FirstEnergy.

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November 15, 2019

VIA FEDEX OVERNIGHT

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

Re: Joint Petition for Approval of Energy Efficiency and Conservation Plans Phase III of Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company and West Penn Power Company, Docket No. M-2015-2514767, *et al*; Annual Report for the period ending May 31, 2019

Dear Secretary Chiavetta:

Enclosed please a copy and a disk of the Final Joint Annual Report of Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company and West Penn Power Company to the Pennsylvania Public Utility Commission in the above-referenced matter.

I have also enclosed an additional copy of the cover letter for you to date stamp and return to my office. Should you have any questions regarding this matter, please do not hesitate to contact me.

Sincerely,

Tori L. Giesler

Tori L. Giesler
Supervising Counsel

TLG:dml

Enclosures

Final Annual Report to the Pennsylvania Public Utility Commission

Phase III of Act 129

Program Year 10

(June 1, 2018 – May 31, 2019)

For Pennsylvania Act 129 of 2008

Energy Efficiency and Conservation Plan

Prepared by ADM Associates and Tetra Tech

For

Metropolitan Edison Company M-2015-2514767

Pennsylvania Electric Company M-2015-2514768

Pennsylvania Power Company M-2015-2514769

West Penn Power Company M-2015-2514772

November 15, 2019

Contents

Acronyms

BDR	Behavioral Demand Response
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
DR	Demand Response
EDC	Electric Distribution Company
EDT	Eastern Daylight Time
EE&C	Energy Efficiency and Conservation
EM&V	Evaluation, Measurement, and Verification
EUL	Effective Useful Life
GNI	Government, Non-Profit, Institutional
HER	Home Energy Report
HIM	High-Impact Measure
HVAC	Heating, Ventilating, and Air Conditioning
ICSP	Implementation Conservation Service Provider
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light-Emitting Diode
LIURP	Low-Income Usage Reduction Program
M&V	Measurement and Verification
MW	Megawatt
MWh	Megawatt-hour
NPV	Net Present Value
NTG	Net-to-Gross
P3TD	Phase III to Date
PA PUC	Pennsylvania Public Utility Commission
PSA	Phase III to Date Preliminary Savings Achieved; equal to VTD + PYRTD
PSA+CO	PSA savings plus Carryover from Phase II
PY	Program Year: e.g. PY8, from June 1, 2016, to May 31, 2017
PYRTD	Program Year Reported to Date
PYVTD	Program Year Verified to Date
RTD	Phase III to Date Reported Gross Savings
SWE	Statewide Evaluator
TRC	Total Resource Cost
TRM	Technical Reference Manual
VTD	Phase III to Date Verified Gross Savings

Types of Savings

Gross Savings: The change in energy consumption and/or peak demand that results directly from program-related actions taken by participants in an 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 III Evaluation Framework allows EDCs and the evaluation contractors the flexibility to not evaluate each program every year. If an EE&C program is being evaluated over a 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 III to Date (P3TD): The energy and peak demand savings achieved by an EE&C program or portfolio within Phase III of Act 129. Reported in several permutations described below.

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

1 Introduction

Pennsylvania Act 129 of 2008, signed on October 15, 2008, mandated energy savings and demand reduction goals for the largest electric distribution companies (EDCs) in Pennsylvania for Phase I (2008 through 2013). Phase II of Act 129 began in June 2013 and concluded in May 2016. In late 2015, 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 III. These plans were updated based on stakeholder input and subsequently approved by the PUC in 2016.

Implementation of Phase III of the Act 129 programs began on June 1, 2016. This report documents the progress and effectiveness of the Phase III EE&C accomplishments in Program Year 10 (PY10) 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, as well as the cumulative accomplishments of the Phase III programs since inception. This report additionally documents the energy savings carried over from Phase II. The Phase II carryover savings count towards EDC savings compliance targets for Phase III.

This report details the participation, spending, reported gross, verified gross, and verified net impacts of the energy efficiency programs in PY10. Compliance with Act 129 savings goals are ultimately based on verified gross savings. This report also includes estimates of cost-effectiveness according to the Total Resource Cost test (TRC).[1] The Companies have retained ADM Associates, Inc. and Tetra Tech, Inc (the ADM team, or ADM) as an independent evaluation contractor for Phase III of Act 129. The ADM team is responsible for the measurement and verification of the savings 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.

Phase III of Act 129 includes a demand response goal for Met-Ed, Penn Power, and WPP. Demand response events are limited to the months of June through September, which are the first four months of the Act 129 program year. Because the demand response season is completed early in the program year, it is possible to complete the independent evaluation of verified gross savings for demand response sooner than is possible for energy efficiency programs. The Companies reported the verified gross demand response impacts for PY10 as well as the cumulative demand response performance of the EE&C program to date for Phase III of Act 129 in the Preliminary Annual Report filed July 15, 2019.

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

2 Summary of Achievements

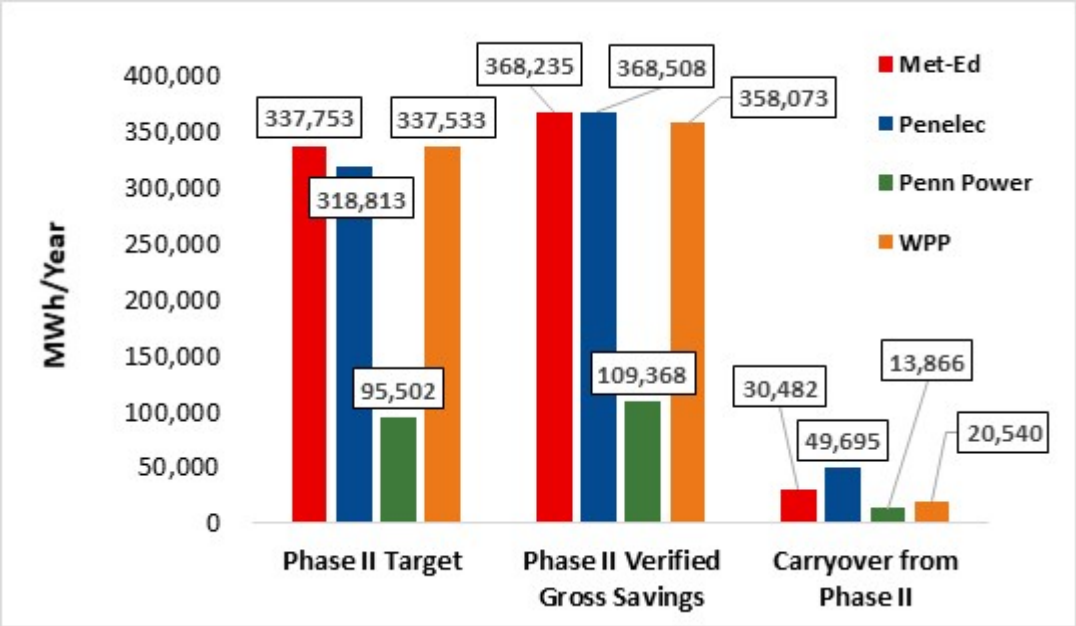
2.1 Carryover Savings from Phase II of Act 129

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

Table 1: Carryover Savings from Phase II

FirstEnergy EDC	Phase II Carryover Savings (MWh/Year)
Met-Ed	30,482
Penelec	49,695
Penn Power	13,866
West Penn Power	20,540

Figure 1: Carryover Savings from Phase II of Act 129



The Commission's Phase III Implementation Order[2] also allowed EDCs to carry over savings in excess of the Phase II Government, Non-Profit, and Institutional (GNI) savings goal and excess savings from the Low-Income (LI) customer segment.[3] Figure 2 shows the calculation of

[2] Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program* Implementation Order, at Docket No. M-2014-2424864, (*Phase III Implementation Order*), entered June 11, 2015.
[3] Proportionate to those savings achieved by dedicated low-income programs in Phase III.

carryover savings for the low-income targets, and Figure 3 shows the calculation of carryover savings for the GNI targets.

