficiency	$7,274	$6,590	1.10	$684
Residential Subtotal	**$39,479**	**$29,686**	**1.33**	**$9,793**
C&I Energy Solutions for Business - Small	$27,680	$18,336	1.51	$9,345
C&I Energy Solutions for Business - Large	$20,107	$14,978	1.34	$5,129
Non-Residential Subtotal	**$47,788**	**$33,314**	**1.43**	**$14,473**
Portfolio Total	**$87,267**	**$63,000**	**1.39**	**$24,267**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 130: 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	$27,098	$7,990	3.39	$19,108
Energy Efficient Products	$5,581	$8,573	0.65	-$2,992
Low Income Energy Efficiency	$7,883	$8,497	0.93	-$614
Residential Subtotal	**$40,562**	**$25,060**	**1.62**	**$15,502**
C&I Energy Solutions for Business - Small	$30,331	$19,571	1.55	$10,760
C&I Energy Solutions for Business - Large	$15,707	$10,575	1.49	$5,132
Non-Residential Subtotal	**$46,038**	**$30,146**	**1.53**	**$15,892**
Portfolio Total	**$86,600**	**$55,206**	**1.57**	**$31,394**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 131: 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	$8,096	$4,853	1.67	$3,243
Energy Efficient Products	$1,775	$2,569	0.69	-$794
Low Income Energy Efficiency	$1,466	$2,394	0.61	-$928
Residential Subtotal	**$11,337**	**$9,816**	**1.15**	**$1,521**
C&I Energy Solutions for Business - Small	$7,223	$6,424	1.12	$799
C&I Energy Solutions for Business - Large	$10,575	$8,551	1.24	$2,025
Non-Residential Subtotal	**$17,799**	**$14,975**	**1.19**	**$2,824**
Portfolio Total	**$29,136**	**$24,791**	**1.18**	**$4,345**
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 132: 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	$27,301	$13,182	2.07	$14,118
Energy Efficient Products	$5,961	$9,808	0.61	-$3,848
Low Income Energy Efficiency	$8,661	$8,834	0.98	-$172
Residential Subtotal	**$41,923**	**$31,825**	**1.32**	**$10,098**
C&I Energy Solutions for Business - Small	$31,153	$24,004	1.30	$7,149
C&I Energy Solutions for Business - Large	$19,786	$12,488	1.58	$7,299
Non-Residential Subtotal	**$50,940**	**$36,492**	**1.40**	**$14,448**
Portfolio Total	**$92,863**	**$68,317**	**1.36**	**$24,546**
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 133 and Table 134 present net-to-gross findings HIMs studied thus far in Phase IV[14]. The Res HVAC and EE Kits initiatives were evaluated in PY15, while other HIMs were evaluated in previous years of Phase IV.

Table 133: 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	42.9%	0.0%	57.1%	47.9%	0.0%	52.1%
CI Prescriptive	39.0%	0.7%	61.7%	36.2%	2.2%	66.0%
CI EMNC	2.2%	0.0%	97.8%	16.2%	0.0%	83.8%
EE Kits	24.1%	6.1%	82.1%	17.4%	23.9%	106.4%
Res HVAC	50.4%	50.4%	50.4%	45.2%	14.9%	69.7%
Res Appliance Turn-In	61.0%	0.0%	39.0%	35.0%	0.0%	65.0%

Table 134: 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	0.0%	0.0%	100.0%	50.9%	0.0%	49.1%
CI Prescriptive	20.6%	1.2%	80.6%	34.5%	1.5%	67.0%
CI EMNC	2.7%	0.0%	97.3%	8.2%	18.2%	110.0%
EE Kits	22.5%	8.4%	85.9%	13.2%	9.5%	96.3%
Res HVAC	47.4%	2.1%	54.7%	48.8%	3.6%	54.8%
Res Appliance Turn-In	62.0%	0.0%	38.0%	30.0%	0.0%	70.0%

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 135, Table 136, Table 137, and Table 138 present PY15 expenditures, by program, compared to the budget estimates set forth in the EE&C plan for PY15 for Met-Ed, Penelec, Penn Power, and WPP. All the dollars in these tables are presented in 2023 Dollars.

Table 135: Comparison of PYTD Expenditures to EE&C Plan ($1,000) Met-Ed

Program	PY15 Budget from EE&C Plan	PY15 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 4,647.00	$ 3,876.58	0.83
Energy Efficient Products Program	$ 2,676.00	$ 2,307.16	0.86
Low Income Energy Efficiency Program	$ 3,068.00	$ 2,794.02	0.91
C&I Energy Solutions for Business Program - Small	$ 7,486.00	$ 11,179.55	1.49
C&I Energy Solutions for Business Program - Large	$ 7,270.00	$ 2,844.57	0.39
Total	**$ 25,147.00**	**$ 23,001.89**	**0.91**

Table 136: Comparison of PYTD Expenditures to EE&C Plan ($1,000) Penelec

Program	PY15 Budget from EE&C Plan	PY15 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 3,741.00	$ 3,095.75	0.83
Energy Efficient Products Program	$ 2,393.00	$ 1,285.30	0.54
Low Income Energy Efficiency Program	$ 3,255.00	$ 4,010.38	1.23
C&I Energy Solutions for Business Program - Small	$ 8,130.00	$ 10,840.20	1.33
C&I Energy Solutions for Business Program - Large	$ 5,685.00	$ 3,444.89	0.61
Total	**$ 23,204.00**	**$ 22,676.52**	**0.98**

Table 137: Comparison of PYTD Expenditures to EE&C Plan ($1,000) Penn Power

Program	PY15 Budget from EE&C Plan	PY15 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 1,591.00	$ 1,624.87	1.02
Energy Efficient Products Program	$ 710.00	$ 505.05	0.71
Low Income Energy Efficiency Program	$ 797.00	$ 970.33	1.22
C&I Energy Solutions for Business Program - Small	$ 2,074.00	$ 2,849.30	1.37
C&I Energy Solutions for Business Program - Large	$ 1,544.00	$ 1,557.24	1.01
Total	**$ 6,716.00**	**$ 7,506.80**	**1.12**

Table 138: Comparison of PYTD Expenditures to EE&C Plan ($1,000) WPP

Program	PY15 Budget from EE&C Plan	PY15 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 4,954.00	$ 4,173.06	0.84
Energy Efficient Products Program	$ 2,931.00	$ 1,707.85	0.58
Low Income Energy Efficiency Program	$ 3,178.00	$ 4,537.14	1.43
C&I Energy Solutions for Business Program - Small	$ 7,093.00	$ 11,253.12	1.59
C&I Energy Solutions for Business Program - Large	$ 5,417.00	$ 4,378.78	0.81
Total	**$ 23,573.00**	**$ 26,049.95**	**1.11**

Table 139, Table 140, Table 141, and Table 142 present P4TD expenditures, by program, compared to the budget estimates set forth in the EE&C plan through PY15 for Met-Ed, Penelec, Penn Power, and WPP respectively. All the dollars in these tables are presented in nominal Dollars.

Table 139: Comparison of P4TD Expenditures to EE&C Plan ($1,000) Met-Ed

Program	Phase IV Budget from EE&C Plan through PY15	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 13,805.00	$ 11,407.29	0.83
Energy Efficient Products Program	$ 8,108.00	$ 8,537.34	1.05
Low Income Energy Efficiency Program	$ 9,242.00	$ 6,704.15	0.73
C&I Energy Solutions for Business Program - Small	$ 20,993.00	$ 17,417.23	0.83
C&I Energy Solutions for Business Program - Large	$ 21,955.00	$ 7,289.83	0.33
Total	**$ 74,103.00**	**$ 51,355.85**	**0.69**

Table 140: Comparison of P4TD Expenditures to EE&C Plan ($1,000) Penelec

Program	Phase IV Budget from EE&C Plan through PY15	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 11,118.00	$ 8,435.92	0.76
Energy Efficient Products Program	$ 7,255.00	$ 5,581.91	0.77
Low Income Energy Efficiency Program	$ 9,874.00	$ 8,798.89	0.89
C&I Energy Solutions for Business Program - Small	$ 22,991.00	$ 19,829.51	0.86
C&I Energy Solutions for Business Program - Large	$ 17,193.00	$ 6,589.37	0.38
Total	**$ 68,431.00**	**$ 49,235.60**	**0.72**

Table 141: Comparison of P4TD Expenditures to EE&C Plan ($1,000) Penn Power

Program	Phase IV Budget from EE&C Plan through PY15	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 4,784.00	$ 4,158.48	0.87
Energy Efficient Products Program	$ 2,149.00	$ 2,109.11	0.98
Low Income Energy Efficiency Program	$ 2,455.00	$ 2,501.92	1.02
C&I Energy Solutions for Business Program - Small	$ 5,914.00	$ 5,443.66	0.92
C&I Energy Solutions for Business Program - Large	$ 4,589.00	$ 2,851.37	0.62
Total	**$ 19,891.00**	**$ 17,064.54**	**0.86**

Table 142: Comparison of P4TD Expenditures to EE&C Plan ($1,000) WPP

Program	Phase IV Budget from EE&C Plan through PY15	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	$ 14,633.00	$ 11,783.64	0.81
Energy Efficient Products Program	$ 8,884.00	$ 7,040.49	0.79
Low Income Energy Efficiency Program	$ 9,656.00	$ 9,313.72	0.96
C&I Energy Solutions for Business Program - Small	$ 20,399.00	$ 20,807.18	1.02
C&I Energy Solutions for Business Program - Large	$ 16,752.00	$ 8,024.43	0.48
Total	**$ 70,324.00**	**$ 56,969.46**	**0.81**

Table 143, Table 144, Table 145, and Table 146 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 143: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Met-Ed

Program	EE&C Plan Projections for PY15	PY15 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	17,756	16,656	0.94
Energy Efficient Products Program	8,978	8,157	0.91
Low Income Energy Efficiency Program	5,457	6,382	1.17
C&I Energy Solutions for Business Program - Small	24,288	32,061	1.32
C&I Energy Solutions for Business Program - Large	38,456	21,376	0.56
Total	**94,935**	**84,633**	**0.89**

Table 144: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Penelec

Program	EE&C Plan Projections for PY15	PY15 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	13,960	12,971	0.93
Energy Efficient Products Program	7,936	4,012	0.51
Low Income Energy Efficiency Program	5,025	6,453	1.28
C&I Energy Solutions for Business Program - Small	30,252	26,431	0.87
C&I Energy Solutions for Business Program - Large	33,650	21,306	0.63
Total	**90,823**	**71,173**	**0.78**

Table 145: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Penn Power

Program	EE&C Plan Projections for PY15	PY15 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	5,149	5,427	1.05
Energy Efficient Products Program	2,481	1,624	0.65
Low Income Energy Efficiency Program	1,644	1,531	0.93
C&I Energy Solutions for Business Program - Small	8,581	6,815	0.79
C&I Energy Solutions for Business Program - Large	8,206	9,790	1.19
Total	**26,062**	**25,188**	**0.97**

Table 146: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for WPP

Program	EE&C Plan Projections for PY15	PY15 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	18,460	15,230	0.83
Energy Efficient Products Program	10,368	5,042	0.49
Low Income Energy Efficiency Program	5,555	7,676	1.38
C&I Energy Solutions for Business Program - Small	25,940	31,756	1.22
C&I Energy Solutions for Business Program - Large	34,524	23,824	0.69
Total	**94,847**	**83,528**	**0.88**

Table 147, Table 148, Table 149, and Table 150 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 147: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for Met-Ed

Program	EE&C Plan through PY15	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	51,356	42,075	0.82
Energy Efficient Products Program	26,934	30,648	1.14
Low Income Energy Efficiency Program	15,858	14,492	0.91
C&I Energy Solutions for Business Program - Small	67,994	55,428	0.82
C&I Energy Solutions for Business Program - Large	114,310	74,200	0.65
Total	**276,454**	**216,844**	**0.78**

Table 148: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for Penelec

Program	EE&C Plan through PY15	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	40,869	39,952	0.98
Energy Efficient Products Program	23,807	19,204	0.81
Low Income Energy Efficiency Program	15,597	17,040	1.09
C&I Energy Solutions for Business Program - Small	85,896	61,081	0.71
C&I Energy Solutions for Business Program - Large	99,893	42,261	0.42
Total	**266,061**	**179,539**	**0.67**

Table 149: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for Penn Power

Program	EE&C Plan through PY15	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	16,012	14,731	0.92
Energy Efficient Products Program	7,443	7,524	1.01
Low Income Energy Efficiency Program	4,707	4,408	0.94
C&I Energy Solutions for Business Program - Small	24,617	13,343	0.54
C&I Energy Solutions for Business Program - Large	24,132	19,401	0.80
Total	**76,912**	**59,407**	**0.77**

Table 150: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for WPP

Program	EE&C Plan through PY15	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	53,184	42,115	0.79
Energy Efficient Products Program	31,103	24,103	0.77
Low Income Energy Efficiency Program	17,162	19,807	1.15
C&I Energy Solutions for Business Program - Small	74,327	66,002	0.89
C&I Energy Solutions for Business Program - Large	103,310	55,311	0.54
Total	**279,086**	**207,337**	**0.74**

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 reported in-service rates reflect the kit non-receipt rate as they are calculated as the ratio of the number of items installed to the number of items claimed to be delivered.

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 PY15. 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 PY13 and PY14. As with last year, realization rates for Penelec and Penn Power were slightly higher than realization rates for Met-Ed and West Penn Power – a difference fundamentally driven by higher proportions of opt-in kits. The ADM team examined results from over 1,000 completed surveys statewide to better understand the nature of the realization rates. 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 151, Table 152, Table 153, and Table 154.

Table 151: EE Kits Sub-Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	31,708	59	Survey (phone + online)
EE Kits - Standard	21,350	84	
School Education kits	4,317	787	
Program Total	**57,375**	**930**	

Table 152: EE Kits Sub-Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	26,594	80	Survey (phone + online)
EE Kits - Standard	27,004	90	
School Education kits	4,336	863	
Program Total	**57,934**	**1,033**	

Table 153: EE Kits Sub-Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	8,423	99	Survey (phone + online)
EE Kits - Standard	8,156	77	
School Education kits	1,606	105	
Program Total	**18,185**	**281**	

Table 154: EE Kits Sub-Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	31,309	109	Survey (phone + online)
EE Kits - Standard	19,888	73	
School Education kits	3,547	578	
Program Total	**54,744**	**760**	

E.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 155, Table 156, Table 157, and Table 158 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 155: 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	7,269	84%	0.8	15.0%
EE Kits - Standard	3,332	90%	0.8	12.5%
School Education kits	690	125%	0.8	3.7%
Program Total	**11,291**	**88.6%**	**0.8**	**9.9%**

Table 156: 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	5,909	96%	0.8	12.9%
EE Kits - Standard	4,182	92%	0.8	12.1%
School Education kits	689	136%	0.8	3.5%
Program Total	**10,780**	**97.0%**	**0.8**	**8.3%**

Table 157: 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	1,893	109%	0.8	11.5%
EE Kits - Standard	1,277	92%	0.8	13.1%
School Education kits	264	124%	0.8	10.9%
Program Total	**3,435**	**103.8%**	**0.8**	**8.0%**

Table 158: 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	7,153	72%	0.8	11.0%
EE Kits - Standard	3,186	92%	0.8	13.5%
School Education kits	585	122%	0.8	4.4%
Program Total	**10,925**	**80.3%**	**0.8**	**7.9%**

E.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 159, Table 160, Table 161, Table 162 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 159: 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	0.77	85.2%	0.8	15.0%
EE Kits - Standard	0.37	91.4%	0.8	12.5%
School Education kits	0.077	114.7%	0.8	3.7%
Program Total	**1.21**	**89.0%**	**0.8**	**9.9%**

Table 160: 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	0.59	93.0%	0.8	12.9%
EE Kits - Standard	0.41	98.4%	0.8	12.1%
School Education kits	0.07	115.1%	0.8	3.5%
Program Total	**1.07**	**96.5%**	**0.8**	**8.3%**

Table 161: EE Kits Sub-Initiative 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	103.5%	0.8	11.5%
EE Kits - Standard	0.14	98.6%	0.8	13.1%
School Education kits	0.03	109.7%	0.8	10.9%
Program Total	**0.37**	**102.1%**	**0.8**	**8.0%**

Table 162: 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	0.78	71.7%	0.8	11.0%
EE Kits - Standard	0.38	95.5%	0.8	13.5%
School Education kits	0.07	108.5%	0.8	4.4%
Program Total	**1.24**	**81.2%**	**0.8**	**7.9%**

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 163 below.

Table 163: EE Kits Initiative Sampling Precisions

EDC	Relative Precision at 85% C.L., Energy	Relative Precision at 85% C.L., Demand
Met-Ed	8.5%	8.4%
Penelec	7.2%	7.2%
Penn Power	8.0%	8.0%
West Penn Power	6.6%	6.6%

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 164. 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 164: 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 165.

Table 165: EE Kits Initiative Net-to-Gross Results

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	10,008	24.1%	6.1%	82.1%	13.1%
Penelec	10,457	17.4%	23.9%	106.4%	11.5%
Penn Power	3,566	22.5%	8.4%	85.9%	14.7%
WPP	8,768	13.2%	9.5%	96.3%	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, 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, (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 the 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 Application of Historical Realization Rates for PY15

The Residential Direct Install Initiative was not evaluated for gross impacts in PY15. ADM applied the PY13 and PY14 weighted average energy and demand gross realization rates, EDC by EDC, to the PY15 program reported impacts. The following sections describe the previous evaluation activities that informed the PY15 realization rates.

F.1.2 Gross Impact Evaluation Methodology

Gross impact evaluation for the Res DI Initiative utilized a stratified sampling plan. The projects are placed into one of the following strata: projects with weatherization measures, and non-weatherization projects.

The program tracking and reporting system is at the measure level, but 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 all measures by unique address and then placed each household in one of the following three strata:

- Weatherization Projects
- Non-Weatherization Projects with impacts below 2 MWh
- Non-Weatherization Projects with impacts above 2 MWh

Evaluation activities for each measure type is described below.

F.1.2.1 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.1.2.2 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.

F.1.3 Sampling

Table 166, Table 167, Table 168, and Table 169 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively. Note that in PY15 sample sizes are zero because the program was not evaluated.

Table 166: Res DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
1	na	572	0	Inspection of QA/QC forms, desk reviews
2	2	0	0	
Weatherization	na	2	0	
Program Total		**574**	**0**	

Table 167: Res DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
1	na	586	0	Inspection of QA/QC forms, desk reviews
2	2	0	0	
Weatherization	na	0	0	
Program Total		**586**	**0**	

Table 168: Res DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
1	na	248	0	Inspection of QA/QC forms, desk reviews
2	2	0	0	
Weatherization	na	1	0	
Program Total		**249**	**0**	

Table 169: Res DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
1	na	609	0	Inspection of QA/QC forms, desk reviews
2	2	1	0	
Weatherization	na	2	0	
Program Total		**612**	**0**	

F.1.4 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 170, Table 171, Table 172, and Table 173 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 170: 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.
1	na	403	109.3%	0.4	0%
2	2	0	109.3%	0.4	0%
Weatherization	na	5	109.3%	0.4	0%
Program Total		**408**	**109.3%**	**n/a**	**0.0%**

Table 171: 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.
1	na	324	114.7%	0.4	0%
2	2	0	0.0%	0.4	0%
Weatherization	na	0	0.0%	0.4	0%
Program Total		**324**	**114.7%**	**n/a**	**0.0%**

Table 172: 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.
1	na	144	110.9%	0.4	0%
2	2	0	0.0%	0.4	0%
Weatherization	na	9	110.9%	0.4	0%
Program Total		**153**	**110.9%**	**n/a**	**0.0%**

Table 173: 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.
1	na	366	112.3%	0.4	0%
2	2	2	112.3%	0.4	0%
Weatherization	na	11	112.3%	0.4	0%
Program Total		**378**	**112.3%**	**n/a**	**0.0%**

F.1.5 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 174, Table 175, Table 176, and Table 177 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 174: 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.
1	na	0.07	73.7%	0.4	0%
2	2	0.00	73.7%	0.4	0%
Weatherization	na	0.00	73.7%	0.4	0%
Program Total		**0.07**	**73.7%**	**n/a**	**0.0%**

Table 175: 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.
1	na	0.05	71.3%	0.4	0%
2	2	0.00	0.0%	0.4	0%
Weatherization	na	0.00	0.0%	0.4	0%
Program Total		**0.05**	**71.3%**	**n/a**	**0.0%**

Table 176: Res DI Initiative Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
1	na	0.02	78.3%	0.4	0%
2	2	0.00	0.0%	0.4	0%
Weatherization	na	0.00	78.3%	0.4	0%
Program Total		**0.02**	**78.3%**	**n/a**	**0.0%**

Table 177: 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.
1	na	0.06	83.8%	0.4	0%
2	2	0.00	83.8%	0.4	0%
Weatherization	na	0.00	83.8%	0.4	0%
Program Total		**0.06**	**83.8%**	**n/a**	**0.0%**

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 178 below.

Table 178: 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 179. 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 179: Res DI Initiative Net-to-Gross Results by EDC

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	446	19.8%	6.6%	86.7%	7.2%
Penelec	372	17.8%	16.9%	99.1%	7.1%
Penn Power	169	14.5%	8.6%	94.1%	6.7%
WPP	425	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 REM/Rate to generate reported energy and demand impacts.

G.1 Gross Impact Evaluation

G.1.1 Application of Historical Realization Rates for PY15

The Res NC Initiative was not evaluated for gross impacts in PY15. ADM applied the PY13 and PY14 weighted average energy and demand gross realization rates for smart thermostats and new homes separately, EDC by EDC, to the PY15 program reported impacts. In PY15, the demand realization rate for new homes was modified to reflect Phase IV coincidence factors, compared to Phase III coincidence factors that were used for reporting in PY13 and PY14. To maintain the same meaning as the PY13 and PY14 realization rates, the PY15 demand realization rate for new homes was adjusted by the ratio of the Phase III to Phase IV coincidence factors for new homes. The following sections describe the previous evaluation activities that informed the PY15 realization rates.

G.1.2 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.1.2.1 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. ADM visual inspections reported lighting counts in each of these three areas.
    - 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
    - ADM visual inspections included make and model of each installed appliance

G.1.2.2 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.1.2.3 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.1.3 Sampling

Table 180, Table 181, Table 182, and Table 183 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. Note that in PY15 gross impact evaluation was not conducted, so the shown sample sizes are zero.

Table 180: RES NC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	647	0	Model Review / On-Site
Smart Thermostats	109	0	
Program Total	**756**	**0**	

Table 181: RES NC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	103	0	Model Review / On-Site
Smart Thermostats	0	0	
Program Total	**103**	**0**	

Table 182: RES NC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	495	0	Model Review / On-Site
Smart Thermostats	278	0	
Program Total	**773**	**0**	

Table 183: RES NC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	860	0	Model Review / On-Site
Smart Thermostats	272	0	
Program Total	**1,132**	**0**	

G.1.4 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 184, Table 185, Table 186, and Table 187 for Met-Ed, Penelec, Penn Power, and WPP respectively. Gross realization rates for Smart Thermostats improved from PY13 values due to revising assumed square footage per ton values in PY14. Smart thermostat realization rates varied across EDCs mainly due to small sample sizes resulting in higher and lower square footage per ton than ex ante assumptions.

Table 184: 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	1,883	100.5%	0.5	0.0%
Smart Thermostats	30	100.5%	0.5	0.0%
Program Total	**1,913**	**100.5%**	**0.5**	**0.0%**

Table 185: 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	220	101.4%	0.5	0.0%
Smart Thermostats	0	0.0%	0.5	0.0%
Program Total	**220**	**101.4%**	**0.5**	**0.0%**

Table 186: 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	1,482	101.4%	0.5	0.0%
Smart Thermostats	48	101.4%	0.5	0.0%
Program Total	**1,530**	**101.4%**	**0.5**	**0.0%**

Table 187: 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	2,337	105.6%	0.5	0.0%
Smart Thermostats	51	105.6%	0.5	0.0%
Program Total	**2,388**	**105.6%**	**0.5**	**0.0%**

G.1.5 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 188, Table 189, Table 190, and Table 191 for Met-Ed, Penelec, Penn Power, and WPP respectively. Gross realization rates for demand savings were driven by missing coincidence factor in reported savings values. SWE issued a memo reflecting errata guidance on CFs in Q3 of PY14. Ex-ante demand impact calculations were changed to follow the SWE guidance memo for PY15. Gross realization rates improved for PY15 as a result of this change.

Table 188: 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	0.44	106.8%	0.5	0.0%
Smart Thermostats	0.01	106.8%	0.5	0.0%
Program Total	**0.45**	**106.8%**	**0.5**	**0.0%**

Table 189: 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	0.06	124.3%	0.5	0.0%
Smart Thermostats	0.00	0.0%	0.5	0.0%
Program Total	**0.06**	**124.3%**	**0.5**	**0.0%**

Table 190: RES NC Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	0.33	112.7%	0.5	0.0%
Smart Thermostats	0.01	112.7%	0.5	0.0%
Program Total	**0.35**	**112.7%**	**0.5**	**0.0%**

Table 191: 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	0.59	101.4%	0.5	0.0%
Smart Thermostats	0.02	101.4%	0.5	0.0%
Program Total	**0.60**	**101.4%**	**0.5**	**0.0%**

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 192.

Table 192: Res NC Initiative Net-to-Gross Results by EDC

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	1,921	28.0%	0.0%	72.0%	14.5%
Penelec	223	28.0%	0.0%	72.0%	14.5%
Penn Power	1,552	28.0%	0.0%	72.0%	14.5%
WPP	2,521	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, 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 PY15 included light bulbs, nightlights, smart power strips, efficient showerheads, and low-flow aerators.

H.1 Gross Impact Evaluation

H.1.1 Application of Historical Realization Rates for PY15

The Res MF Initiative was not evaluated for gross impacts in PY15. ADM applied the PY13 and PY14 weighted average energy and demand gross realization rates ,EDC by EDC, to the PY15 program reported impacts. The following sections describe the previous evaluation activities that informed the PY15 realization rates.

H.1.2 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, but 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.1.3 Sampling

Table 193, Table 194, Table 195, and Table 196 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively. Note that in PY15 gross impact evaluation was not conducted, so the shown sample sizes are zero.

Table 193: 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	53	0	
Program Total		**53**	**0**	

Table 194: Res MF Initiative Gross Impact Sample Design for Penelec

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	145	0	
Program Total		**145**	**0**	

Table 195: 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	9	0	
Program Total		**9**	**0**	

Table 196: 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	238	0	
Program Total		**238**	**0**	

H.1.4 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 197, Table 198, Table 199, and Table 200 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 197: 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	109.4%	0.4	0%
All Other	na	25	109.4%	0.4	0%
Program Total		**25**	**109.4%**	**n/a**	**0.0%**

Table 198: 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	0	121.5%	0.4	0%
All Other	na	79	121.5%	0.4	0%
Program Total		**79**	**121.5%**	**n/a**	**0.0%**

Table 199: 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	113.2%	0.4	0%
All Other	na	6	113.2%	0.4	0%
Program Total		**6**	**113.2%**	**n/a**	**0.0%**

Table 200: 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	111.8%	0.4	0%
All Other	na	73	111.8%	0.4	0%
Program Total		**73**	**111.8%**	**n/a**	**0.0%**

H.1.5 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 201, Table 202, Table 203, and Table 204 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 201: 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	84.3%	0.4	0%
All Other	na	0.00	84.3%	0.4	0%
Program Total		**0.00**	**84.3%**	**n/a**	**0.0%**

Table 202: 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	95.7%	0.4	0%
All Other	na	0.01	95.7%	0.4	0%
Program Total		**0.01**	**95.7%**	**n/a**	**0.0%**

Table 203: Res MF Initiative 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	85.4%	0.4	0%
All Other	na	0.00	85.4%	0.4	0%
Program Total		**0.00**	**85.4%**	**n/a**	**0.0%**

Table 204: 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	83.9%	0.4	0%
All Other	na	0.01	83.9%	0.4	0%
Program Total		**0.01**	**83.9%**	**n/a**	**0.0%**

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 205 below.

Table 205: 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 206.

Table 206: Res MF Initiative Net-to-Gross Results by EDC

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	27	0.6%	0.0%	99.5%	12.8%
Penelec	96	0.6%	0.0%	99.5%	12.8%
Penn Power	6	0.6%	0.0%	99.5%	12.8%
WPP	82	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. Additionally, concerns were raised at the potential impact of behavioral savings ramp-up impacting the measurement of incremental first-year savings, since overlap with the HER Behavioral component may introduce undue bias in the regression results. Therefore, the regression analysis was limited to the subset of non-HER customers with opt-in dates prior to January 1, 2024, to ensure sufficient post-exposure data (5,292 total customers in the EE Homes analysis; 573 total customers in the Low Income analysis).ADM retained this aggregation for PY15.

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 PY15, ADM used the 12-month period prior to the month of participation, as the baseline period for matching. This is a departure from the PY14 analysis, which used the previous program year as the benchmarking period. This change was made in response to technical feedback from SWE and improved overall resolution by ensuring that comparison and treatment groups tracked closely to each other in energy usage, right up to the treatment period. 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.

These seven 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 2:1 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:

$$\mathrm{kWh_{i,d}} = \beta_{\mathrm{i}} + \beta_{post} * post_{i,d} + \beta_{cdd} * \mathrm{CDD}_{i,d} + \beta_{hdd} * \mathrm{HDD}_{i,d} + \beta_{post,cdd} * post_{i,d} * \mathrm{CDD}_{i,d} +$$

$$\beta_{post,hdd} * post_{i,d} * \mathrm{HDD}_{i,d} + \beta_{treat,cdd} * treat_i * \mathrm{CDD}_{i,d} + \beta_{treat,hdd} * treat_i * \mathrm{HDD}_{i,d} + \tau_{post,treat} * post_{i,d} * \mathrm{treat}_i +$$

$$\tau_{post,treat,cdd} * post_{i,d} * \mathrm{treat} * \mathrm{CDD}_{i,d} + \tau_{post,treat,hdd} * post_{i,d} * \mathrm{treat} * \mathrm{HDD}_{i,d} + \varepsilon_{\mathrm{imy}}$$

Equation 4: Formula specifying the Online Audits regression model

The variables above are defined in Table 207 below.

Table 207: 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.
$post_{i,d}$	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.
$\tau_{post,treat}$	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 9 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 removing these participants from the treatment and comparison group. This is because, unlike other EE measures, participation in HER is compulsory. Thus, any savings estimated via regression analysis for Online Audits does not contain any cross-savings with HER.

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 measure month interacted with the treatment term. A negative coefficient represents a daily savings that can be attributed to the treatment effect for that measure month. Multiplying the inverse of the coefficient by the number of days in the month and the number of participants in that month provides the total kWh saved for that month. Summing the savings for the months corresponding to the program year provides the savings attributable to the component for the program year prior to adjusting for dual participation in other programs. Additionally, interactive effects of the main effect of treatment by HDD and CDD can be multiplied by the total HDDs and CDDs for all participants for the program year of interest to obtain the weather-dependent savings of interest. 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 102 below.

Table 208: 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, 2023, and ending May 31, 2024. This ETDF was then applied to energy savings to estimate demand savings.

I.1.2 Results for Energy and Demand

Table 209 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 210 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. The PY14 and PY15 analyses did achieve the requisite level of significance, with results shown below for PY15.