Figure 2: Low-Income Carryover from Phase II

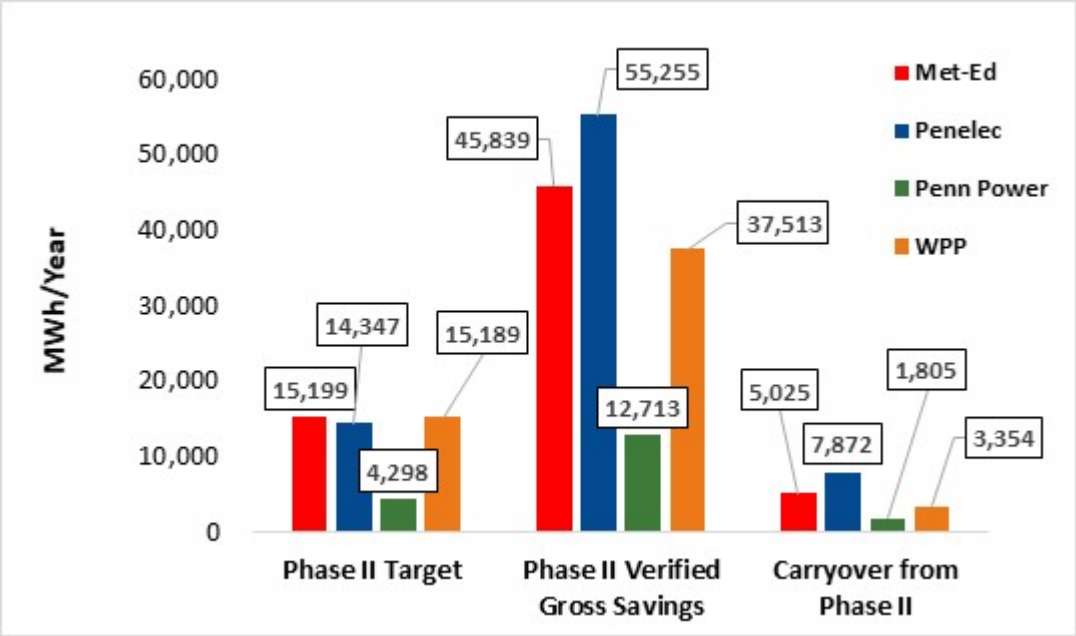
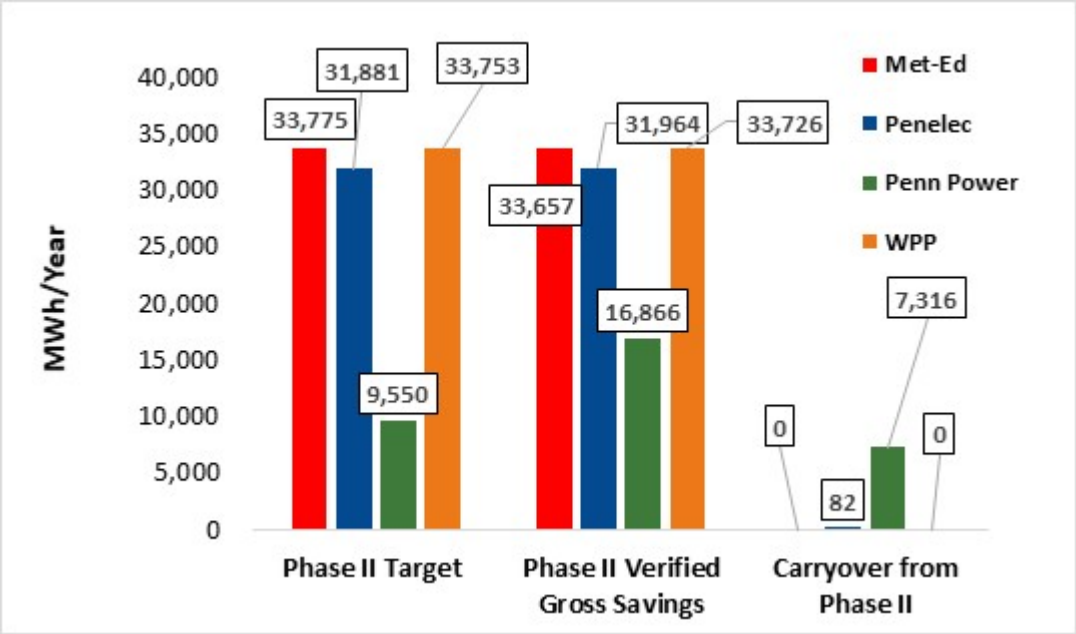


Figure 3: GNI Carryover from Phase II



2.2 Phase III Energy Efficiency Achievements to Date

Since the beginning of Program Year 10 on June 1, 2018, the four FirstEnergy PA EDCs reported and verified gross electric energy savings and gross peak demand savings are shown in Table 2 below.

Table 2: Gross Reported and Verified Electric and Demand Savings for PY10

EDC	PYRTD MWh	PYRTD MW	PYVTD MWh	PYVTD MW
Met-Ed	166,339	23	184,080	24
Penelec	170,893	21	190,594	22
Penn Power	52,733	7	57,717	8
West Penn Power	141,982	20	145,540	19

Since the beginning of Program Year 8 on June 1, 2016, 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 III of Act 129

EDC	RTD MWh	RTD MW	VTD MWh	VTD MW
Met-Ed	459,058	62	500,620	66
Penelec	446,194	56	477,681	57
Penn Power	140,804	19	152,201	20
West Penn Power	444,250	60	472,366	59

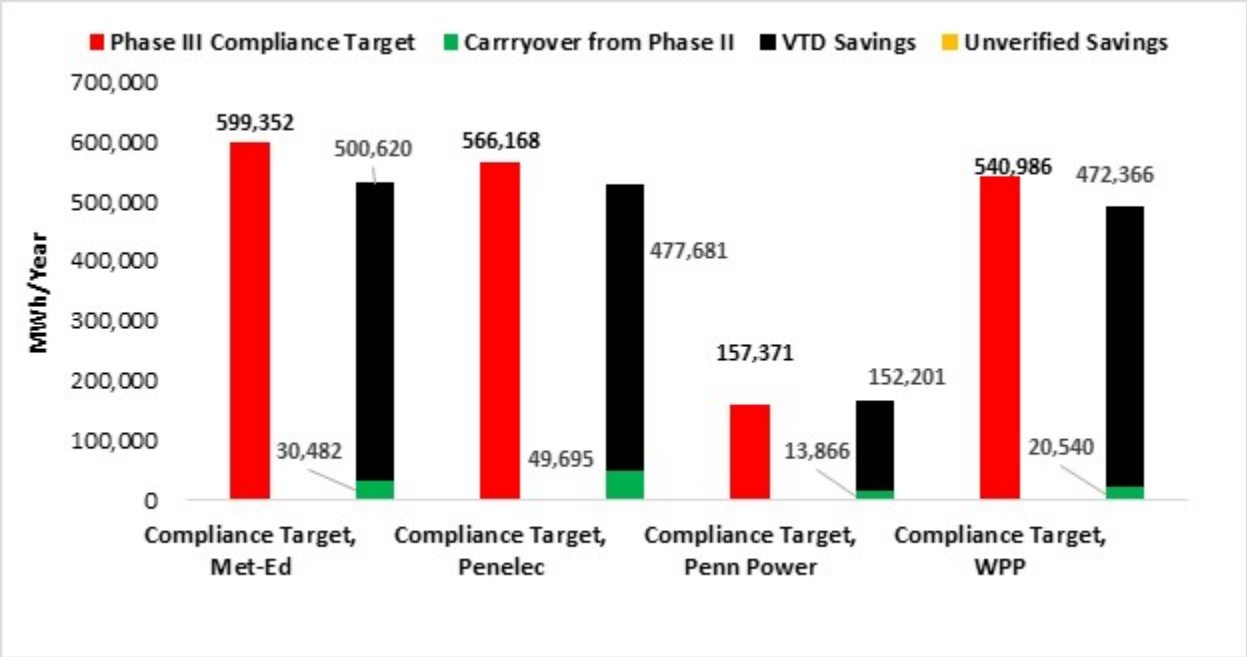
Achievements toward Phase III Energy Savings compliance, including carryover savings from Phase II, are shown in Table 4 below for the four PA EDCs.

Table 4: Phase III Electric Savings including Phase II Carryover

EDC	VTD +CO MWh	Compliance Target	Percent of Target to Date
Met-Ed	531,102	599,352	89%
Penelec	527,376	566,168	93%
Penn Power	166,067	157,371	106%
West Penn Power	492,906	540,986	91%

Figure 4 summarizes progress towards the Phase III portfolio compliance targets for each of the four EDCs.

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



The Phase III Implementation Order directed EDCs to offer conservation measures to the low-income customer segment based on the proportion of electric sales attributable to low-income households. The proportionate number of measures targets for the EDCs are listed in the second column of Table 5. The 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 Measures Available	% Measures Offered
Met-Ed	9%	158	59	37%
Penelec	10%	158	59	37%
Penn Power	11%	158	59	37%
West Penn Power	9%	158	59	37%

The PA PUC also established a low-income energy savings target of 5.5% 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-