Table 209: 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	6,099	793	581	73.24%	26.43%
Met-Ed	**Total for EEH Program**	**6,099**	**793**	**581**	**73.24%**	**26.43%**
Met-Ed	ME-1-LI	594	77	356	461.17%	14.09%
Met-Ed	**Total for LI Program**	**594**	**77**	**356**	**461.17%**	**14.09%**
Penelec	PN-1	4,094	532	433	81.37%	22.96%
Penelec	**Total for EEH Program**	**4,094**	**532**	**433**	**81.37%**	**22.96%**
Penelec	PN-1-LI	877	114	579	507.96%	12.27%
Penelec	**Total for LI Program**	**877**	**114**	**579**	**507.96%**	**12.27%**
Penn Power	PP-1	1,544	201	143	71.22%	26.02%
Penn Power	**Total for EEH Program**	**1,544**	**201**	**143**	**71.22%**	**26.02%**
Penn Power	PP-1-LI	186	24	107	441.99%	14.03%
Penn Power	**Total for LI Program**	**186**	**24**	**107**	**441.99%**	**14.03%**
WPP	WP-1	5,923	770	543	70.51%	26.50%
WPP	**Total for EEH Program**	**5,923**	**770**	**543**	**70.51%**	**26.50%**
WPP	WP-1-LI	590	77	373	486.77%	12.76%
WPP	**Total for LI Program**	**590**	**77**	**373**	**486.77%**	**12.76%**

Table 210: 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	0.09	0.10	114.41%
Met-Ed	**Total for EEH Program**	**0.09**	**0.10**	**114.41%**
Met-Ed	ME-1-LI	0.01	0.05	647.37%
Met-Ed	**Total for LI Program**	**0.01**	**0.05**	**647.37%**
Penelec	PN-1	0.06	0.07	111.87%
Penelec	**Total for EEH Program**	**0.06**	**0.07**	**111.87%**
Penelec	PN-1-LI	0.01	0.08	639.73%
Penelec	**Total for LI Program**	**0.01**	**0.08**	**639.73%**
Penn Power	PP-1	0.02	0.02	104.78%
Penn Power	**Total for EEH Program**	**0.02**	**0.02**	**104.78%**
Penn Power	PP-1-LI	0.00	0.02	607.38%
Penn Power	**Total for LI Program**	**0.00**	**0.02**	**607.38%**
WPP	WP-1	0.08	0.09	105.37%
WPP	**Total for EEH Program**	**0.08**	**0.09**	**105.37%**
WPP	WP-1-LI	0.01	0.05	626.80%
WPP	**Total for LI Program**	**0.01**	**0.05**	**626.80%**

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 four sub-initiatives: Appliance Recycling, Low-Income Appliance Recycling, Nonresidential Appliance Recycling, and Midstream Appliance Recycling. The midstream sub-initiative differs from the other three in that it intercepts old, working, inefficient appliances at reseller locations before the old appliances are sold back to the public instead of at end-user homes and businesses.

There are five distinct measures offered by the program: refrigerator recycling, freezer recycling, room air conditioner (RAC) recycling, dehumidifier recycling, and mini refrigerator recycling. The midstream sub-initiative only offered refrigerator recycling and freezer recycling in PY15.

J.1.1 Application of Historical Realization Rates for PY15

The ATI Initiative was not evaluated for gross impacts in PY15. ADM applied the PY13 and PY14 weighted average energy and demand gross realization rates ,EDC by EDC, to the PY15 program reported impacts. The following sections describe the previous evaluation activities that informed the PY15 realization rates.

J.1.2 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, from customer verification surveys, and, for the midstream sub-initiative, from on-site verification activities.

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. For the midstream sub-initiative, these parameter values were taken from TRM defaults due to very limited survey responses.

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 211 lists the data sources for gross impact calculation algorithms.

Table 211: 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.1.3 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 212, Table 213, Table 214, and Table 215. 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.

For the midstream sub-initiative, sampled sites were decided based on availability of evaluation staff and implementation staff to coordinate site visits. Midstream sample sizes reflect batches of verified appliances collected from reseller locations.

Note that in PY15 gross impact evaluation was not conducted, so the shown sample sizes are zero.

Table 212: ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	495	1	Application of Historical Realization Rates
Freezers	125	1	
RACs	52	1	
Dehumidifiers	46	1	
Mini Friges	18	1	
Refrigerators - Midstream	0	1	
Freezers - Midstream	0	1	
Program Total	**736**	**7**	

Table 213: ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	248	1	Application of Historical Realization Rates
Freezers	57	1	
RACs	33	1	
Dehumidifiers	22	1	
Mini Friges	4	1	
Refrigerators - Midstream	43	1	
Freezers - Midstream	0	1	
Program Total	**407**	**7**	

Table 214: ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	72	1	Application of Historical Realization Rates
Freezers	21	1	
RACs	12	1	
Dehumidifiers	7	1	
Mini Friges	1	1	
Refrigerators - Midstream	0	1	
Freezers - Midstream	0	1	
Program Total	**113**	**7**	

Table 215: ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	301	1	Application of Historical Realization Rates
Freezers	81	1	
RACs	29	1	
Dehumidifiers	34	1	
Mini Friges	9	1	
Refrigerators - Midstream	124	1	
Freezers - Midstream	0	1	
Program Total	**578**	**7**	

J.1.4 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 216, Table 217, Table 218, and Table 219 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 216: ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	453	109.2%	0.5	71.9%
Freezers	74	109.2%	0.5	71.7%
RACs	7	109.2%	0.5	71.3%
Dehumidifiers	26	109.2%	0.5	71.2%
Mini Friges	4	109.2%	0.5	70.0%
Refrigerators - Midstream	0	100.0%	0.5	0.0%
Freezers - Midstream	0	100.0%	0.5	0.0%
Program Total	**564**	**109.2%**	**0.5**	**58.6%**

Table 217: ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	228	107.2%	0.5	71.9%
Freezers	37	107.2%	0.5	71.4%
RACs	3	107.2%	0.5	70.9%
Dehumidifiers	11	107.2%	0.5	70.3%
Mini Friges	1	107.2%	0.5	62.4%
Refrigerators - Midstream	40	107.2%	0.5	71.2%
Freezers - Midstream	0	100.0%	0.5	0.0%
Program Total	**320**	**107.2%**	**0.5**	**52.6%**

Table 218: ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	66	99.3%	0.5	71.5%
Freezers	13	99.3%	0.5	70.3%
RACs	1	99.3%	0.5	68.9%
Dehumidifiers	4	99.3%	0.5	66.7%
Mini Friges	0	99.3%	0.5	0.0%
Refrigerators - Midstream	0	100.0%	0.5	0.0%
Freezers - Midstream	0	100.0%	0.5	0.0%
Program Total	**85**	**99.3%**	**0.5**	**57.0%**

Table 219: ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	279	103.2%	0.5	71.9%
Freezers	52	103.2%	0.5	71.6%
RACs	3	103.2%	0.5	70.7%
Dehumidifiers	18	103.2%	0.5	70.9%
Mini Friges	2	103.2%	0.5	67.9%
Refrigerators - Midstream	115	103.2%	0.5	71.7%
Freezers - Midstream	0	100.0%	0.5	0.0%
Program Total	**469**	**103.2%**	**0.5**	**47.0%**

J.1.5 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 220, Table 221, Table 222, and Table 223 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 220: ATI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.08	106.2%	0.5	71.9%
Freezers	0.01	106.2%	0.5	71.7%
RACs	0.01	106.2%	0.5	71.3%
Dehumidifiers	0.01	106.2%	0.5	71.2%
Mini Friges	0.00	106.2%	0.5	70.0%
Refrigerators - Midstream	0.00	100.0%	0.5	0.0%
Freezers - Midstream	0.00	100.0%	0.5	0.0%
Program Total	**0.11**	**106.2%**	**0.5**	**52.4%**

Table 221: ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.04	102.4%	0.5	71.9%
Freezers	0.01	102.4%	0.5	71.4%
RACs	0.01	102.4%	0.5	70.9%
Dehumidifiers	0.00	102.4%	0.5	70.3%
Mini Friges	0.00	102.4%	0.5	62.4%
Refrigerators - Midstream	0.01	102.4%	0.5	71.2%
Freezers - Midstream	0.00	100.0%	0.5	0.0%
Program Total	**0.07**	**102.4%**	**0.5**	**46.6%**

Table 222: ATI Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.01	97.9%	0.5	71.5%
Freezers	0.00	97.9%	0.5	70.3%
RACs	0.00	97.9%	0.5	68.9%
Dehumidifiers	0.00	97.9%	0.5	66.7%
Mini Friges	0.00	97.9%	0.5	0.0%
Refrigerators - Midstream	0.00	100.0%	0.5	0.0%
Freezers - Midstream	0.00	100.0%	0.5	0.0%
Program Total	**0.02**	**97.9%**	**0.5**	**48.7%**

Table 223: ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.05	101.6%	0.5	71.9%
Freezers	0.01	101.6%	0.5	71.6%
RACs	0.01	101.6%	0.5	70.7%
Dehumidifiers	0.00	101.6%	0.5	70.9%
Mini Friges	0.00	101.6%	0.5	67.9%
Refrigerators - Midstream	0.02	101.6%	0.5	71.7%
Freezers - Midstream	0.00	100.0%	0.5	0.0%
Program Total	**0.09**	**101.6%**	**0.5**	**43.1%**

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 224 below. For PY15, precisions are shown as 0% because the program was

not evaluated and there was no sampling involved. The gross realization rates for PY15 are based on PY13 and PY14 results.

Table 224: ATI Initiative Sampling Precisions

EDC	Relative Precision at 85% C.L., Energy	Relative Precision at 85% C.L., Demand
Met-Ed	0.0%	0.0%
Penelec	0.0%	0.0%
Penn Power	0.0%	0.0%
West Penn Power	0.0%	0.0%

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 225, Table 226, Table 227, and Table 228 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 225: ATI Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	6,143	160	139	21.7%
Program Total	**6,143**	**160**	**139**	**21.7%**

Table 226: ATI Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	5,444	143	165	28.9%
Program Total	**5,444**	**143**	**165**	**28.9%**

Table 227: ATI Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	1,947	77	86	28.0%
Program Total	**1,947**	**77**	**86**	**28.0%**

Table 228: ATI Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	6,673	154	155	25.2%
Program Total	**6,673**	**154**	**155**	**25.2%**

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 229, Table 230, Table 231, and Table 232 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 229: ATI Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	616	61.0%	0.0%	39.0%	12.2%
Program Total	**616**	**61.0%**	**0.0%**	**39.0%**	**12.2%**

Table 230: ATI Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	343	35.0%	0.0%	65.0%	11.2%
Program Total	**343**	**35.0%**	**0.0%**	**65.0%**	**11.2%**

Table 231: ATI Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	84	62.0%	0.0%	38.0%	15.5%
Program Total	**84**	**62.0%**	**0.0%**	**38.0%**	**15.5%**

Table 232: ATI Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	484	30.0%	0.0%	70.0%	11.6%
Program Total	**484**	**30.0%**	**0.0%**	**70.0%**	**11.6%**

Appendix K Evaluation Detail – Residential Upstream Electronics Initiative

The Companies did not offer this program component in PY15.

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 233 lists the data sources for gross impact calculation algorithms.

Table 233: Data Sources for the Res HVAC Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
All Measures	Appliance Age	Tracking and Reporting System
All HVAC Equipment	AHRI or Model # (to get other TRM parameters)	Invoice Inspections and Tracking Data
All HVAC Equipment	Heating Capacity	Tracking and Reporting System
All HVAC Equipment	Cooling Capacity	Tracking and Reporting System
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. Nearly 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 assuming a replace on burnout scenario rather than early retirement[16].

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 also 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

[16] Although early retirements are eligible and do occur in the program, the downstream rebate program does not have any special provisions, such as mandatory pre-inspections, to accommodate early retirement. For this program, early retirement is viewed by ADM as a phenomenon that may increase net impacts, but not gross impacts.

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 heating. 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

As there were only three PTACs and zero PTHPs reported, ADM elected to pass these measures through the evaluation process with no activity.

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 234, Table 235, Table 236, and Table 237.

Table 234: Res HVAC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	311	24	25
ASHP	323	9	4
Smart Thermostat	352	8	11
GSHP	61	5	3
CAC	340	7	7
Furnace Fan	314	8	9
Tune-Up	94	3	3
Circulating Pump	1	0	0
Bathroom Fan	51	6	2
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	**1,847**	**70**	**64**

Table 235: Res HVAC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	344	30	31
ASHP	59	2	6
Smart Thermostat	63	4	5
GSHP	19	1	2
CAC	38	3	1
Furnace Fan	136	6	7
Tune-Up	88	14	4
Circulating Pump	2	0	0
Bathroom Fan	36	4	4
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	**785**	**64**	**60**

Table 236: Res HVAC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	46	7	7
ASHP	62	4	11
Smart Thermostat	43	3	4
GSHP	13	0	4
CAC	58	3	4
Furnace Fan	142	7	16
Tune-Up	32	1	2
Circulating Pump	7	0	0
Bathroom Fan	30	1	1
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	**433**	**26**	**49**

Table 237: Res HVAC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	246	24	24
ASHP	204	11	4
Smart Thermostat	196	5	5
GSHP	31	1	3
CAC	111	5	3
Furnace Fan	657	7	13
Tune-Up	315	11	5
Circulating Pump	5	0	0
Bathroom Fan	109	3	3
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	**1,874**	**67**	**60**

L.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 238, Table 239, Table 240, and Table 241 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 238: 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	369	302.3%	0.5	13.8%
ASHP	315	92.2%	0.5	35.8%
Smart Thermostat	187	102.2%	0.5	21.4%
GSHP	156	43.5%	0.5	40.5%
CAC	113	90.3%	0.5	26.9%
Furnace Fan	59	97.6%	0.5	23.7%
Tune-Up	14	140.2%	0.5	40.9%
Circulating Pump	0	100.0%	0.5	100.0%
Bathroom Fan	2	15.6%	0.5	49.9%
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	**1,216**	**151.8%**	**0.5**	**10.6%**

Table 239: Res HVAC Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	398	106.1%	0.5	12.3%
ASHP	74	88.5%	0.5	27.9%
Smart Thermostat	38	82.1%	0.5	30.9%
GSHP	34	73.0%	0.5	48.2%
CAC	9	92.4%	0.5	71.0%
Furnace Fan	24	99.6%	0.5	26.5%
Tune-Up	6	121.0%	0.5	35.2%
Circulating Pump	0	100.0%	0.5	100.0%
Bathroom Fan	1	66.0%	0.5	33.9%
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	**585**	**100.0%**	**0.5**	**9.9%**

Table 240: 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	52	343.4%	0.5	25.1%
ASHP	54	104.3%	0.5	19.7%
Smart Thermostat	17	73.3%	0.5	34.3%
GSHP	30	98.2%	0.5	30.0%
CAC	15	91.8%	0.5	34.7%
Furnace Fan	24	103.7%	0.5	17.0%
Tune-Up	4	133.7%	0.5	49.3%
Circulating Pump	1	100.0%	0.5	100.0%
Bathroom Fan	1	35.2%	0.5	70.8%
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	**198**	**163.1%**	**0.5**	**14.8%**

Table 241: Res HVAC Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	284	256.0%	0.5	14.0%
ASHP	214	106.4%	0.5	35.6%
Smart Thermostat	123	93.5%	0.5	31.8%
GSHP	66	81.7%	0.5	39.5%
CAC	30	90.2%	0.5	41.0%
Furnace Fan	118	98.2%	0.5	19.8%
Tune-Up	33	177.1%	0.5	31.9%
Circulating Pump	1	100.0%	0.5	100.0%
Bathroom Fan	4	84.1%	0.5	41.0%
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	**873**	**152.4%**	**0.5**	**10.6%**

L.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 242, Table 243, Table 244, and Table 245 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 242: 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	0.03	209.4%	0.5	13.8%
ASHP	0.03	110.3%	0.5	35.8%
Smart Thermostat	0.02	94.6%	0.5	21.4%
GSHP	0.03	53.6%	0.5	40.5%
CAC	0.06	109.2%	0.5	26.9%
Furnace Fan	0.02	104.4%	0.5	23.7%
Tune-Up	0.01	104.7%	0.5	40.9%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	11.6%	0.5	49.9%
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	**0.19**	**113.2%**	**0.5**	**11.0%**

Table 243: 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	218.2%	0.5	12.3%
ASHP	0.00	133.0%	0.5	27.9%
Smart Thermostat	0.00	104.3%	0.5	30.9%
GSHP	0.01	95.3%	0.5	48.2%
CAC	0.00	105.6%	0.5	71.0%
Furnace Fan	0.00	124.5%	0.5	26.5%
Tune-Up	0.00	118.4%	0.5	35.2%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	48.8%	0.5	33.9%
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	**0.05**	**164.0%**	**0.5**	**10.1%**

Table 244: Res HVAC Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.00	333.6%	0.5	25.1%
ASHP	0.01	124.8%	0.5	19.7%
Smart Thermostat	0.00	98.7%	0.5	34.3%
GSHP	0.01	120.3%	0.5	30.0%
CAC	0.01	114.6%	0.5	34.7%
Furnace Fan	0.01	129.8%	0.5	17.0%
Tune-Up	0.00	140.0%	0.5	49.3%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	26.0%	0.5	70.8%
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	**0.03**	**140.6%**	**0.5**	**11.5%**

Table 245: Res HVAC Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.02	261.4%	0.5	14.0%
ASHP	0.02	112.1%	0.5	35.6%
Smart Thermostat	0.01	97.9%	0.5	31.8%
GSHP	0.01	94.7%	0.5	39.5%
CAC	0.02	105.3%	0.5	41.0%
Furnace Fan	0.03	117.5%	0.5	19.8%
Tune-Up	0.02	100.7%	0.5	31.9%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	62.1%	0.5	41.0%
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	**0.13**	**133.5%**	**0.5**	**9.8%**

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 246, Table 247, Table 248, and Table 249 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 246: 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 247: 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 248: 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 249: 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 250, Table 251, Table 252, and Table 253 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 250: Res HVAC Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	1,847	50.0%	0.6%	50.6%	13.4%
Program Total	**1,847**	**50.0%**	**0.6%**	**50.6%**	**13.4%**

Table 251: Res HVAC Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	585	45.2%	14.9%	69.7%	12.6%
Program Total	**585**	**45.2%**	**14.9%**	**69.7%**	**12.6%**

Table 252 Res HVAC Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	323	47.4%	2.1%	54.7%	12.6%
Program Total	**323**	**47.4%**	**2.1%**	**54.7%**	**12.6%**

Table 253 Res HVAC Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	1,330	48.8%	3.6%	54.8%	12.6%
Program Total	**1,330**	**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 PY15 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. Nearly 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.

As there were only fifteen ceiling fans reported, ADM elected to pass these measures through the evaluation process with no activity.

Table 254 lists the data sources for gross impact calculation algorithms.

Table 254: 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 255, Table 256, Table 257, and Table 258.

Table 255: Res Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	2,550	2	29
Ceiling Fan	0	0	0
Clothes Dryer	550	11	4
Clothes Washer	814	13	6
Dehumidifier	220	3	3
Dishwasher	751	7	4
Freezer	101	8	4
Heat Pump Water Heater	111	3	6
Mini Refrigerator	0	0	0
Pool Pump	0	0	0
Refrigerator	1,054	12	10
Room Air Conditioner	154	1	2
Smart Thermostat	745	8	10
Low-Income Total	**2,646**	**12**	**36**
Non Low-Income Total	**4,404**	**56**	**42**
Program Total	**7,050**	**68**	**78**

Table 256: Res Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	3,742	6	29
Ceiling Fan	0	0	0
Clothes Dryer	306	7	7
Clothes Washer	510	6	6
Dehumidifier	214	9	8
Dishwasher	495	5	5
Freezer	86	3	1
Heat Pump Water Heater	35	1	5
Mini Refrigerator	0	0	0
Pool Pump	0	0	0
Refrigerator	799	10	9
Room Air Conditioner	97	2	3
Smart Thermostat	370	6	8
Low-Income Total	**3,900**	**14**	**38**
Non Low-Income Total	**2,754**	**41**	**43**
Program Total	**6,654**	**55**	**81**

Table 257: Res Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	1,067	3	31
Ceiling Fan	1	0	0
Clothes Dryer	144	3	4
Clothes Washer	251	3	11
Dehumidifier	98	1	2
Dishwasher	241	5	5
Freezer	28	2	1
Heat Pump Water Heater	14	1	0
Mini Refrigerator	0	0	0
Pool Pump	0	0	0
Refrigerator	325	5	7
Room Air Conditioner	9	1	1
Smart Thermostat	250	2	11
Low-Income Total	**1,075**	**6**	**29**
Non Low-Income Total	**1,353**	**20**	**44**
Program Total	**2,428**	**26**	**73**

Table 258: Res Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	3,031	9	30
Ceiling Fan	0	0	0
Clothes Dryer	568	10	4
Clothes Washer	838	6	7
Dehumidifier	251	6	4
Dishwasher	838	11	8
Freezer	92	3	3
Heat Pump Water Heater	77	4	2
Mini Refrigerator	0	0	0
Pool Pump	0	0	0
Refrigerator	1,275	9	8
Room Air Conditioner	81	0	1
Smart Thermostat	729	7	13
Low-Income Total	**3,136**	**16**	**37**
Non Low-Income Total	**4,644**	**49**	**43**
Program Total	**7,780**	**65**	**80**

M.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 259, Table 260, Table 261, and Table 262 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 259: 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	1,117	107.0%	0.5	13.3%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	15	55.3%	0.5	21.5%
Clothes Washer	98	152.1%	0.5	19.8%
Dehumidifier	29	107.9%	0.5	41.3%
Dishwasher	21	105.7%	0.5	27.1%
Freezer	3	154.9%	0.5	24.4%
Heat Pump Water Heater	160	114.0%	0.5	28.6%
Mini Refrigerator	0	0.0%	0.5	100.0%
Pool Pump	0	0.0%	0.5	100.0%
Refrigerator	70	93.9%	0.5	20.7%
Room Air Conditioner	9	47.3%	0.5	50.6%
Smart Thermostat	257	116.6%	0.5	22.6%
Low-Income Total	**1,066**	**110.4%**	**0.5**	**na**
Non Low-Income Total	**713**	**110.4%**	**0.5**	**na**
Program Total	**1,779**	**110.4%**	**0.5**	**9.4%**

Table 260: 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	1,618	105.7%	0.5	13.3%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	8	105.4%	0.5	26.9%
Clothes Washer	58	143.3%	0.5	29.2%
Dehumidifier	29	94.1%	0.5	23.5%
Dishwasher	13	99.9%	0.5	32.0%
Freezer	3	154.0%	0.5	40.8%
Heat Pump Water Heater	55	113.2%	0.5	29.8%
Mini Refrigerator	0	0.0%	0.5	100.0%
Pool Pump	0	0.0%	0.5	100.0%
Refrigerator	55	79.6%	0.5	22.6%
Room Air Conditioner	3	66.7%	0.5	40.9%
Smart Thermostat	96	28.8%	0.5	25.2%
Low-Income Total	**1,602**	**102.3%**	**0.5**	**na**
Non Low-Income Total	**335**	**102.3%**	**0.5**	**na**
Program Total	**1,937**	**102.3%**	**0.5**	**11.6%**

Table 261: 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	473	106.6%	0.5	12.7%
Ceiling Fan	0	100.0%	0.5	100.0%
Clothes Dryer	4	81.4%	0.5	35.5%
Clothes Washer	28	141.9%	0.5	21.2%
Dehumidifier	13	83.8%	0.5	50.4%
Dishwasher	6	100.0%	0.5	31.9%
Freezer	1	153.2%	0.5	49.1%
Heat Pump Water Heater	14	100.0%	0.5	69.4%
Mini Refrigerator	0	0.0%	0.5	100.0%
Pool Pump	0	0.0%	0.5	100.0%
Refrigerator	21	95.8%	0.5	26.9%
Room Air Conditioner	0	196.5%	0.5	67.9%
Smart Thermostat	93	101.2%	0.5	21.2%
Low-Income Total	**444**	**106.2%**	**0.5**	**na**
Non Low-Income Total	**210**	**106.2%**	**0.5**	**na**
Program Total	**654**	**106.2%**	**0.5**	**9.9%**

Table 262: 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	1,324	106.0%	0.5	13.1%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	15	109.2%	0.5	22.6%
Clothes Washer	103	173.0%	0.5	27.1%
Dehumidifier	34	82.8%	0.5	29.0%
Dishwasher	23	100.0%	0.5	21.6%
Freezer	3	149.9%	0.5	40.9%
Heat Pump Water Heater	108	103.9%	0.5	35.1%
Mini Refrigerator	0	0.0%	0.5	100.0%
Pool Pump	0	0.0%	0.5	100.0%
Refrigerator	87	69.1%	0.5	23.9%
Room Air Conditioner	3	18.1%	0.5	71.6%
Smart Thermostat	239	102.2%	0.5	19.8%
Low-Income Total	**1,279**	**106.8%**	**0.5**	**na**
Non Low-Income Total	**660**	**106.8%**	**0.5**	**na**
Program Total	**1,939**	**106.8%**	**0.5**	**9.7%**

M.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 263, Table 264, Table 265, and Table 266 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 263: 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	0.14	107.1%	0.5	13.3%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	56.0%	0.5	21.5%
Clothes Washer	0.01	151.6%	0.5	19.8%
Dehumidifier	0.01	107.9%	0.5	41.3%
Dishwasher	0.00	105.8%	0.5	27.1%
Freezer	0.00	155.8%	0.5	24.4%
Heat Pump Water Heater	0.01	114.0%	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	94.1%	0.5	20.7%
Room Air Conditioner	0.02	52.1%	0.5	50.6%
Smart Thermostat	0.03	119.2%	0.5	22.6%
Low-Income Total	**0.14**	**106.0%**	**0.5**	**na**
Non Low-Income Total	**0.11**	**106.0%**	**0.5**	**na**
Program Total	**0.24**	**106.0%**	**0.5**	**9.1%**

Table 264: 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	0.20	105.8%	0.5	13.3%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	106.8%	0.5	26.9%
Clothes Washer	0.01	143.0%	0.5	29.2%
Dehumidifier	0.01	94.1%	0.5	23.5%
Dishwasher	0.00	100.0%	0.5	32.0%
Freezer	0.00	154.9%	0.5	40.8%
Heat Pump Water Heater	0.00	113.2%	0.5	29.8%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Pool Pump	0.00	0.0%	0.5	100.0%
Refrigerator	0.01	79.7%	0.5	22.6%
Room Air Conditioner	0.01	67.3%	0.5	40.9%
Smart Thermostat	0.01	79.0%	0.5	25.2%
Low-Income Total	**0.20**	**103.3%**	**0.5**	**na**
Non Low-Income Total	**0.05**	**103.3%**	**0.5**	**na**
Program Total	**0.25**	**103.3%**	**0.5**	**11.1%**

Table 265: Res Appliances Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	0.06	106.6%	0.5	12.7%
Ceiling Fan	0.00	100.0%	0.5	100.0%
Clothes Dryer	0.00	82.4%	0.5	35.5%
Clothes Washer	0.00	141.8%	0.5	21.2%
Dehumidifier	0.00	83.9%	0.5	50.4%
Dishwasher	0.00	100.0%	0.5	31.9%
Freezer	0.00	154.0%	0.5	49.1%
Heat Pump Water Heater	0.00	100.0%	0.5	69.4%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Pool Pump	0.00	0.0%	0.5	100.0%
Refrigerator	0.00	96.1%	0.5	26.9%
Room Air Conditioner	0.00	172.2%	0.5	67.9%
Smart Thermostat	0.01	103.4%	0.5	21.2%
Low-Income Total	**0.06**	**106.5%**	**0.5**	**na**
Non Low-Income Total	**0.03**	**106.5%**	**0.5**	**na**
Program Total	**0.08**	**106.5%**	**0.5**	**9.7%**

Table 266: 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	0.17	106.0%	0.5	13.1%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	110.7%	0.5	22.6%
Clothes Washer	0.01	172.7%	0.5	27.1%
Dehumidifier	0.01	83.0%	0.5	29.0%
Dishwasher	0.00	100.0%	0.5	21.6%
Freezer	0.00	150.8%	0.5	40.9%
Heat Pump Water Heater	0.01	103.9%	0.5	35.1%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Pool Pump	0.00	0.0%	0.5	100.0%
Refrigerator	0.02	69.3%	0.5	23.9%
Room Air Conditioner	0.01	24.4%	0.5	71.6%
Smart Thermostat	0.03	111.3%	0.5	19.8%
Low-Income Total	**0.16**	**104.4%**	**0.5**	**na**
Non Low-Income Total	**0.10**	**104.4%**	**0.5**	**na**
Program Total	**0.26**	**104.4%**	**0.5**	**9.4%**

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 267, Table 268, Table 269, and Table 270 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 267: 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 268: 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 269: 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 270: 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 271, Table 272, Table 273, and Table 274 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 271: Res Appliances Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	787	42.4%	10.3%	67.9%	13.0%
Program Total	**787**	**42.4%**	**10.3%**	**67.9%**	**13.0%**

Table 272: Res Appliances Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	343	52.2%	1.5%	49.4%	12.8%
Program Total	**343**	**52.2%**	**1.5%**	**49.4%**	**12.8%**

Table 273: Res Appliances Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	223	49.8%	2.0%	52.3%	12.6%
Program Total	**223**	**49.8%**	**2.0%**	**52.3%**	**12.6%**

Table 274: Res Appliances Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	704	50.0%	2.2%	52.2%	12.7%
Program Total	**704**	**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 customer surveys or 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 275, Table 276, Table 277, and Table 278.

Table 275: Res Midstream Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	7,947	7,947
Heat Pump Water Heater	846	846
Ceiling Fan	17	17
Air Purifier	3,529	3,529
Room Air Conditioner	3,609	3,609
Smart Thermostat	1,144	1,144
Program Total	**17,092**	**17,092**

Table 276: Res Midstream Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	10,302	10,302
Heat Pump Water Heater	177	177
Ceiling Fan	15	15
Air Purifier	1,527	1,527
Room Air Conditioner	2,304	2,304
Smart Thermostat	954	954
Program Total	**15,279**	**15,279**

Table 277: Res Midstream Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	3,312	3,312
Heat Pump Water Heater	55	55
Ceiling Fan	11	11
Air Purifier	486	486
Room Air Conditioner	763	763
Smart Thermostat	843	843
Program Total	**5,470**	**5,470**

Table 278: Res Midstream Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	8,745	8,745
Heat Pump Water Heater	204	204
Ceiling Fan	21	21
Air Purifier	1,196	1,196
Room Air Conditioner	2,440	2,440
Smart Thermostat	1,456	1,456
Program Total	**14,062**	**14,062**

N.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 279, Table 280, Table 281, and Table 282 for Met-Ed, Penelec, Penn Power, and WPP respectively. In general, gross realization rates were near 95% for energy but about 10% lower for demand, driven by lower realization rates for dehumidifiers - which had slightly lower efficiencies and capacities than assumed in ex-ante calculations - and room air conditioners, which had lower capacities than assumed in ex-ante calculations.