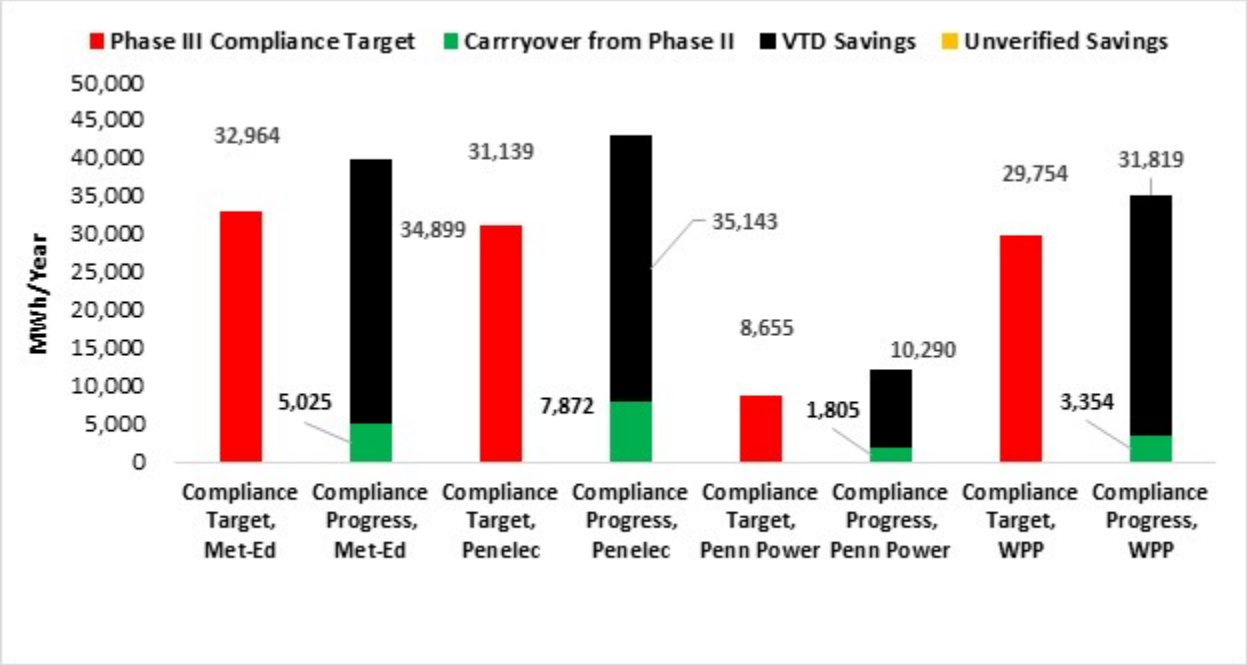
income impacts, inclusive of Phase II carryover. The percentages of the Phase III low-income energy savings targets achieved to date are shown in the last column of the table.

Table 6: Low-Income Program Energy Savings and Targets

EDC	Compliance Target	LI VTD +CO MWh	Percent of Target to Date
Met-Ed	32,964	39,924	121%
Penelec	31,139	43,015	138%
Penn Power	8,655	12,096	140%
West Penn Power	29,754	35,173	118%

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

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



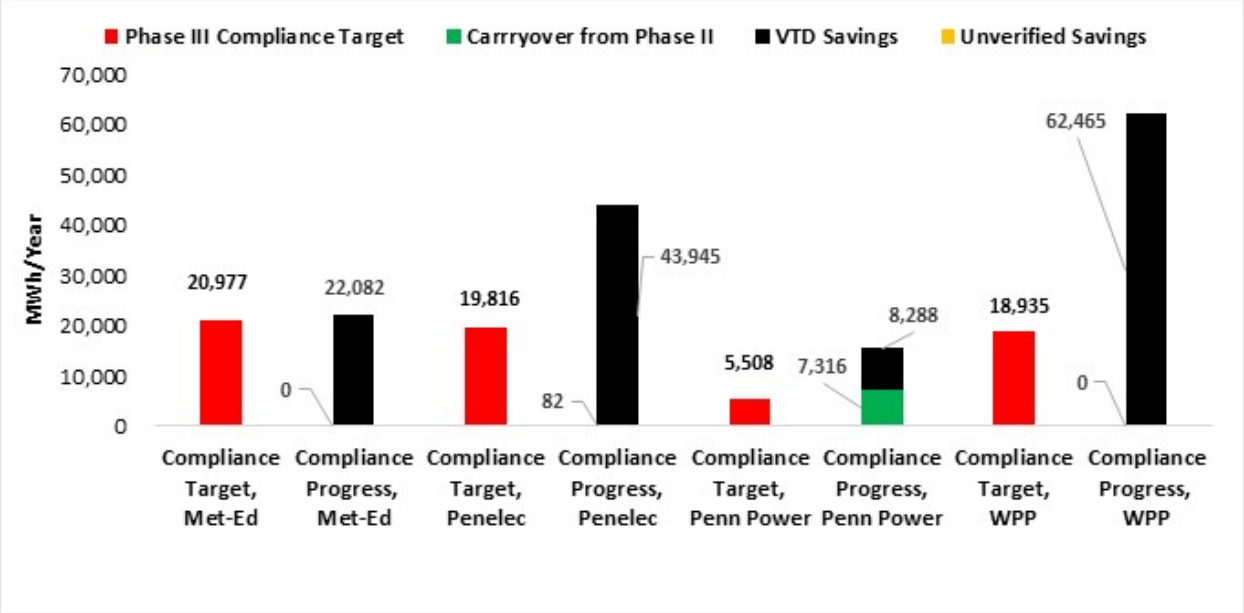
The Phase III Implementation Order established a GNI energy savings target of 3.5% of the portfolio savings goal. The second column of Table 7 shows the GNI savings targets, based on verified gross savings, for each EDC. The third column of the table shows the verified low-income impacts, inclusive of Phase II carryover. The percentages of the Phase III GNI energy savings targets achieved to date are shown in the last column of the table.

Table 7: GNI Savings and Targets

EDC	Compliance Target	GNI VTD +CO MWh	Percent of Target to Date
Met-Ed	20,977	22,082	105%
Penelec	19,816	44,027	222%
Penn Power	5,508	15,605	283%
West Penn Power	18,935	62,465	330%

Figure 6 compares the VTD performance for the GNI customer segment to the Phase III savings target.

Figure 6: EE&C Plan Performance against Phase III GNI Compliance Target



2.3 Phase III Demand Response Achievements to Date

The Phase III demand response performance targets are 49 MW for Met-Ed, 17 MW for Penn Power, and 64 MW for West Penn Power. Penelec does not have DR targets in Phase III. Compliance targets for demand response programs are based on average performance across events for the entire phase, beginning with PY9 and were established at the system level, which means the load reductions measured at the customer meter must be escalated to reflect transmission and distribution losses.

Act 129 demand response events are triggered by PJM's day-ahead load forecast. When the day-ahead forecast is above 96% of the peak load forecast for the year, a demand response event is initiated for the following day. In PY10, there were 6 demand response events called. Table 8 lists the days that DR events were called, along with verified gross demand reductions achieved by each EDC and program for PY10. Table 8 also lists the average DR performance for PY10 and for Phase III to date. The FirstEnergy EDCs' DR performance to date, with

consideration of the measurement confidence intervals reflecting the uncertainty of average values, is 9% above, 203% above, and 115% above the Phase III compliance reduction targets for Met-Ed, Penn Power and West Penn Power respectively. Without consideration of measurement confidence intervals around the average values, the EDC's average DR performance is 5% above, 147% above, and 87% above the Phase III compliance reduction target for Met-Ed, Penn Power and West Penn Power respectively.

Met-Ed's demand response achievement to date demonstrates compliance with Act 129 target, as the confidence interval associated with measurements exceeds the Act 129 target value. The 49.1 – 53.5 MW confidence interval of the measurement exceeds the 49.0 MW target.

Penn Power's demand response achievement to date demonstrates compliance with Act 129 target, as the confidence interval associated with measurements exceeds the Act 129 target value. The 31.3 – 52.6 MW confidence interval of the measurement exceeds the 17.0 MW target.

West Penn Power's demand response achievement to date demonstrates compliance with Act 129 target, as the confidence interval associated with measurements exceeds the Act 129 target value. The 137.5 – 101.8 MW confidence interval of the measurement exceeds the 64.0 MW target.

Table 8: PY10 Demand Response PYVTD Performance by Event

EDC	Event Date	Start Hour	End Hour	Small C&I Load Curtailment	Large C&I Load Curtailment	BDR	Average Portfolio MW Impact
Met-Ed	7/2/2018	15	18	6.0 ± 0.8	51.9 ± 4.3	6.3 ± 1.8	64.3 ± 4.8
	7/3/2018	15	18	6.7 ± 0.9	51.1 ± 4.3	3.4 ± 1.8	61.2 ± 4.7
	8/6/2018	15	18	6.3 ± 0.8	39.2 ± 3.7	4.4 ± 1.7	49.9 ± 4.2
	8/28/2018	15	18	4.9 ± 0.9	44.2 ± 3.5	8.1 ± 1.7	57.2 ± 4.0
	9/4/2018	15	18	3.8 ± 0.7	35.1 ± 3.5	7.8 ± 1.7	46.7 ± 3.9
	9/5/2018	15	18	2.6 ± 0.4	35.1 ± 3.4	7.1 ± 1.7	44.8 ± 3.8
	PYVTD - Average PY10 DR Event Performance						54.0 ± 2.7
	VTD - Average Phase III DR Event Performance						**51.3 ± 2.2**
Penn Power	7/2/2018	15	18	0.0 ± 0.0	50.7 ± 20.1	2.6 ± 0.6	53.3 ± 20.1
	7/3/2018	15	18	0.0 ± 0.0	31.8 ± 18.5	1.4 ± 0.6	33.2 ± 18.5
	8/6/2018	15	18	0.0 ± 0.0	54.9 ± 21.9	1.9 ± 0.6	56.8 ± 21.9
	8/28/2018	15	18	0.0 ± 0.0	43.1 ± 18.2	1.9 ± 0.6	45.0 ± 18.2
	9/4/2018	15	18	0.0 ± 0.0	56.9 ± 21.9	2.7 ± 0.6	59.6 ± 21.9
	9/5/2018	15	18	0.0 ± 0.0	26.7 ± 12.6	2.3 ± 0.5	29.1 ± 12.6
	PYVTD - Average PY10 DR Event Performance						46.1 ± 12.8
	VTD - Average Phase III DR Event Performance						**41.9 ± 10.6**
West Penn Power	7/2/2018	15	18	1.1 ± 0.2	145.2 ± 30.3	4.0 ± 0.9	150.3 ± 30.3
	7/3/2018	15	18	1.1 ± 0.2	132.5 ± 30.2	2.2 ± 0.9	135.7 ± 30.2
	8/6/2018	15	18	1.2 ± 0.2	152.6 ± 32.9	3.3 ± 0.9	157.0 ± 32.9
	8/28/2018	15	18	1.2 ± 0.2	127.0 ± 33.6	2.8 ± 0.9	131.0 ± 33.6
	9/4/2018	15	18	1.2 ± 0.2	122.9 ± 33.3	3.5 ± 0.9	127.6 ± 33.3
	9/5/2018	15	18	1.1 ± 0.2	125.6 ± 33.5	2.6 ± 0.9	129.3 ± 33.6
	PYVTD - Average PY10 DR Event Performance						138.5 ± 21.7
	VTD - Average Phase III DR Event Performance						**119.6 ± 17.9**

The Commission's Phase III Implementation Order also established a requirement that EDCs achieve at least 85% of the Phase III demand reduction target in each DR event. For each DR event, this translates to a 41.7 MW minimum for Met-Ed, a 14.5 MW minimum for Penn Power, and a 54.4 MW minimum for West Penn Power. Penelec does not have DR targets in Phase III. Figure 7, Figure 8, and Figure 9 compare the performances of each of the DR events in PY10 to the event-specific minimum and average targets for Met-Ed, Penn Power, and West Penn Power respectively.

Figure 7: Met-Ed Event Performance Compared to 85% Per-Event Target

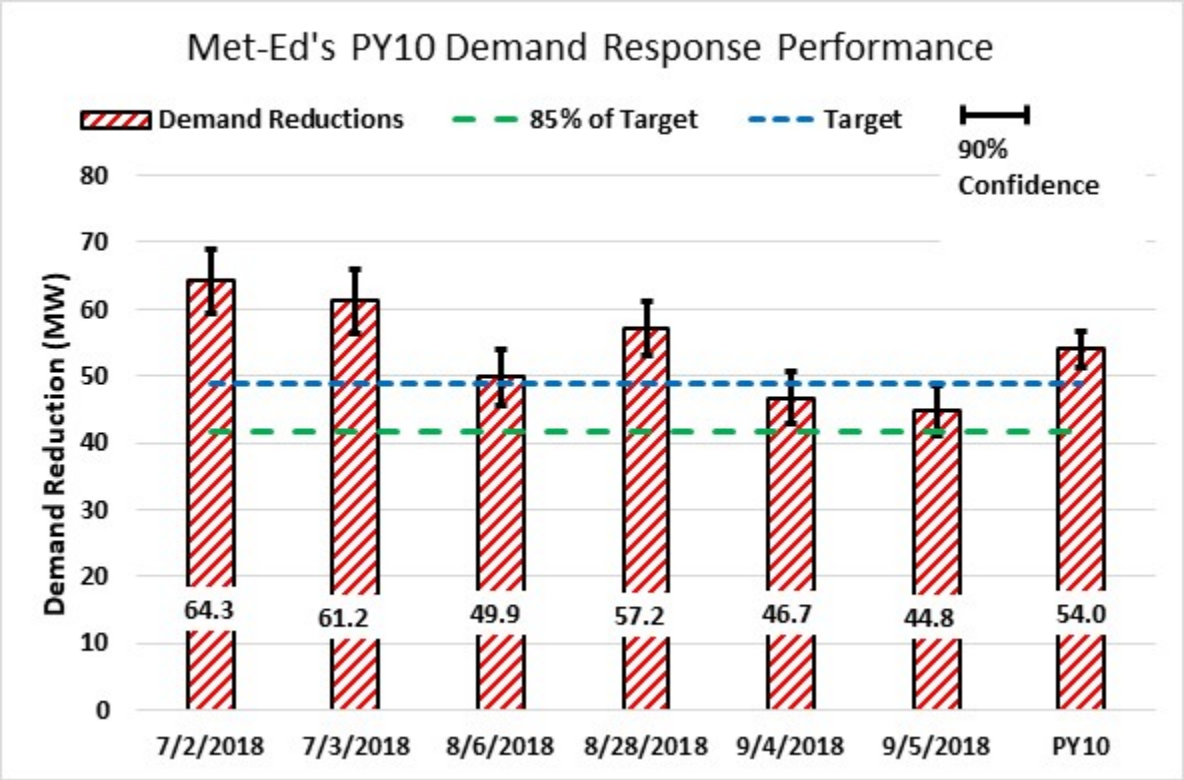


Figure 8: Penn Power Event Performance Compared to 85% Per-Event Target

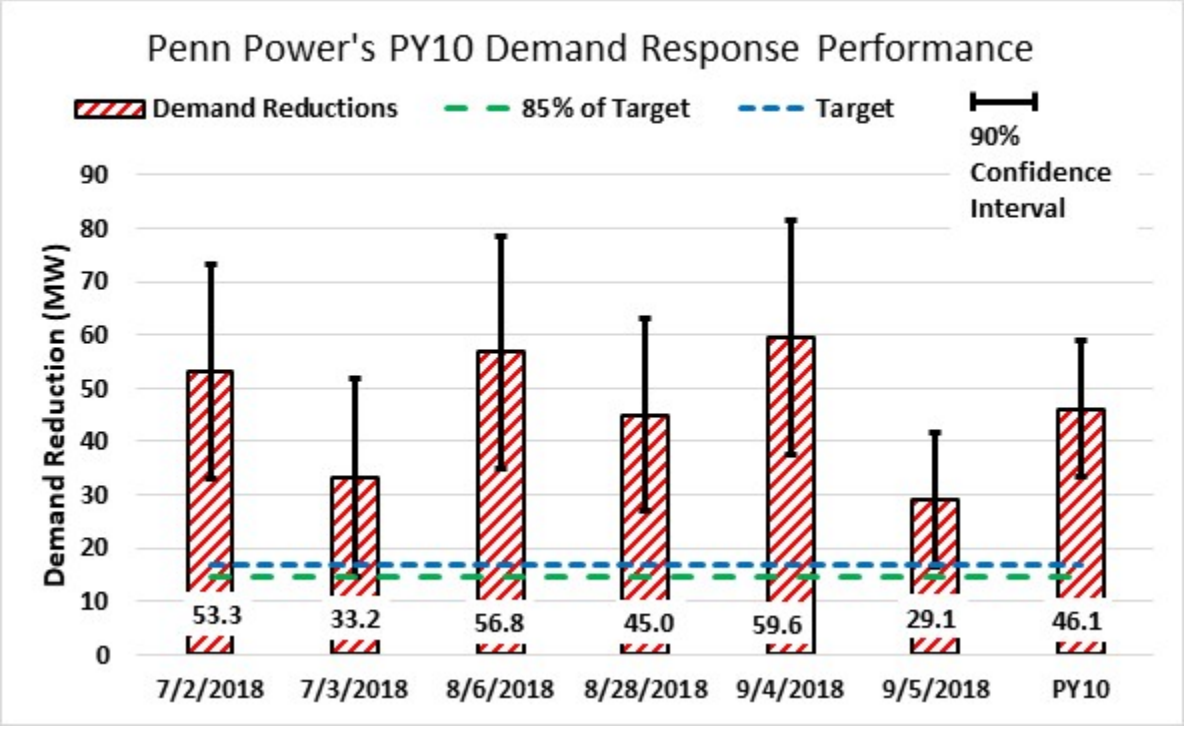
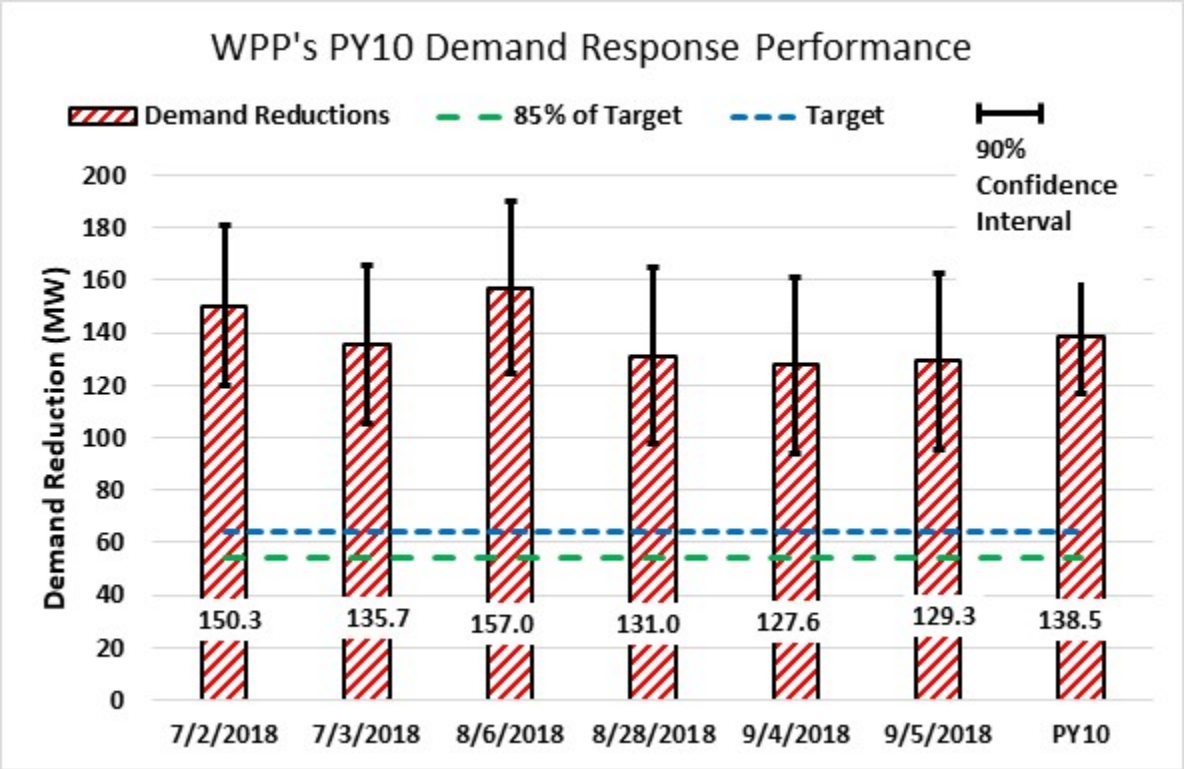