Table 279: 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	1,111.4	85.3%	0.5	0.0%
Heat Pump Water Heater	1,487.5	111.0%	0.5	0.0%
Ceiling Fan	0.7	63.0%	0.5	0.0%
Air Purifier	1,678.6	112.1%	0.5	0.0%
Room Air Conditioner	137.6	56.1%	0.5	0.0%
Smart Thermostat	349.4	100.0%	0.5	0.0%
Program Total	**4,765**	**103.0%**	**0.5**	**0.0%**

Table 280: 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	1,443.2	84.0%	0.5	0.0%
Heat Pump Water Heater	302.8	112.3%	0.5	0.0%
Ceiling Fan	0.6	63.0%	0.5	0.0%
Air Purifier	810.7	117.9%	0.5	0.0%
Room Air Conditioner	60.4	60.5%	0.5	0.0%
Smart Thermostat	196.6	100.0%	0.5	0.0%
Program Total	**2,814**	**97.4%**	**0.5**	**0.0%**

Table 281: 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	466.2	84.5%	0.5	0.0%
Heat Pump Water Heater	84.9	111.5%	0.5	0.0%
Ceiling Fan	0.4	63.0%	0.5	0.0%
Air Purifier	258.8	116.0%	0.5	0.0%
Room Air Conditioner	22.1	57.1%	0.5	0.0%
Smart Thermostat	192.0	100.0%	0.5	0.0%
Program Total	**1,025**	**97.0%**	**0.5**	**0.0%**

Table 282: 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	1,223.5	84.1%	0.5	0.0%
Heat Pump Water Heater	340.0	111.4%	0.5	0.0%
Ceiling Fan	0.8	63.0%	0.5	0.0%
Air Purifier	623.2	118.1%	0.5	0.0%
Room Air Conditioner	73.0	56.1%	0.5	0.0%
Smart Thermostat	338.3	100.0%	0.5	0.0%
Program Total	**2,599**	**97.1%**	**0.5**	**0.0%**

N.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 283, Table 284, Table 285, and Table 286 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 283: 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	0.3	85.3%	0.5	0.0%
Heat Pump Water Heater	0.1	111.0%	0.5	0.0%
Ceiling Fan	0.0	57.0%	0.5	0.0%
Air Purifier	0.2	112.1%	0.5	0.0%
Room Air Conditioner	0.3	57.4%	0.5	0.0%
Smart Thermostat	0.0	100.0%	0.5	0.0%
Program Total	**0.96**	**87.1%**	**0.5**	**0.0%**

Table 284: 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	0.4	84.0%	0.5	0.0%
Heat Pump Water Heater	0.0	112.3%	0.5	0.0%
Ceiling Fan	0.0	57.0%	0.5	0.0%
Air Purifier	0.1	117.9%	0.5	0.0%
Room Air Conditioner	0.1	57.9%	0.5	0.0%
Smart Thermostat	0.0	100.0%	0.5	0.0%
Program Total	**0.70**	**85.3%**	**0.5**	**0.0%**

Table 285: Res Midstream Appliances Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	0.1	84.6%	0.5	0.0%
Heat Pump Water Heater	0.0	111.5%	0.5	0.0%
Ceiling Fan	0.0	57.0%	0.5	0.0%
Air Purifier	0.0	116.0%	0.5	0.0%
Room Air Conditioner	0.1	57.0%	0.5	0.0%
Smart Thermostat	0.0	100.0%	0.5	0.0%
Program Total	**0.24**	**85.5%**	**0.5**	**0.0%**

Table 286: 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	0.3	84.1%	0.5	0.0%
Heat Pump Water Heater	0.0	111.4%	0.5	0.0%
Ceiling Fan	0.0	57.0%	0.5	0.0%
Air Purifier	0.1	118.1%	0.5	0.0%
Room Air Conditioner	0.2	56.3%	0.5	0.0%
Smart Thermostat	0.0	100.0%	0.5	0.0%
Program Total	**0.66**	**83.3%**	**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 PY15. Net impact evaluation results from downstream appliances are used as a proxy. 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 PY15.

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 287. The achieved sample sizes and response rates in the table below are from the PY14 net impact evaluation effort.

Table 287: 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 288.

Table 288: Res Appliances Initiative Net-to-Gross Results

EDC	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	4,907	52.8%	0.0%	47.2%	13.0%
Penelec	2,741	46.9%	0.0%	53.1%	12.8%
Penn Power	994	56.0%	0.0%	44.0%	12.6%
WPP	2,523	49.2%	0.0%	50.8%	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 four distinct measures offered by the program: refrigerator recycling, freezer recycling, room AC (RAC) recycling, and dehumidifier recycling.

O.1.1 Application of Historical Realization Rates for PY15

The ATI Initiative was not evaluated for gross impacts in PY15. ADM applied the PY13 and PY14 weighted average energy and demand gross realization rates ,EDC by EDC, to the PY15 program reported impacts. The following sections describe the previous evaluation activities that informed the PY15 realization rates.

O.1.2 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 ARCA, were taken from program tracking and reporting data. TRM or IMP default parameters were used tor room air conditioners (RACs) and dehumidifiers. Table 289 lists the data sources for gross impact calculation algorithms.

Table 289: 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.1.3 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 290, Table 291, Table 292, and Table 293. 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 224 in Appendix J. Note that in PY15 gross impact evaluation was not conducted, so the shown sample sizes are zero.

Table 290: LI ATI Sub-Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	44	0	Application of Historical Realization Rates
Freezers	11	0	
RACs	9	0	
Dehumidifiers	2	0	
Mini Friges	6	0	
Program Total	**72**	**0**	

Table 291: LI ATI Sub-Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	35	0	Application of Historical Realization Rates
Freezers	12	0	
RACs	7	0	
Dehumidifiers	4	0	
Mini Friges	2	0	
Program Total	**60**	**0**	

Table 292: LI ATI Sub-Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	9	0	Application of Historical Realization Rates
Freezers	3	0	
RACs	0	0	
Dehumidifiers	1	0	
Mini Friges	0	0	
Program Total	**13**	**0**	

Table 293: LI ATI Sub-Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	26	0	Application of Historical Realization Rates
Freezers	6	0	
RACs	4	0	
Dehumidifiers	1	0	
Mini Friges	1	0	
Program Total	**38**	**0**	

O.1.4 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 294, Table 295, Table 296, and Table 297 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 294: 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	40	107.2%	0.5	0.0%
Freezers	7	107.2%	0.5	0.0%
RACs	1	107.2%	0.5	0.0%
Dehumidifiers	1	107.2%	0.5	0.0%
Mini Friges	1	107.2%	0.5	0.0%
Program Total	**50**	**107.2%**	**0.5**	**0.0%**

Table 295: 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	32	103.2%	0.5	0.0%
Freezers	8	103.2%	0.5	0.0%
RACs	1	103.2%	0.5	0.0%
Dehumidifiers	2	103.2%	0.5	0.0%
Mini Friges	0	103.2%	0.5	0.0%
Program Total	**43**	**103.2%**	**0.5**	**0.0%**

Table 296: 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	8	106.7%	0.5	0.0%
Freezers	2	106.7%	0.5	0.0%
RACs	0	106.7%	0.5	0.0%
Dehumidifiers	1	106.7%	0.5	0.0%
Mini Friges	0	106.7%	0.5	0.0%
Program Total	**11**	**106.7%**	**0.5**	**0.0%**

Table 297: 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	24	112.5%	0.5	0.0%
Freezers	4	112.5%	0.5	0.0%
RACs	0	112.5%	0.5	0.0%
Dehumidifiers	0	112.5%	0.5	0.0%
Mini Friges	0	112.5%	0.5	0.0%
Program Total	**29**	**112.5%**	**0.5**	**0.0%**

O.1.5 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 298, Table 299, Table 300, and Table 301 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 298: 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	0.01	102.4%	0.5	0.0%
Freezers	0.00	102.4%	0.5	0.0%
RACs	0.00	102.4%	0.5	0.0%
Dehumidifiers	0.00	102.4%	0.5	0.0%
Mini Friges	0.00	102.4%	0.5	0.0%
Program Total	**0.01**	**102.4%**	**0.5**	**0.0%**

Table 299: 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	0.01	101.6%	0.5	0.0%
Freezers	0.00	101.6%	0.5	0.0%
RACs	0.00	101.6%	0.5	0.0%
Dehumidifiers	0.00	101.6%	0.5	0.0%
Mini Friges	0.00	101.6%	0.5	0.0%
Program Total	**0.01**	**101.6%**	**0.5**	**0.0%**

Table 300: LI ATI Sub-Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.00	97.8%	0.5	0.0%
Freezers	0.00	97.8%	0.5	0.0%
RACs	0.00	97.8%	0.5	0.0%
Dehumidifiers	0.00	97.8%	0.5	0.0%
Mini Friges	0.00	97.8%	0.5	0.0%
Program Total	**0.00**	**97.8%**	**0.5**	**0.0%**

Table 301: 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	0.00	108.4%	0.5	0.0%
Freezers	0.00	108.4%	0.5	0.0%
RACs	0.00	108.4%	0.5	0.0%
Dehumidifiers	0.00	108.4%	0.5	0.0%
Mini Friges	0.00	108.4%	0.5	0.0%
Program Total	**0.01**	**108.4%**	**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 Application of Historical Realization Rates for PY15

The LI DI Initiative was not evaluated for gross impacts in PY15. ADM applied the PY13 and PY14 weighted average energy and demand gross realization rates ,EDC by EDC, to the PY15 program reported impacts. The following sections describe the previous evaluation activities that informed the PY15 realization rates.

P.1.2 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.1.2.1 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.1.2.2 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.1.3 Sampling

The sampling strategy for gross impact evaluation is summarized in Table 302, Table 303, Table 304, and Table 305 for Met-Ed, Penelec, Penn Power, and WPP respectively. Note that in PY15 gross impact evaluation was not conducted, so the shown sample sizes are zero.

Table 302: LI DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,900	917	0	Application of Historical Realization Rates
Medium Savings	1,050	241	0	
Low Savings	0	122	0	
Program Total		**1,280**	**0**	

Table 303: LI DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,350	1,935	0	Application of Historical Realization Rates
Medium Savings	700	585	0	
Low Savings	0	149	0	
Program Total		**2,669**	**0**	

Table 304: LI DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,650	475	0	Application of Historical Realization Rates
Medium Savings	900	107	0	
Low Savings	0	47	0	
Program Total		**629**	**0**	

Table 305: LI DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,950	1,716	0	Application of Historical Realization Rates
Medium Savings	1,050	683	0	
Low Savings	0	239	0	
Program Total		**2,638**	**0**	

P.1.4 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 306, Table 307, Table 308, and Table 309 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 306: 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	1,900	406	100.9%	0.5	0%
Medium Savings	1,050	331	100.9%	0.5	0%
Low Savings	0	341	100.9%	0.5	0%
Program Total		**1,077**	**100.9%**	**0.5**	**0.0%**

Table 307: 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	1,350	871	99.7%	0.5	0%
Medium Savings	700	787	99.7%	0.5	0%
Low Savings	0	381	99.7%	0.5	0%
Program Total		**2,038**	**99.7%**	**0.5**	**0.0%**

Table 308: 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	1,650	227	100.9%	0.5	0%
Medium Savings	900	149	100.9%	0.5	0%
Low Savings	0	124	100.9%	0.5	0%
Program Total		**500**	**100.9%**	**0.5**	**0.0%**

Table 309: 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	1,950	967	100.1%	0.5	0%
Medium Savings	1,050	947	100.1%	0.5	0%
Low Savings	0	629	100.1%	0.5	0%
Program Total		**2,543**	**100.1%**	**0.5**	**0.0%**

P.1.5 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 310, Table 311, Table 312, and Table 313 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 310: 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	1,900	0.05	101.1%	0.5	0%
Medium Savings	1,050	0.05	101.1%	0.5	0%
Low Savings	0	0.11	101.1%	0.5	0%
Program Total		**0.21**	**101.1%**	**0.5**	**0.0%**

Table 311: 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	1,350	0.11	99.2%	0.5	0%
Medium Savings	700	0.10	99.2%	0.5	0%
Low Savings	0	0.04	99.2%	0.5	0%
Program Total		**0.25**	**99.2%**	**0.5**	**0.0%**

Table 312: LI DI Initiative Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1,650	0.03	100.8%	0.5	0%
Medium Savings	900	0.02	100.8%	0.5	0%
Low Savings	0	0.01	100.8%	0.5	0%
Program Total		**0.06**	**100.8%**	**0.5**	**0.0%**

Table 313: 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	1,950	0.14	100.1%	0.5	0%
Medium Savings	1,050	0.13	100.1%	0.5	0%
Low Savings	0	0.08	100.1%	0.5	0%
Program Total		**0.36**	**100.1%**	**0.5**	**0.0%**

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 314, Table 315, Table 316, and Table 317. 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 163 in Appendix E.

Table 314: LI EE Kits Sub-Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	4,783	74	Survey (phone + online)
LI EE Kits - Standard	3,064	31	
LI School Education Kits	1,467	84	
Program Total	**9,314**	**189**	

Table 315: LI EE Kits Sub-Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	2,884	47	Survey (phone + online)
LI EE Kits - Standard	2,559	33	
LI School Education Kits	2,981	617	
Program Total	**8,424**	**697**	

Table 316: 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 317: LI EE Kits Sub-Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	4,796	59	Survey (phone + online)
LI EE Kits - Standard	3,116	32	
LI School Education Kits	2,835	367	
Program Total	**10,747**	**458**	

Q.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 318, Table 319, Table 320, and Table 321 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 318: 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	1,273	83.0%	1.00	17%
LI EE Kits - Standard	648	97.7%	1.00	26%
LI School Education Kits	325	108.9%	1.00	15%
Program Total	**2,246**	**91.0%**	**1.00**	**12.0%**

Table 319: 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	756	95.5%	1.00	21%
LI EE Kits - Standard	545	99.0%	1.00	25%
LI School Education Kits	670	103.1%	1.00	5%
Program Total	**1,972**	**99.1%**	**1.00**	**10.5%**

Table 320: 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%	1.00	0%
LI EE Kits - Standard	0	0.0%	1.00	0%
LI School Education Kits	0	0.0%	1.00	0%
Program Total	**0**	**100.0%**	**1.00**	**0.0%**

Table 321: 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	1,255	113.4%	1.00	19%
LI EE Kits - Standard	672	73.7%	1.00	25%
LI School Education Kits	645	104.7%	1.00	7%
Program Total	**2,572**	**100.9%**	**1.00**	**11.5%**

Q.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 322, Table 323, Table 324, and Table 325 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 322: 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	86.7%	1.00	17%
LI EE Kits - Standard	0.07	105.7%	1.00	26%
LI School Education Kits	0.04	106.9%	1.00	15%
Program Total	**0.25**	**95.4%**	**1.00**	**12.2%**

Table 323: 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	0.08	98.7%	1.00	21%
LI EE Kits - Standard	0.06	105.9%	1.00	25%
LI School Education Kits	0.07	97.8%	1.00	5%
Program Total	**0.20**	**100.4%**	**1.00**	**10.8%**

Table 324: LI EE Kits Sub-Initiative 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%	1.00	0%
LI EE Kits - Standard	0.00	0.0%	1.00	0%
LI School Education Kits	0.00	0.0%	1.00	0%
Program Total	**0.00**	**100.0%**	**1.00**	**0.0%**

Table 325: 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	116.1%	1.00	19%
LI EE Kits - Standard	0.08	78.8%	1.00	25%
LI School Education Kits	0.08	106.4%	1.00	7%
Program Total	**0.30**	**103.4%**	**1.00**	**11.2%**

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. For most lighting projects, the default activities are on-site verification and logging hours of use. Most lighting projects are metered unless there is a good reason not to meter.

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 34 sampled projects, only two exceeded 100 MWh in reported energy savings). ADM determined hours of use with lighting loggers for the sole sampled project with reported impacts above 250 MWh.

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 PY15. Due to the low evaluation risk posed by these projects, desk reviews were identified as the most appropriate impact evaluation activity.

(a) Application of Historical Realization Rates for PY15

The Downstream Non-lighting Initiative was not evaluated for gross impacts in PY15. ADM applied the PY13 and PY14 unweighted average (that is, PY14 and PY15 results weighted equally) energy and demand gross realization rates ,EDC by EDC, to the PY15 program reported impacts. The unweighted average of PY13 and PY14 realization rates is preferred in this case because PY14 impacts were far greater in PY14, so that a weighted average would render PY13 uninformative. This is problematic because the PY14 evaluation included some findings that are not directly applicable to PY15: systematic reporting errors associated with ECM fan motors were discovered and remedied in time for PY15. Over-reliance on the PY14 realization rate would result in imputation of low realization rates for an issue that has been resolved by PY15.

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.

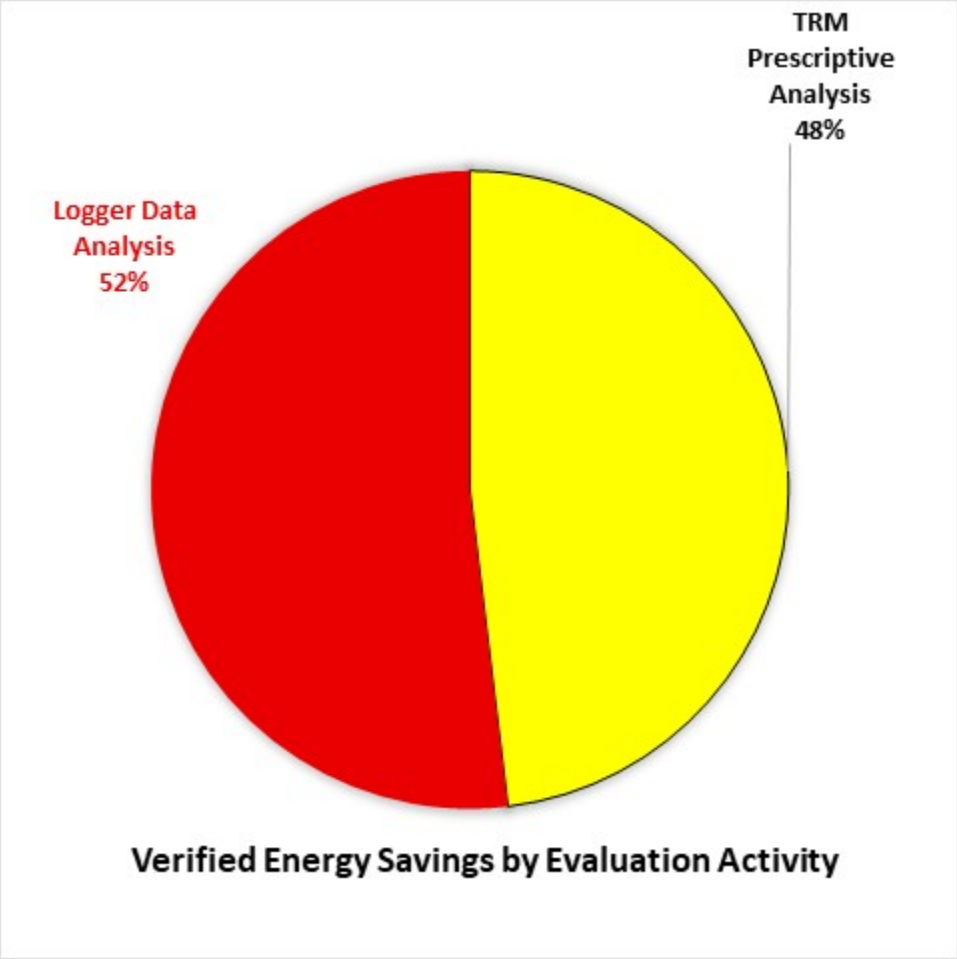


Figure 7: Fraction of verified energy savings by evaluation activity.

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 PY15, only the downstream lighting component 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 . In addition to downstream lighting, there are three strata, one each for midstream lighting, downstream non-lighting, and midstream non-lighting. The sample designs for the four EDCs are shown in Table 326, Table 327, Table 328, and Table 329. Note that in PY15 gross impact evaluation was not conducted for the Downstream Non-lighting stratum, so the associated sample sizes are zero.

Table 326: CI Prescriptive Initiative Gross Impact Sample Design for Met-Ed

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	18	2	
Downstream Lighting-1	0	136	11	
Downstream Nonlighting	0	24	0	
Midstream Lighting	0	575	13	
Midstream Nonlighting	0	0	0	
Program Total	**n/a**	**756**	**29**	

Table 327: CI Prescriptive Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	4	4	Desk Review, On-Site Verification
Downstream Lighting-2	120	20	2	
Downstream Lighting-1	0	129	8	
Downstream Nonlighting	0	33	0	
Midstream Lighting	0	731	10	
Midstream Nonlighting	0	1	1	
Program Total	**n/a**	**918**	**25**	

Table 328: CI Prescriptive Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	2	2	Desk Review, On-Site Verification
Downstream Lighting-2	120	3	1	
Downstream Lighting-1	0	38	4	
Downstream Nonlighting	0	13	0	
Midstream Lighting	0	174	9	
Midstream Nonlighting	0	0	0	
Program Total	**n/a**	**230**	**16**	

Table 329: CI Prescriptive Initiative Gross Impact Sample Design for WPP

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	18	4	
Downstream Lighting-1	0	100	5	
Downstream Nonlighting	0	39	0	
Midstream Lighting	0	788	9	
Midstream Nonlighting	0	3	1	
Program Total	**n/a**	**953**	**24**	

R.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 330, Table 331, Table 332, and Table 333 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.

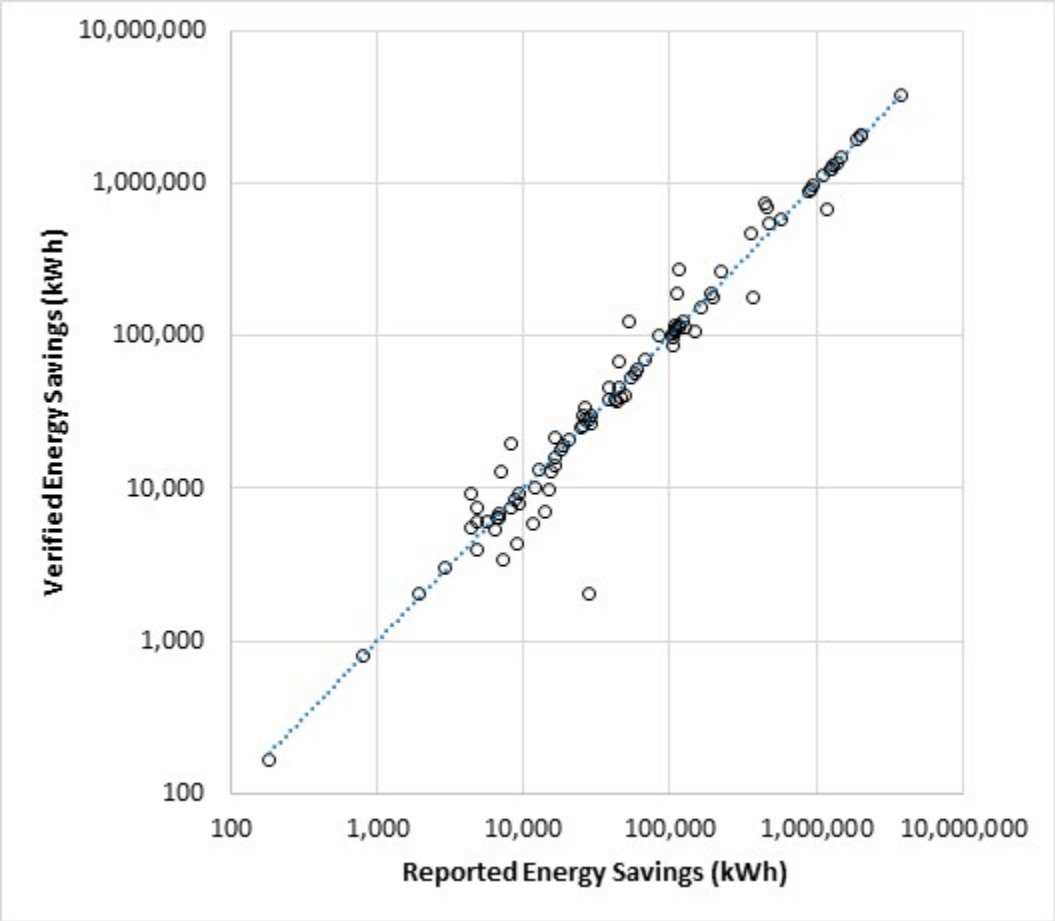


Figure 8: Verified vs. Reported Energy Savings for Sampled Prescriptive Projects.

Table 330: 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	3,460	102.1%	0.4	0%
Downstream Lighting-2	120	4,953	64.6%	0.4	38%
Downstream Lighting-1	0	2,713	99.8%	0.4	17%
Downstream Nonlighting	0	500	69.6%	0.4	0%
Midstream Lighting	0	11,551	162.7%	0.5	20%
Midstream Nonlighting	0	0	100.0%	0.4	0%
Program Total	**n/a**	**23,177**	**123.4%**		**13.8%**

Table 331: 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	7,392	99.9%	0.4	0%
Downstream Lighting-2	120	5,059	126.0%	0.4	39%
Downstream Lighting-1	0	3,643	91.4%	0.4	20%
Downstream Nonlighting	0	260	69.6%	0.4	0%
Midstream Lighting	0	10,909	84.7%	0.5	23%
Midstream Nonlighting	0	19	100.0%	0.4	0%
Program Total	**n/a**	**27,282**	**97.3%**		**12.4%**

Table 332: 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	2,609	100.0%	0.4	0%
Downstream Lighting-2	120	671	90.1%	0.4	47%
Downstream Lighting-1	0	1,300	110.4%	0.4	27%
Downstream Nonlighting	0	137	69.6%	0.4	0%
Midstream Lighting	0	3,479	100.5%	0.5	23%
Midstream Nonlighting	0	0	100.0%	0.4	0%
Program Total	**n/a**	**8,195**	**100.5%**		**11.5%**

Table 333: 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	7,335	100.5%	0.4	0%
Downstream Lighting-2	120	4,340	104.6%	0.4	25%
Downstream Lighting-1	0	3,987	100.0%	0.4	25%
Downstream Nonlighting	0	562	69.6%	0.4	0%
Midstream Lighting	0	12,959	106.6%	0.5	24%
Midstream Nonlighting	0	2	100.0%	0.4	47%
Program Total	**n/a**	**29,185**	**103.1%**		**12.1%**

R.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 334, Table 335, Table 336, and Table 337 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 334: 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	0.39	102.2%	0.4	0%
Downstream Lighting-2	120	0.80	30.3%	0.4	38%
Downstream Lighting-1	0	0.43	100.6%	0.4	17%
Downstream Nonlighting	0	0.09	76.2%	0.4	0%
Midstream Lighting	0	3.15	100.4%	0.5	20%
Midstream Nonlighting	0	0.00	100.0%	0.4	0%
Program Total	**n/a**	**4.86**	**88.6%**		**14.8%**

Table 335: 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	0.80	105.4%	0.4	0%
Downstream Lighting-2	120	0.87	185.0%	0.4	39%
Downstream Lighting-1	0	0.72	94.6%	0.4	20%
Downstream Nonlighting	0	0.04	76.2%	0.4	0%
Midstream Lighting	0	2.93	65.2%	0.5	23%
Midstream Nonlighting	0	0.00	100.0%	0.4	0%
Program Total	**n/a**	**5.36**	**94.6%**		**15.1%**

Table 336: CI Prescriptive Initiative 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	0.39	100.0%	0.4	0%
Downstream Lighting-2	120	0.14	100.0%	0.4	47%
Downstream Lighting-1	0	0.28	100.6%	0.4	27%
Downstream Nonlighting	0	0.03	76.2%	0.4	0%
Midstream Lighting	0	0.90	114.6%	0.5	23%
Midstream Nonlighting	0	0.00	100.0%	0.4	0%
Program Total	**n/a**	**1.74**	**107.3%**		**14.0%**

Table 337: 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	1.07	101.1%	0.4	0%
Downstream Lighting-2	120	0.90	82.4%	0.4	25%
Downstream Lighting-1	0	0.81	100.9%	0.4	25%
Downstream Nonlighting	0	0.10	76.2%	0.4	0%
Midstream Lighting	0	3.54	102.0%	0.5	24%
Midstream Nonlighting	0	0.00	100.0%	0.4	47%
Program Total	**n/a**	**6.41**	**98.6%**		**14.3%**

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., Prescriptive 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 338, Table 339, Table 340, and Table 341 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 338: 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 339: 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 340: 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 341: 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 342, Table 343, Table 344, and Table 345 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 342: CI Prescriptive Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	9,442	29.1%	2.1%	73.0%	9.7%
Downstream Nonlighting	348	29.1%	2.1%	73.0%	9.7%
Midstream Lighting	18,799	44.2%	0.0%	55.8%	15.6%
Midstream Nonlighting	0	44.2%	0.0%	55.8%	15.6%
Program Total	**28,589**	**39.0%**	**0.7%**	**61.7%**	**3.8%**

Table 343: CI Prescriptive Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	17,094	37.3%	3.3%	66.0%	6.9%
Downstream Nonlighting	181	37.3%	3.3%	66.0%	6.9%
Midstream Lighting	9,239	34.2%	0.0%	65.8%	10.0%
Midstream Nonlighting	19	34.2%	0.0%	65.8%	10.0%
Program Total	**26,532**	**36.2%**	**2.2%**	**66.0%**	**4.5%**

Table 344 CI Prescriptive Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	4,648	17.4%	2.1%	84.8%	9.5%
Downstream Nonlighting	95	17.4%	2.1%	84.8%	9.5%
Midstream Lighting	3,496	25.0%	0.0%	75.0%	67.3%
Midstream Nonlighting	0	25.0%	0.0%	75.0%	67.3%
Program Total	**8,239**	**20.6%**	**1.2%**	**80.6%**	**5.7%**

Table 345 CI Prescriptive Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	15,895	42.8%	2.7%	59.9%	5.9%
Downstream Nonlighting	391	42.8%	2.7%	59.9%	5.9%
Midstream Lighting	13,808	24.7%	0.0%	75.3%	14.3%
Midstream Nonlighting	2	24.7%	0.0%	75.3%	14.3%
Program Total	**30,096**	**34.5%**	**1.5%**	**67.0%**	**2.8%**

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 are encouraged to 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.

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.

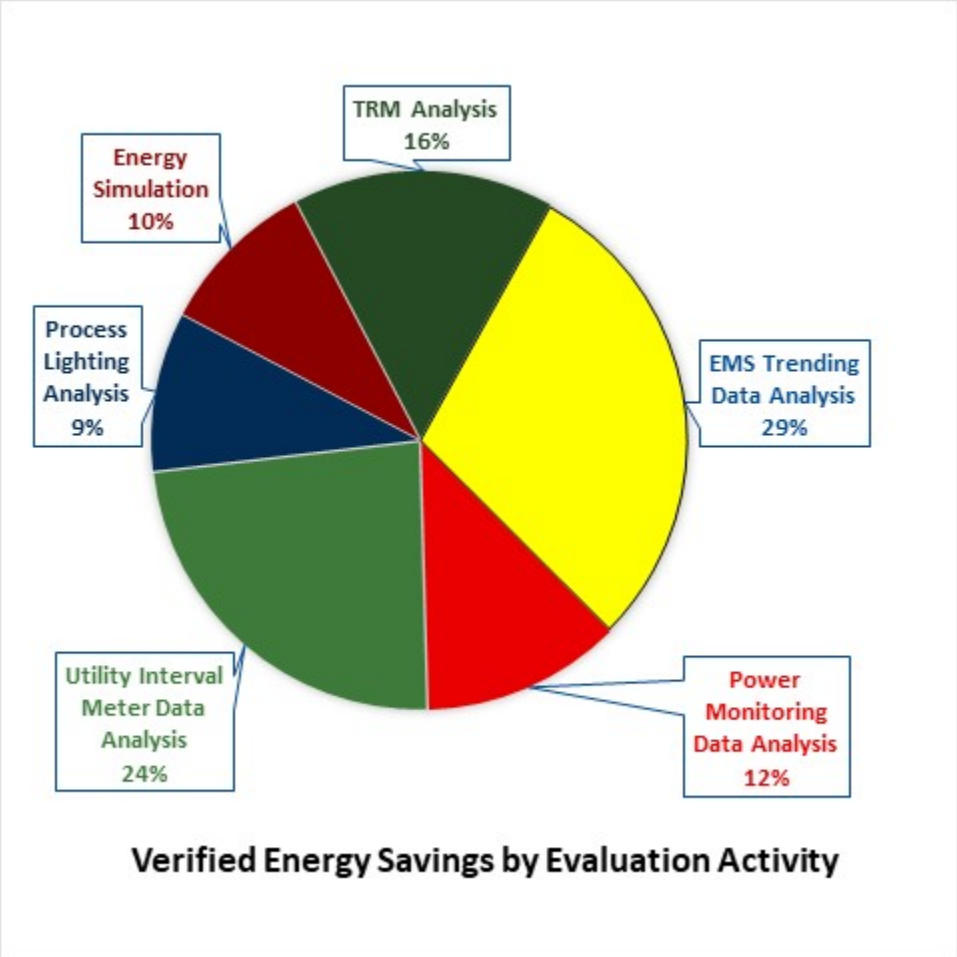


Figure 9: Fraction of verified energy savings by evaluation activity.