Figure 9: WPP Event Performance Compared to 85% Per-Event Target



2.4 PHASE III PERFORMANCE BY CUSTOMER SEGMENT

Table 9 presents the participation, savings, and spending by customer sector for PY10. The residential, Small C&I, 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 classes. The savings, spending, and participation values for the LI and GNI segments have been removed from the parent sectors in Table 9. The values in Table 9 and Table 10 below also reflect adjustments related to cross sector sales of upstream lighting. Participant counts, incentive amounts, and reported impacts were removed from the parent (residential) sector, and allocated to Small C&I and GNI sectors, to reflect cross-sector sales adjustments to reported data for the Energy Efficient Products Program in Table 87, Table 88, Table 89, and Table 90 of Section 3.3.1.

Please note that the Companies' acquisition costs through Phase III PY10 have been heavily influenced by results to date significantly exceeding plan projections in lower cost programs (e.g. lighting, EE kits, behavioral). The Companies' anticipate that their acquisition costs will increase through the end of Phase III as participation among higher cost programs and measures increase to offset the reduction in lighting that will occur through the remainder of Phase III.

Table 9: Program Year 10 Summary Statistics by Customer Segment

EDC	Parameter	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI
Met-Ed	# participants	597,021	31,297	17,918	223	10,811
	PYRTD MWh/yr	85,282	11,093	25,248	36,953	7,763
	PYRTD MW (Energy Efficiency)	11.84	1.39	3.84	4.54	0.92
	PYVTD MW (Demand Response)	6.19	0.00	2.25	35.96	9.61
	Incentives ($1000)	$6,424.07	$85.87	$1,138.94	$1,746.46	$393.57
Penelec	# participants	562,853	35,507	16,419	162	9,923
	PYRTD MWh/yr	75,665	10,924	26,387	31,299	26,618
	PYRTD MW (Energy Efficiency)	9.11	1.22	4.02	3.68	3.31
	PYVTD MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives ($1000)	$6,056.03	$103.01	$1,257.66	$1,453.96	$973.92
Penn Power	# participants	157,925	8,548	5,382	44	3,140
	PYRTD MWh/yr	25,960	3,418	13,165	8,145	2,045
	PYRTD MW (Energy Efficiency)	3.53	0.40	1.93	1.05	0.20
	PYVTD MW (Demand Response)	2.14	0.00	0.00	43.72	0.29
	Incentives ($1000)	$2,021.36	$32.74	$652.31	$798.78	$99.54
West Penn Power	# participants	512,507	30,270	14,927	158	9,099
	PYRTD MWh/yr	69,085	9,896	27,967	20,925	14,108
	PYRTD MW (Energy Efficiency)	11.07	1.31	3.90	2.07	1.54
	PYVTD MW (Demand Response)	3.06	0.00	1.16	134.27	0.03
	Incentives ($1000)	$3,996.26	$82.72	$1,369.06	$2,398.46	$632.02

Table 10 summarizes plan performance by sector since the beginning of Phase III.

Table 10: Phase III Summary Statistics by Customer Segment

EDC	Parameter	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI
Met-Ed	# participants	1,347,819	47,504	66,548	495	15,189
	PSA MWh/yr	242,207	30,481	75,550	90,199	20,622
	PSA MW (Energy Efficiency)	32.11	3.73	11.23	11.72	2.95
	Phase III MW (Demand Response)	6.19	0.00	4.14	75.18	14.45
	Incentives ($1000)	$16,760.31	$352.69	$4,042.71	$4,327.16	$1,130.02
Penelec	# participants	1,180,255	53,247	67,592	369	15,031
	PSA MWh/yr	215,605	31,603	69,024	85,400	44,562
	PSA MW (Energy Efficiency)	26.27	3.67	10.15	10.54	5.59
	Phase III MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives ($1000)	$14,514.17	$275.52	$3,985.43	$5,232.49	$2,301.55
Penn Power	# participants	296,541	14,875	17,617	109	4,517
	PSA MWh/yr	67,304	9,914	33,282	22,364	7,940
	PSA MW (Energy Efficiency)	9.43	1.24	4.87	2.67	0.83
	Phase III MW (Demand Response)	4.30	0.00	0.04	74.83	0.44
	Incentives ($1000)	$5,241.90	$133.99	$1,924.63	$2,030.19	$445.64
West Penn Power	# participants	1,100,374	42,661	62,974	322	13,892
	PSA MWh/yr	233,674	29,890	70,348	50,717	59,620
	PSA MW (Energy Efficiency)	34.75	3.96	9.82	6.21	5.44
	Phase III MW (Demand Response)	3.06	0.00	3.85	213.47	0.03
	Incentives ($1000)	$14,599.62	$280.32	$4,361.07	$5,354.30	$3,324.15

2.5 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 11 provides the current participation totals for PY10 and Phase III.

- For the Appliance Turn-In Program and the low-income Appliance Turn-In components of the 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 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 Upstream Lighting component of the Energy Efficient Products Program, the participant count is equal to the number of packs sold. This is approximately equal to number of bulbs divided by three.
- 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 rebates 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 Appliances rebated by the program. If a customer purchases multiple Appliances, then the customer counts as multiple participants. The majority of rebate applications however, are for a single appliance.
- 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 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.
- For the Commercial and Industrial Demand Response Programs, each unique utility premise is taken to be a unique participant.
- For the Behavioral Demand Response program component, the number of participants is taken as the maximum number of participants in the treatment group during the year.

Table 11: EE&C Portfolio Participation by Program

Utility	Program	PYTD Participation	P3TD Participation
Met-Ed	Appliance Turn-in	5,008	13,769
	Energy Efficient Homes	201,029	326,719
	Energy Efficient Products	418,961	1,087,300
	Low Income Energy Efficiency	31,297	47,504
	C&I Energy Solutions for Business - Small	574	1,346
	C&I Demand Response - Small	57	94
	C&I Energy Solutions for Business - Large	222	545
	C&I Demand Response - Large	76	143
	Governmental & Institutional Tariff	46	135
	Portfolio Total	**657,270**	**1,477,555**
Penelec	Appliance Turn-in	4,485	12,123
	Energy Efficient Homes	212,396	196,748
	Energy Efficient Products	371,152	1,050,876
	Low Income Energy Efficiency	35,507	53,247
	C&I Energy Solutions for Business - Small	947	2,296
	C&I Demand Response - Small	0	0
	C&I Energy Solutions for Business - Large	216	502
	C&I Demand Response - Large	0	0
	Governmental & Institutional Tariff	161	701
	Portfolio Total	**624,864**	**1,316,493**
Penn Power	Appliance Turn-in	1,641	4,336
	Energy Efficient Homes	40,980	21,743
	Energy Efficient Products	123,485	291,377
	Low Income Energy Efficiency	8,548	14,875
	C&I Energy Solutions for Business - Small	331	931
	C&I Demand Response - Small	0	3
	C&I Energy Solutions for Business - Large	44	111
	C&I Demand Response - Large	9	15
	Governmental & Institutional Tariff	1	268
	Portfolio Total	**175,039**	**333,659**
West Penn Power	Appliance Turn-in	5,682	15,842
	Energy Efficient Homes	174,170	121,031
	Energy Efficient Products	355,605	1,037,404
	Low Income Energy Efficiency	30,270	42,661
	C&I Energy Solutions for Business - Small	797	2,092
	C&I Demand Response - Small	14	33
	C&I Energy Solutions for Business - Large	166	360
	C&I Demand Response - Large	35	47
	Governmental & Institutional Tariff	222	752
	Portfolio Total	**566,961**	**1,220,222**

2.6 SUMMARY OF IMPACT EVALUATION RESULTS

During PY10 the ADM Tetra Tech team completed gross impact evaluations for all the energy efficiency programs in the portfolio, and net impact evaluations for many program components as described in this report. Table 12 and Table 13 summarize the realization rates and net-to-gross ratios by program. Initiative-level evaluation detail is available in the Appendices to this report.