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 two 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 sampling stratum. The sample designs for the four EDCs are shown in Table 346, Table 347, Table 348, and Table 349.

Table 346: CI Custom Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	4	4	On-Site Verification, Metering
Custom-1	0	32	4	
Program Total	**n/a**	**36**	**8**	

Table 347: CI Custom Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	2	2	On-Site Verification, Metering
Custom-1	0	26	5	
Program Total	**n/a**	**28**	**7**	

Table 348: CI Custom Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	1	1	On-Site Verification, Metering
Custom-1	0	11	3	
Program Total	**n/a**	**12**	**4**	

Table 349: CI Custom Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	2	2	On-Site Verification, Metering
Custom-1	0	40	7	
Program Total	**n/a**	**42**	**9**	

S.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 350, Table 351, Table 352, and Table 353 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 0.5.

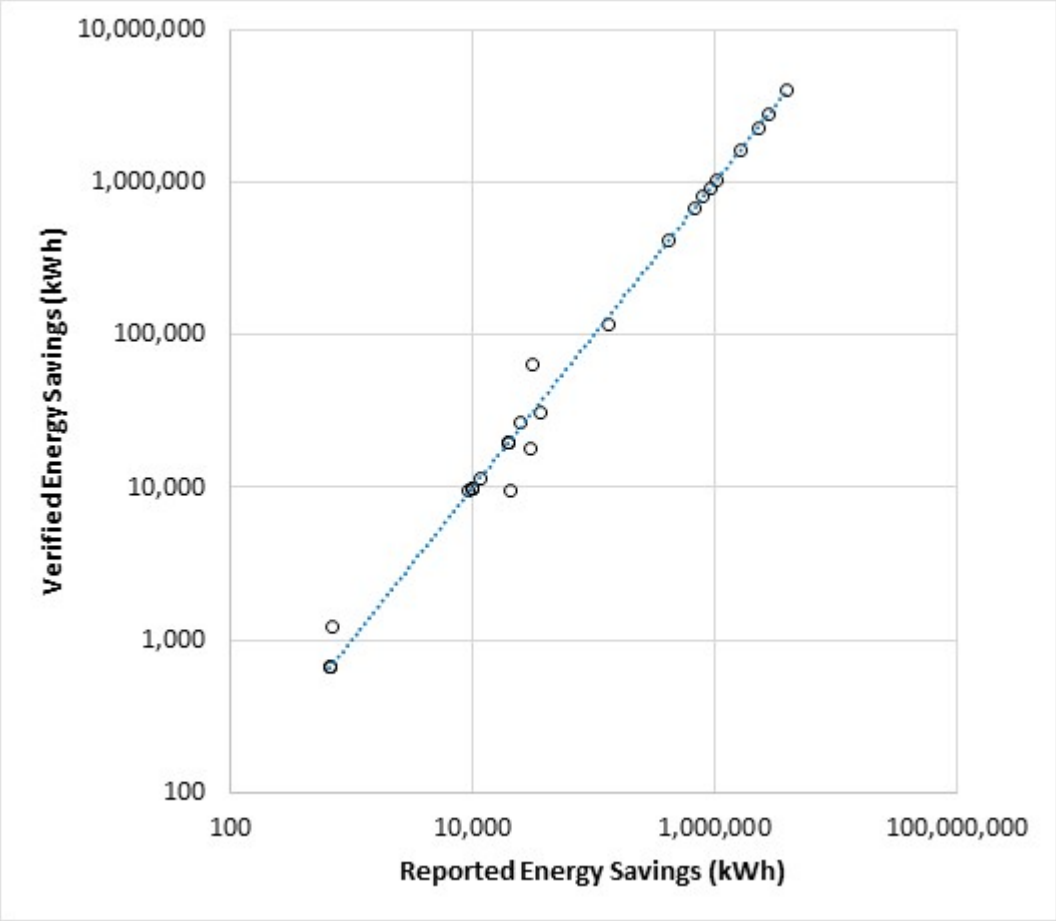


Figure 10: Verified vs. Reported Energy Savings for Sampled Custom Projects.

Table 350: 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	5,859	100.0%	0.4	0%
Custom-1	0	2,219	101.5%	0.4	27%
Program Total	**n/a**	**8,078**	**100.4%**		**7.5%**

Table 351: 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	4,418	100.0%	0.4	0%
Custom-1	0	2,111	77.7%	0.4	23%
Program Total	**n/a**	**6,529**	**92.8%**		**5.8%**

Table 352: 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	2,271	100.0%	0.4	0%
Custom-1	0	1,160	85.5%	0.4	28%
Program Total	**n/a**	**3,431**	**95.1%**		**8.2%**

Table 353: 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	1,935	100.0%	0.4	0%
Custom-1	0	2,021	70.4%	0.4	20%
Program Total	**n/a**	**3,956**	**84.9%**		**7.1%**

S.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 354, Table 355, Table 356, and Table 357 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 354: 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	0.90	100.0%	0.4	0%
Custom-1	0	0.49	95.2%	0.4	27%
Program Total	**n/a**	**1.38**	**98.3%**		**9.0%**

Table 355: 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	1.45	100.0%	0.4	0%
Custom-1	0	0.43	33.5%	0.4	23%
Program Total	**n/a**	**1.88**	**84.6%**		**1.8%**

Table 356: CI Custom Initiative 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	0.31	100.0%	0.4	0%
Custom-1	0	0.12	79.8%	0.4	28%
Program Total	**n/a**	**0.42**	**94.5%**		**6.2%**

Table 357: 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	0.13	123.5%	0.4	0%
Custom-1	0	0.26	15.3%	0.4	20%
Program Total	**n/a**	**0.40**	**51.8%**		**2.0%**

S.2 NET IMPACT EVALUATION

S.2.1 Net Impact Evaluation Methodology

In PY15, 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., Prescriptive 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.

S.2.2 Sampling

The sample designs for the four EDCs are shown in Table 358, Table 359, Table 360, and Table 361 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 358: CI Custom Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom	10	7	70%
Program Total	**10**	**7**	**70%**

Table 359: CI Custom Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom	21	13	62%
Program Total	**21**	**13**	**62%**

Table 360: CI Custom Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom	5	4	80%
Program Total	**5**	**4**	**80%**

Table 361: CI Custom Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom	18	12	67%
Program Total	**18**	**12**	**67%**

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 362, Table 363, Table 364, and Table 365 for Met-Ed, Penelec, Penn Power, and WPP respectively. Inspection of stratum-level NTG ratios for all four EDCs suggests that NTG ratios are lower for custom projects than for lighting projects.

Table 362: CI Custom Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom	8,111	42.9%	0.0%	57.1%	14.9%
Program Total	**8,111**	**42.9%**	**0.0%**	**57.1%**	**14.9%**

Table 363: CI Custom Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom	6,059	47.9%	0.0%	52.1%	12.3%
Program Total	**6,059**	**47.9%**	**0.0%**	**52.1%**	**12.3%**

Table 364: CI Custom Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom	3,263	0.0%	0.0%	100.0%	16.1%
Program Total	**3,263**	**0.0%**	**0.0%**	**100.0%**	**16.1%**

Table 365: CI Custom Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom	3,358	50.9%	0.0%	49.1%	12.0%
Program Total	**3,358**	**50.9%**	**0.0%**	**49.11%**	**12.0%**

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 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.

All five subprograms completed rebate applications in PY15.

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

Application of Historical Realization Rates for PY15

The Commercial New Construction program component was not scheduled to be evaluated for gross impacts in PY15. The PY15 New Construction program component was expected to be relatively small (with the exception of a few known large projects for West Penn Power), but two large projects at warehouses were approved at the end of PY15, resulting in over 4,000 MWh of reported impacts for Met-Ed. ADM conducted on-site verification visits and calculation reviews for these large Met-Ed projects, but logging lighting hours of use would be impractical because the new warehouses were not yet utilized at the time of the site visit, and interviews with site contacts suggested that it would take several months for occupancy to ramp up to normal levels. ADM applied historical realization rates from PY13 and PY14, with a modification to reflect three projects from West Penn Power that ADM evaluated in PY15 as part of their "above threshold" upfront evaluation process for large projects.

Previous 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. Our PY15 sample included measures such as wall insulation, high-speed refrigeration doors, chiller replacements, variable frequency drives, and commissioning. 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.

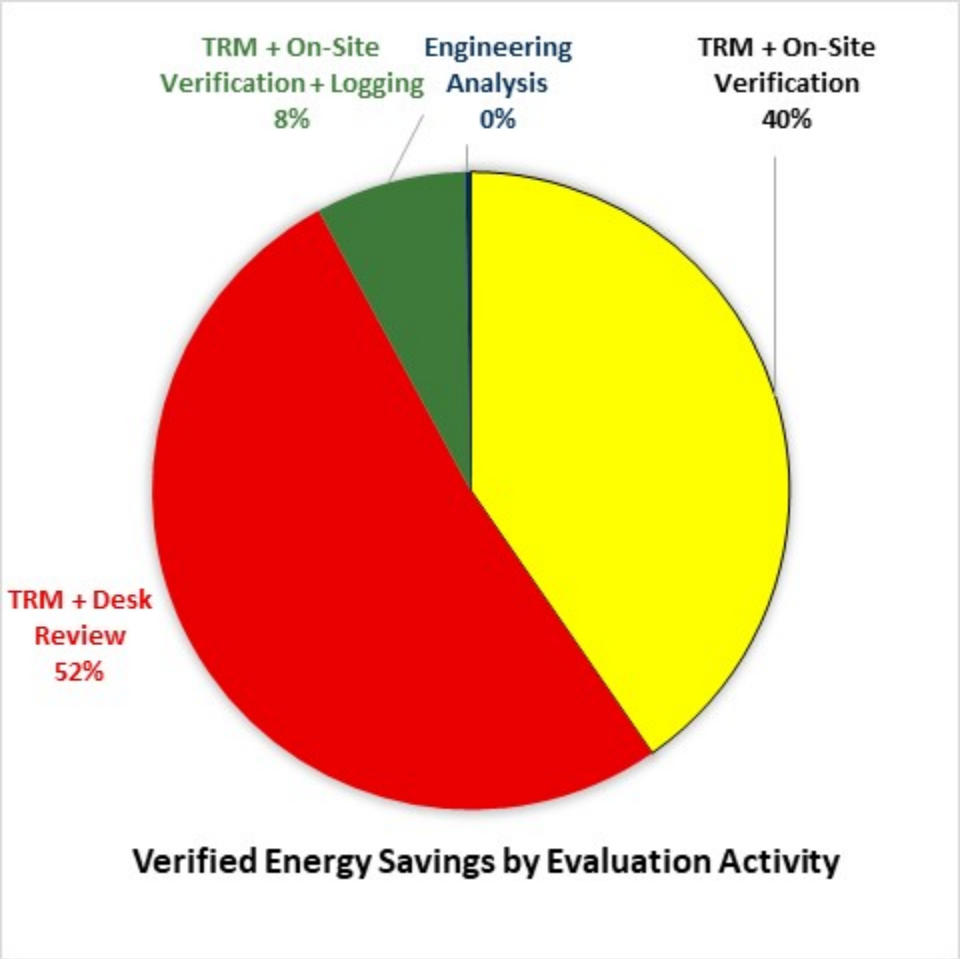
T.1.1.4 Building Operator Certification

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 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 366, Table 367, Table 368, and Table 369. Note that sampled values for the New Construction component are shown as zero since historical realization rates were applied to that stratum in PY15.

Table 366: CI Lighting Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-3	255	0	0	Desk Review; On-Site Verification
Building Tune-Ups-2	50	49	4	
Building Tune-Ups-1	0	436	16	
BOC-1	0	4	2	
CNC-1	0	14	0	
CBI-RCX-1	0	13	1	
EMNC-C	0	0	0	
Program Total	**n/a**	**516**	**23**	

Table 367: CI EMNC Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-3	255	5	3	Desk Review; On-Site Verification
Building Tune-Ups-2	50	76	7	
Building Tune-Ups-1	0	339	11	
BOC-1	0	3	1	
CNC-1	0	2	0	
CBI-RCX-1	0	12	1	
EMNC-C	0	1	1	
Program Total	**n/a**	**438**	**24**	

Table 368: CI EMNC Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-3	255	0	0	Desk Review; On-Site Verification
Building Tune-Ups-2	50	35	10	
Building Tune-Ups-1	0	90	8	
BOC-1	0	1	1	
CNC-1	0	0	0	
CBI-RCX-1	0	8	1	
EMNC-C	0	1	1	
Program Total	**n/a**	**135**	**21**	

Table 369: CI EMNC Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-3	255	4	2	Desk Review; On-Site Verification
Building Tune-Ups-2	50	77	9	
Building Tune-Ups-1	0	421	14	
BOC-1	0	5	2	
CNC-1	0	7	0	
CBI-RCX-1	0	18	1	
EMNC-C	0	0	0	
Program Total	**n/a**	**516**	**23**	

T.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 370, Table 371, Table 372, and Table 373 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 0.4, but the actual error ratios are variable stratum by stratum, but overall tend to be somewhat lower than 0.4.

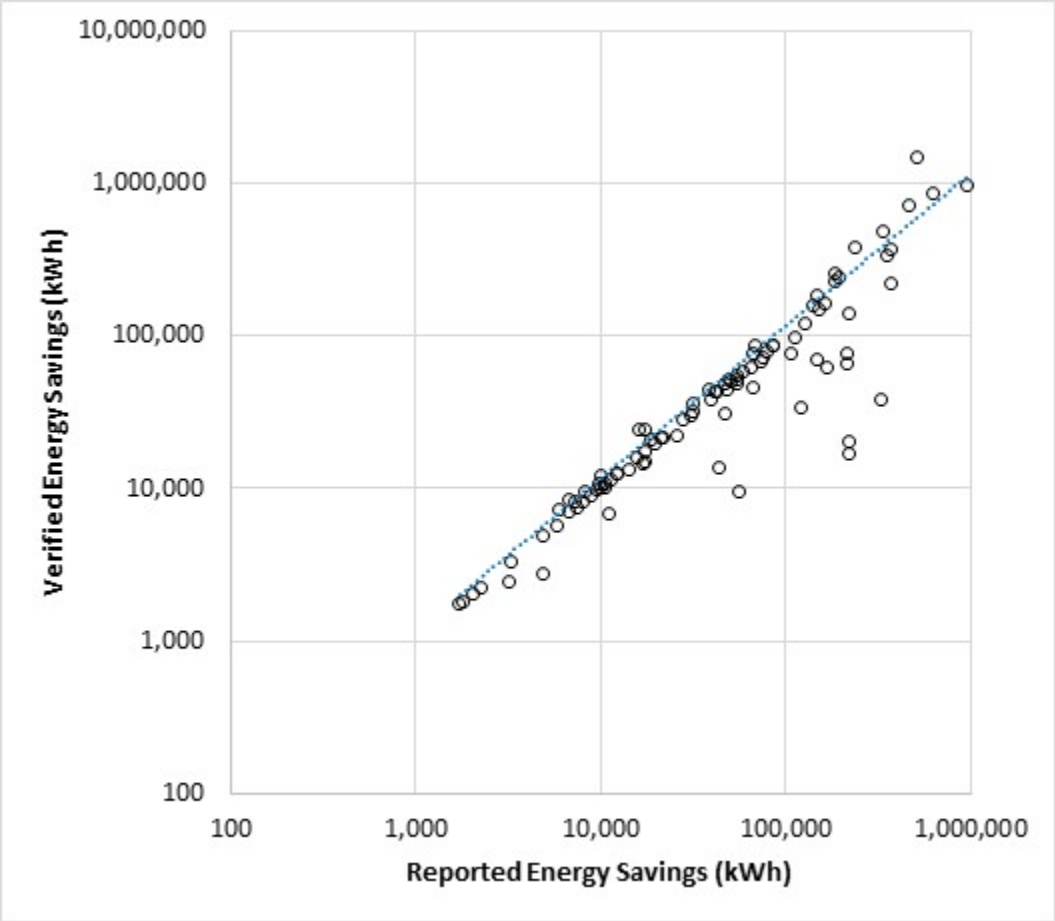


Figure 12: Verified vs. Reported Energy Savings for Sampled EMNC Projects.