Table 12: Impact Evaluation Results Summary for Met-Ed and Penelec

Program/ Initiative	Met-Ed			Penelec		
	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio
Appliance Turn-In	98.3%	97.9%	45.0%	94.7%	94.6%	47.0%
Energy Efficient Homes	108.2%	90.3%	91.0%	108.2%	96.9%	88.2%
Energy Efficient Products	141.3%	148.5%	31.8%	139.2%	145.0%	33.1%
Low Income Program	119.3%	110.5%	100.0%	109.1%	105.1%	100.0%
C&I Solutions for Business Program - Small	98.8%	99.2%	63.2%	108.2%	92.2%	75.2%
C&I Solutions for Business Program - Large	99.1%	99.1%	62.7%	102.6%	88.9%	80.4%
Government and Insitutional Tariff Program	98.7%	100.7%	64.1%	109.4%	95.4%	75.8%

Table 13: Impact Evaluation Results Summary for Penn Power and WPP

Program/ Initiative	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
Appliance Turn-In	91.6%	91.7%	51.0%	99.5%	98.2%	48.0%
Energy Efficient Homes	110.1%	100.1%	89.7%	86.0%	61.7%	96.0%
Energy Efficient Products	138.8%	147.3%	28.4%	141.2%	142.0%	27.2%
Low Income Program	103.9%	105.1%	100.0%	105.5%	94.1%	100.0%
C&I Solutions for Business Program - Small	94.6%	92.1%	75.4%	91.6%	91.3%	65.2%
C&I Solutions for Business Program - Large	97.7%	90.7%	72.9%	90.9%	87.7%	65.9%
Government and Insitutional Tariff Program	93.3%	92.4%	77.1%	92.3%	93.5%	66.8%

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. Most programs, and particularly high impact measures (HIMs), were evaluated for net-to-gross in PY8. Only the appliance turn-in HIM was evaluated for net-to-gross in PY10, with results nearly identical to those in PY8. Table 14 and Table 15 present net-to-gross findings for HIMs studied in PY8, PY9, and PY10, as applied to the PY10 program populations.

Table 14: 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
Res Appliance Turn-In	55.0%	0.0%	45.0%	53.0%	0.0%	47.0%
Res Upstream Lighting	71.0%	0.0%	29.0%	69.0%	0.0%	31.0%
Res EE Kits	21.2%	3.1%	82.0%	20.1%	3.2%	83.1%
C&I Lighting	36.6%	0.7%	64.1%	27.5%	3.3%	75.8%
C&I Custom	46.1%	0.0%	53.9%	14.2%	0.4%	86.2%

Table 15: 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
Res Appliance Turn-In	49.0%	0.0%	51.0%	52.0%	0.0%	48.0%
Res Upstream Lighting	74.0%	0.0%	26.0%	77.0%	0.0%	23.0%
Res EE Kits	20.2%	2.2%	82.0%	20.7%	9.6%	89.0%
C&I Lighting	24.0%	1.0%	77.1%	33.8%	0.6%	66.8%
C&I Custom	39.7%	0.0%	60.3%	42.9%	0.0%	57.1%

2.7 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 2.7.1. Lifetime energy savings incorporate the Effective Useful Life (EUL) of installed measures and estimate the total energy savings associated with EE&C program activity. Lifetime savings are used in the TRC test, by program participants when assessing the economics of upgrades, and by the SWE when calculating the emissions benefits of Act 129 programs. Section 2.7.2 presents the lifetime energy savings by program.

2.7.1 Incremental Annual Energy Savings by Program

Figure 10, Figure 11, Figure 12, and Figure 13 present summaries of the PYTD energy savings by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Program Year 10. The energy impacts in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. The verified gross savings are adjusted by energy realization rates and the verified net savings are adjustments by both the gross realization rates and the net-to-gross ratios.