Table 370: 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	255	0	100.0%	0.5	0%
Building Tune-Ups-2	50	3,988	101.5%	0.5	34%
Building Tune-Ups-1	0	5,630	93.7%	0.5	18%
BOC-1	0	524	94.1%	0.5	36%
CNC-1	0	4,359	109.8%	0.5	0%
CBI-RCX-1	0	1,215	92.2%	0.5	69%
EMNC-C	0	0	100.0%	0.5	0%
Program Total	**n/a**	**15,715**	**100.0%**	**0.5**	**11.8%**

Table 371: 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	255	1,958	113.7%	0.5	26%
Building Tune-Ups-2	50	6,982	60.2%	0.5	26%
Building Tune-Ups-1	0	5,505	102.2%	0.5	21%
BOC-1	0	404	98.7%	0.5	59%
CNC-1	0	228	109.8%	0.5	0%
CBI-RCX-1	0	405	30.8%	0.5	69%
EMNC-C	0	523	280.3%	0.5	0%
Program Total	**n/a**	**16,006**	**89.3%**	**0.5**	**12.2%**

Table 372: 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	255	0	100.0%	0.5	0%
Building Tune-Ups-2	50	3,558	62.5%	0.5	19%
Building Tune-Ups-1	0	1,311	105.0%	0.5	24%
BOC-1	0	76	96.4%	0.5	0%
CNC-1	0	0	100.0%	0.5	0%
CBI-RCX-1	0	421	100.0%	0.5	67%
EMNC-C	0	963	100.0%	0.5	0%
Program Total	**n/a**	**6,328**	**79.9%**	**0.5**	**12.1%**

Table 373: 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	255	1,307	98.7%	0.5	36%
Building Tune-Ups-2	50	7,078	100.9%	0.5	23%
Building Tune-Ups-1	0	6,545	102.1%	0.5	19%
BOC-1	0	417	95.2%	0.5	39%
CNC-1	0	4,389	101.5%	0.5	0%
CBI-RCX-1	0	1,677	113.4%	0.5	70%
EMNC-C	0	0	100.0%	0.5	0%
Program Total	**n/a**	**21,413**	**102.1%**	**0.5**	**11.4%**

T.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 374, Table 375, Table 376, and Table 377 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 374: 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	255	0.00	100.0%	0.5	0%
Building Tune-Ups-2	50	0.47	123.7%	0.5	34%
Building Tune-Ups-1	0	0.90	97.4%	0.5	18%
BOC-1	0	0.10	92.3%	0.5	36%
CNC-1	0	0.60	80.5%	0.5	0%
CBI-RCX-1	0	0.23	81.1%	0.5	69%
EMNC-C	0	0.00	100.0%	0.5	0%
Program Total	**n/a**	**2.31**	**96.5%**	**0.5**	**12.9%**

Table 375: 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	255	0.38	66.1%	0.5	26%
Building Tune-Ups-2	50	0.88	60.4%	0.5	26%
Building Tune-Ups-1	0	0.89	106.6%	0.5	21%
BOC-1	0	0.06	98.8%	0.5	59%
CNC-1	0	0.06	80.5%	0.5	0%
CBI-RCX-1	0	0.04	51.4%	0.5	69%
EMNC-C	0	0.11	103.9%	0.5	0%
Program Total	**n/a**	**2.42**	**81.5%**	**0.5**	**13.0%**

Table 376: CI EMNC Initiative 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	255	0.00	100.0%	0.5	0%
Building Tune-Ups-2	50	0.53	69.9%	0.5	19%
Building Tune-Ups-1	0	0.18	109.3%	0.5	24%
BOC-1	0	0.01	96.5%	0.5	0%
CNC-1	0	0.00	100.0%	0.5	0%
CBI-RCX-1	0	0.06	100.0%	0.5	67%
EMNC-C	0	0.07	100.1%	0.5	0%
Program Total	**n/a**	**0.85**	**83.1%**	**0.5**	**13.4%**

Table 377: 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	255	0.28	104.1%	0.5	36%
Building Tune-Ups-2	50	1.02	74.5%	0.5	23%
Building Tune-Ups-1	0	1.04	108.5%	0.5	19%
BOC-1	0	0.07	110.6%	0.5	39%
CNC-1	0	0.86	96.6%	0.5	0%
CBI-RCX-1	0	0.27	17.5%	0.5	70%
EMNC-C	0	0.00	100.0%	0.5	0%
Program Total	**n/a**	**3.54**	**88.6%**	**0.5**	**9.4%**

T.2 NET IMPACT EVALUATION

T.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. Nonparticipant spillover was estimated from vendor self-report surveys at the program component level (i.e., Prescriptive 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.

T.2.2 Sampling

The sample designs for the four EDCs are shown in Table 378, Table 379, Table 380, and Table 381 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 378: CI EMNC Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
EMNC	79	34	43%
Program Total	**79**	**34**	**43%**

Table 379: CI EMNC Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
EMNC	98	32	33%
Program Total	**98**	**32**	**33%**

Table 380: CI EMNC Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
EMNC	42	11	26%
Program Total	**42**	**11**	**26%**

Table 381: CI EMNC Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
EMNC	120	35	29%
Program Total	**120**	**35**	**29%**

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 382, Table 383, Table 384, and Table 385 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 382: CI EMNC Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
EMNC	15,719	2.2%	0.0%	97.8%	9.3%
Program Total	**15,719**	**2.2%**	**0.0%**	**97.8%**	**9.3%**

Table 383: CI EMNC Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
EMNC	14,293	16.2%	0.0%	83.8%	10.4%
Program Total	**14,293**	**16.2%**	**0.0%**	**83.8%**	**10.4%**

Table 384 CI EMNC Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
EMNC	5,056	2.7%	0.0%	97.3%	18.7%
Program Total	**5,056**	**2.7%**	**0.0%**	**97.3%**	**18.7%**

Table 385 CI EMNC Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
EMNC	21,864	8.2%	18.2%	110.0%	10.2%
Program Total	**21,864**	**8.2%**	**18.2%**	**110.0%**	**10.2%**

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 PY15 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 Application of Historical Realization Rates for PY15

The CI MF Initiative was not evaluated for gross impacts in PY15. ADM applied the PY14 average energy and demand gross realization rates to the PY15 program reported impacts. Due to low participation and small evaluation sizes thus far in Phase IV, ADM averaged the realization rates among all EDCs and applied the resulting average to each EDC. Additionally, ADM made one modification to the cross-EDC weighed average realization rates. West Penn Power's PY14 realization rate was affected by one project which used as-found wattages for baseline incandescent lamps in common areas of apartments. This issue was identified in the PY13 evaluation, and the program's calculator was updated in PY14 to replace the incandescent lamp wattage with an equivalent EISA-compliant wattage. This issue was resolved mid-way in PY14 (the sampled project was from Q1 of PY14). To reflect the programmatic correction, ADM recalculated WPP's realization rates by removing the said project prior to averaging realization rates across EDCs.

U.1.1.2 Historical 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 PY15 realization rates.

U.1.2 Sampling

Table 386, Table 387, Table 388, and Table 389 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively. Note that in PY15 gross impact evaluation was not conducted, so the shown sample sizes are zero.

Table 386: CI MF Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	16	0	Desk Review, On-Site Verification, Logging HOU
Program Total	**n/a**	**16**	**0**	

Table 387: CI MF Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	11	0	Desk Review, On-Site Verification, Logging HOU
Program Total	**n/a**	**11**	**0**	

Table 388: CI MF Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	1	0	Desk Review, On-Site Verification, Logging HOU
Program Total	**n/a**	**1**	**0**	

Table 389: CI MF Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	12	0	Desk Review, On-Site Verification, Logging HOU
Program Total	**n/a**	**12**	**0**	

U.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 390, Table 391, Table 392, and Table 393 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.

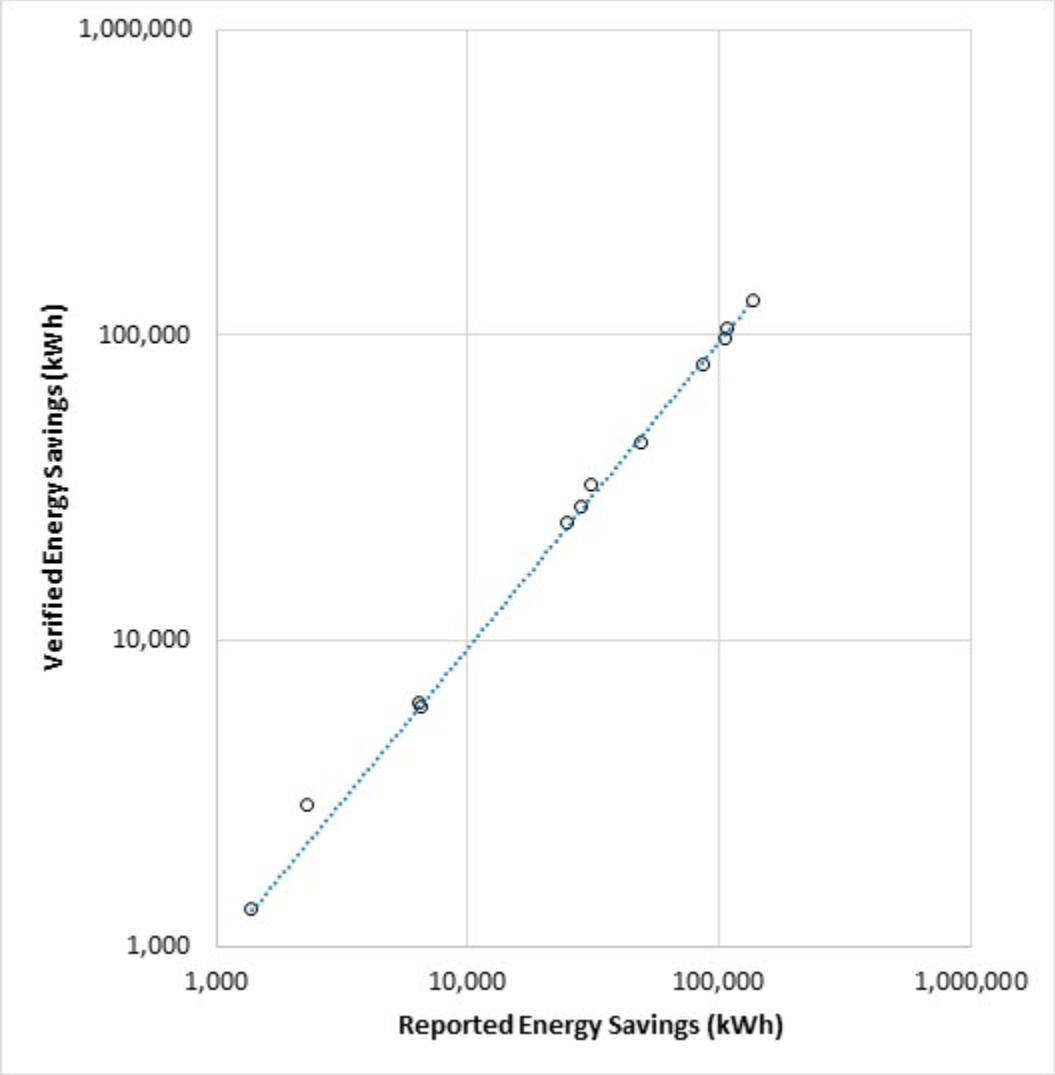


Figure 13: Verified vs. Reported Energy Savings for Sampled Multifamily Projects.

Table 390: 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	1,000	100.5%	0.5	0%
Program Total	**n/a**	**1,000**	**100.5%**	**0.5**	**0.0%**

Table 391: 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	844	100.5%	0.5	0%
Program Total	**n/a**	**844**	**100.5%**	**0.5**	**0.0%**

Table 392: 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	39	100.5%	0.5	0%
Program Total	**n/a**	**39**	**100.5%**	**0.5**	**0.0%**

Table 393: 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	258	100.5%	0.5	0%
Program Total	**n/a**	**258**	**100.5%**	**0.5**	**0.0%**

U.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 394, Table 395, Table 396, and Table 397 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 394: 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	0.14	92.2%	0.5	0%
Program Total	**n/a**	**0.14**	**92.2%**	**0.5**	**0.0%**

Table 395: 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	0.12	92.2%	0.5	0%
Program Total	**n/a**	**0.12**	**92.2%**	**0.5**	**0.0%**

Table 396: CI MF Initiative 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	92.2%	0.5	0%
Program Total	**n/a**	**0.01**	**92.2%**	**0.5**	**0.0%**

Table 397: 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	0.04	92.2%	0.5	0%
Program Total	**n/a**	**0.04**	**92.2%**	**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 205 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 398, Table 399, Table 400, and Table 401 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 224 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 398: C&I ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	11	11	T&R Review, Deem RR from ATI
Program Total	**11**	**11**	

Table 399: C&I ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	4	4	T&R Review, Deem RR from ATI
Program Total	**4**	**4**	

Table 400: C&I ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	2	2	T&R Review, Deem RR from ATI
Program Total	**2**	**2**	

Table 401: C&I ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	4	4	T&R Review, Deem RR from ATI
Program Total	**4**	**4**	

V.1.2 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 402, Table 403, Table 404, Table 405, and for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 402: 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	13	109.2%	0.5	0.0%
Program Total	**13**	**109.2%**	**0.5**	**0.0%**

Table 403: 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	4	107.2%	0.5	0.0%
Program Total	**4**	**107.2%**	**0.5**	**0.0%**

Table 404: 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	8	99.3%	0.5	0.0%
Program Total	**8**	**99.3%**	**0.5**	**0.0%**

Table 405: 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	3	103.2%	0.5	0.0%
Program Total	**3**	**103.2%**	**0.5**	**0.0%**

V.1.3 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 406, Table 407, Table 408, and Table 409 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 406: 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	0.00	106.2%	0.5	0.0%
Program Total	**0.00**	**106.2%**	**0.5**	**0.0%**

Table 407: 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	0.00	102.4%	0.5	0.0%
Program Total	**0.00**	**102.4%**	**0.5**	**0.0%**

Table 408: C&I ATI Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0.00	97.9%	0.5	0.0%
Program Total	**0.00**	**97.9%**	**0.5**	**0.0%**

Table 409: 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	0.00	101.6%	0.5	0.0%
Program Total	**0.00**	**101.6%**	**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 410: Report Update Timestamp

Tables and Charts Updated on 09/25/24, at 20:16

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, 2021 to May 31, 2022 for Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company and West Penn Power 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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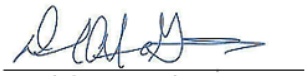

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