Figure 10: PYTD Energy Savings by Program for Met-Ed

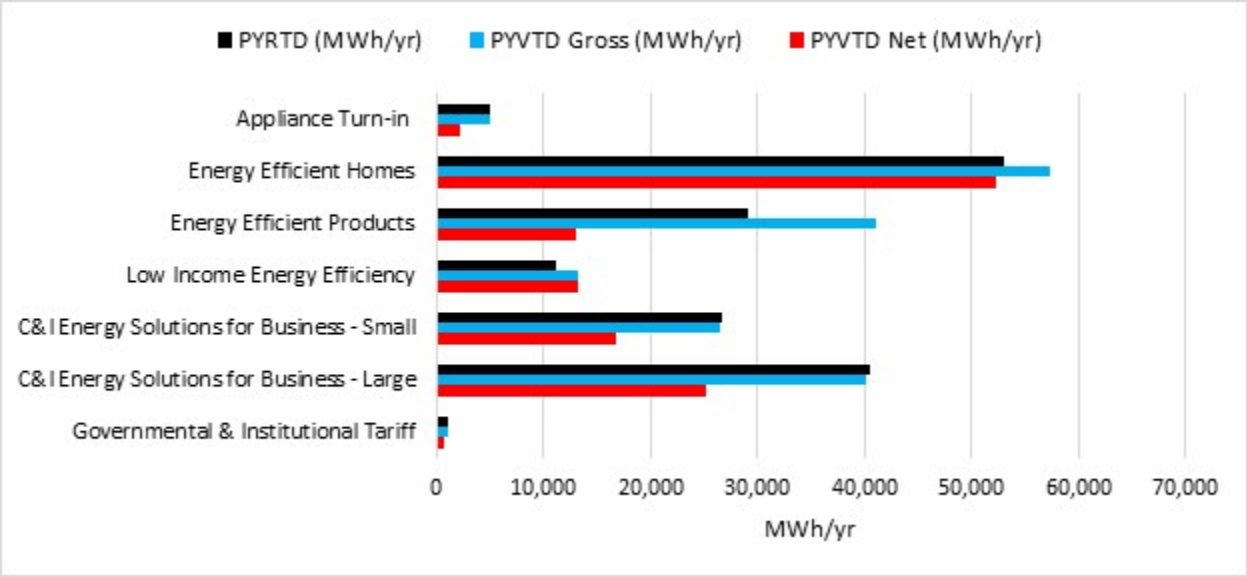


Figure 11: PYTD Energy Savings by Program for Penelec

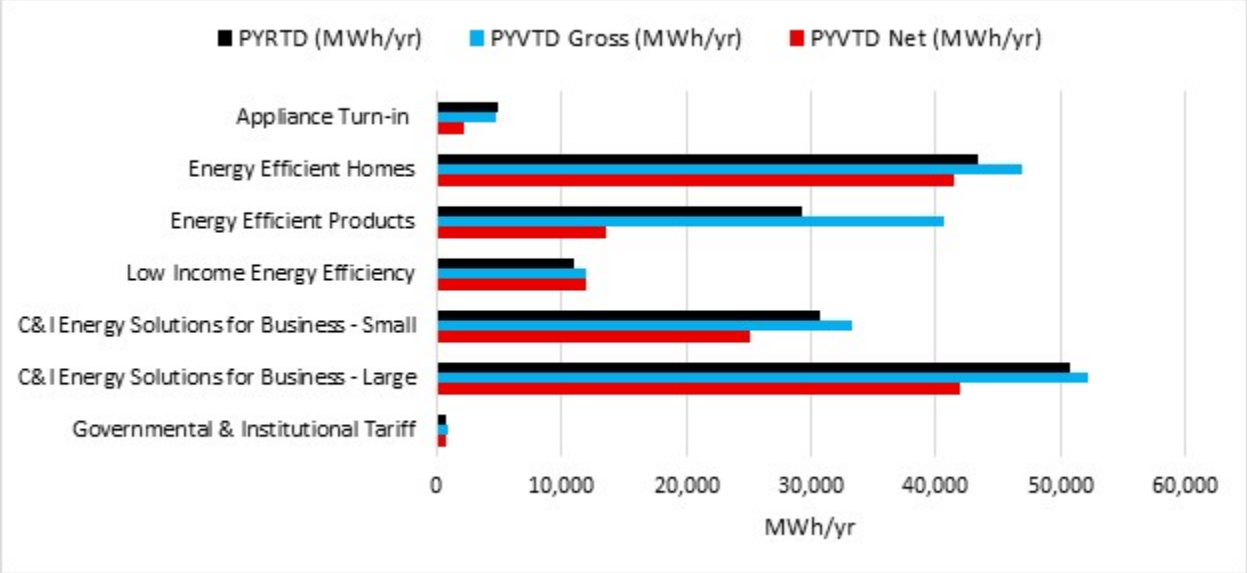


Figure 12: PYTD Energy Savings by Program for Penn Power

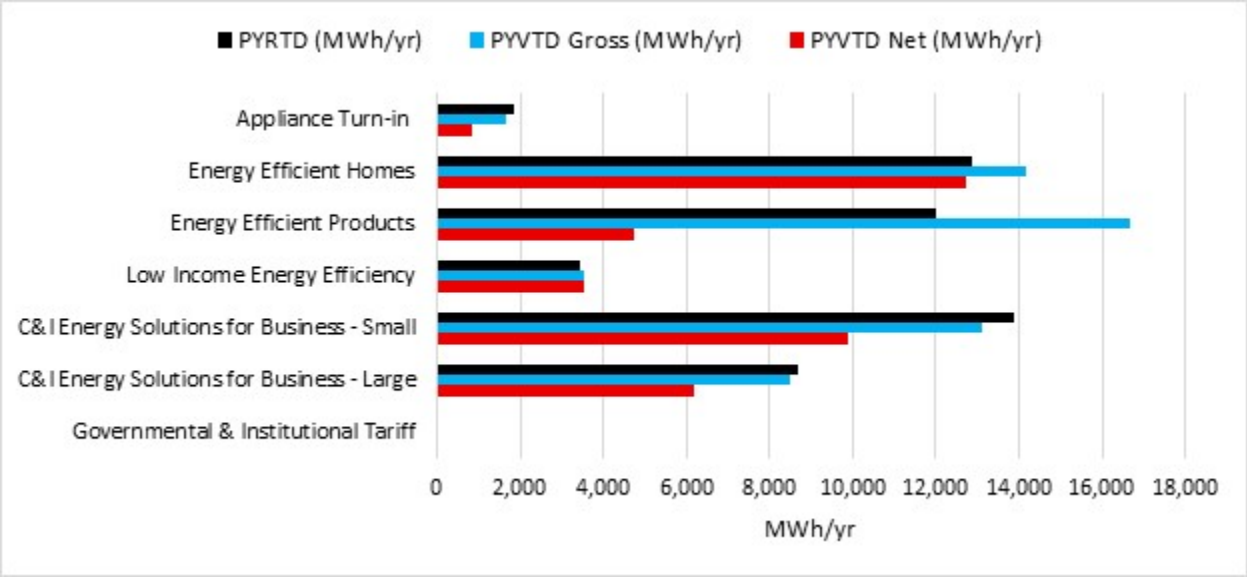


Figure 13: PYTD Energy Savings by Program for WPP

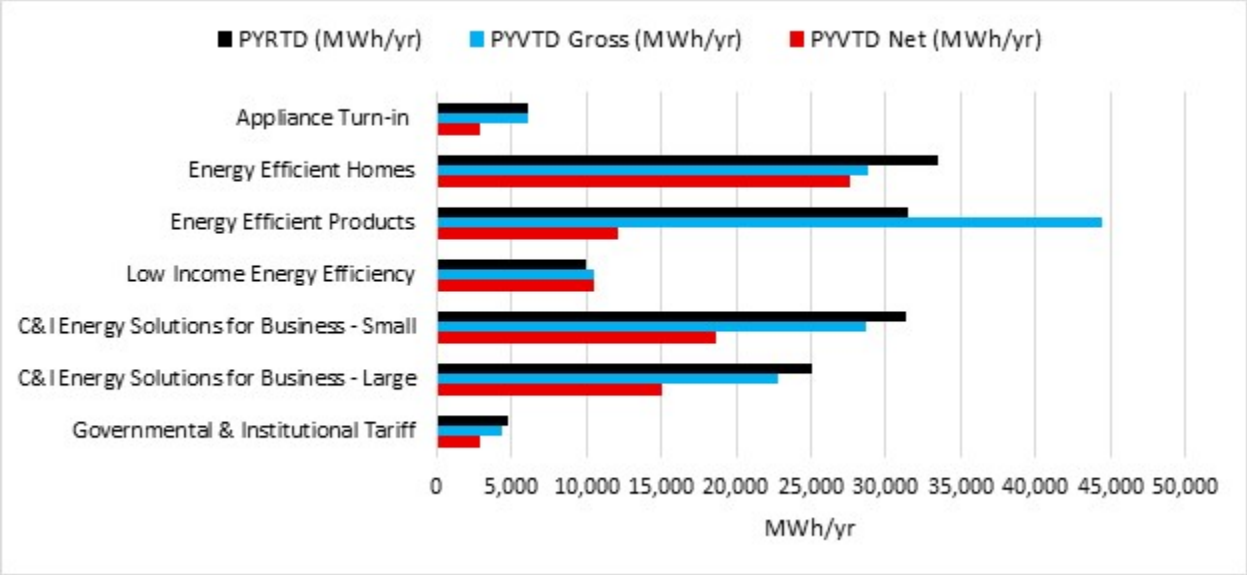


Figure 14, Figure 15, Figure 16, and Figure 17 present summaries of the energy savings by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Phase III of Act 129.

Figure 14: P3TD Energy Savings by Program for Met-Ed

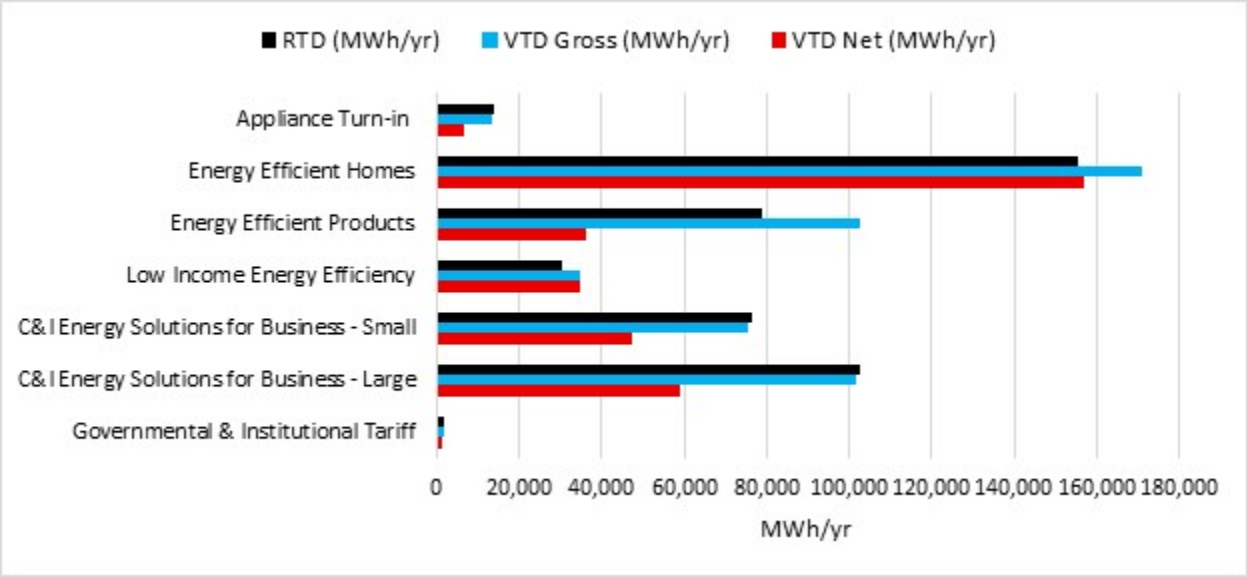


Figure 15: P3TD Energy Savings by Program for Penelec

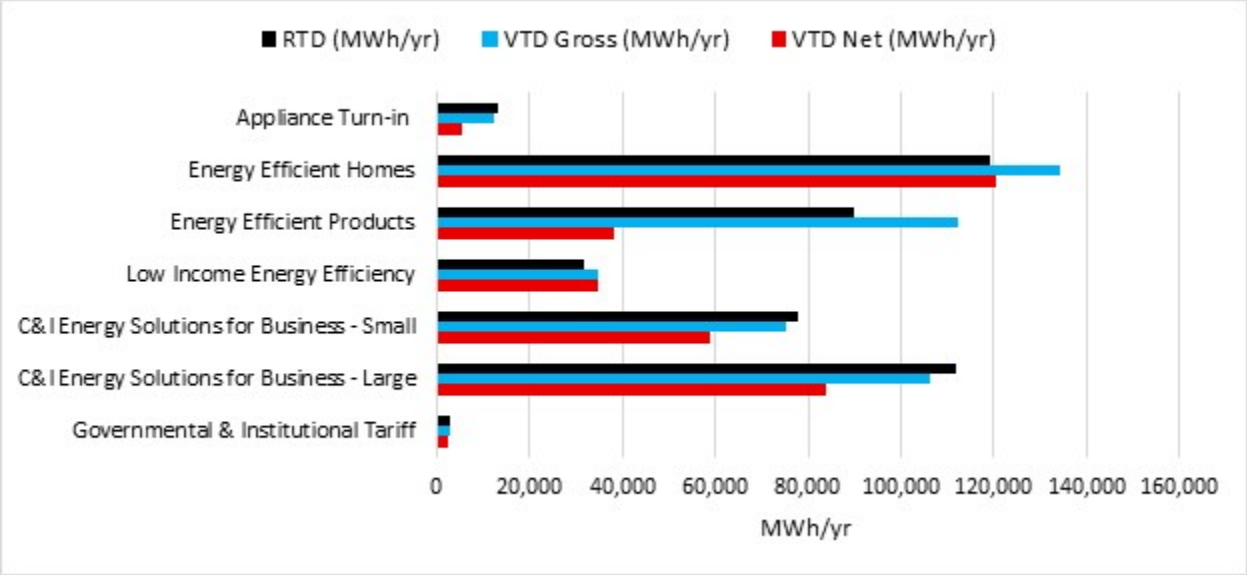


Figure 16: P3TD Energy Savings by Program for Penn Power

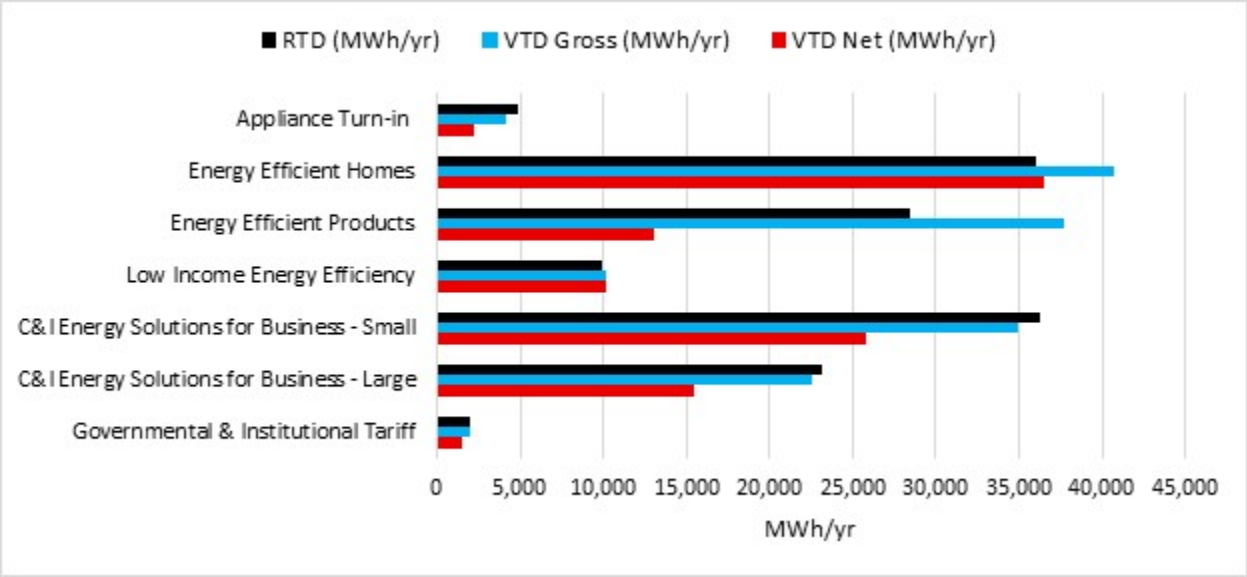
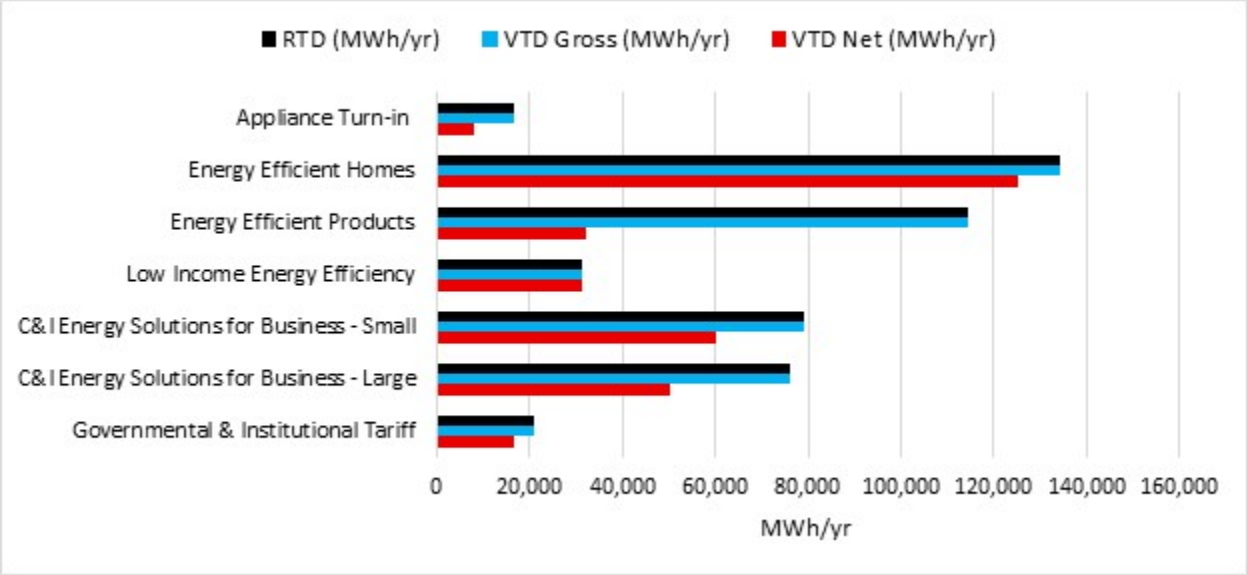


Figure 17: P3TD Energy Savings by Program for WPP



Summaries of energy impacts by program through PY10 are presented in Table 16, Table 17, Table 18, and Table 19 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 16: 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)
Appliance Turn-in	5,041	4,956	2,230	13,859	13,562	6,487
Energy Efficient Homes	52,988	57,355	52,203	155,353	171,171	156,970
Energy Efficient Products	29,061	41,050	13,035	78,603	102,598	36,342
Low Income Energy Efficiency	11,093	13,231	13,231	30,481	34,754	34,754
C&I Energy Solutions for Business - Small	26,697	26,386	16,681	76,158	75,279	47,184
C&I Energy Solutions for Business - Large	40,492	40,147	25,160	102,745	101,423	59,042
Governmental & Institutional Tariff	967	954	611	1,859	1,832	1,173
Portfolio Total	**166,339**	**184,080**	**123,151**	**459,058**	**500,620**	**341,952**

Table 17: 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)
Appliance Turn-in	4,940	4,677	2,198	13,331	12,385	5,599
Energy Efficient Homes	43,349	46,916	41,377	119,153	134,113	120,532
Energy Efficient Products	29,264	40,726	13,486	89,813	112,143	38,194
Low Income Energy Efficiency	10,924	11,917	11,917	31,603	34,838	34,838
C&I Energy Solutions for Business - Small	30,784	33,323	25,067	77,753	75,366	58,885
C&I Energy Solutions for Business - Large	50,833	52,161	41,937	111,736	106,175	83,796
Governmental & Institutional Tariff	800	875	663	2,804	2,661	2,164
Portfolio Total	**170,893**	**190,594**	**136,644**	**446,194**	**477,681**	**344,007**

Table 18: 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)
Appliance Turn-in	1,837	1,683	858	4,820	4,102	2,181
Energy Efficient Homes	12,878	14,173	12,719	36,062	40,739	36,480
Energy Efficient Products	12,021	16,683	4,736	28,473	37,724	13,058
Low Income Energy Efficiency	3,418	3,552	3,552	9,914	10,110	10,110
C&I Energy Solutions for Business - Small	13,871	13,121	9,893	36,303	34,994	25,747
C&I Energy Solutions for Business - Large	8,705	8,503	6,200	23,200	22,587	15,426
Governmental & Institutional Tariff	2	2	2	2,032	1,945	1,463
Portfolio Total	**52,733**	**57,717**	**37,959**	**140,804**	**152,201**	**104,465**

Table 19: 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)
Appliance Turn-in	6,068	6,038	2,898	16,951	16,423	7,921
Energy Efficient Homes	33,459	28,790	27,627	133,180	134,090	125,094
Energy Efficient Products	31,495	44,483	12,083	89,895	114,484	32,044
Low Income Energy Efficiency	9,896	10,441	10,441	29,890	31,382	31,382
C&I Energy Solutions for Business - Small	31,273	28,645	18,664	77,361	78,957	59,949
C&I Energy Solutions for Business - Large	25,104	22,816	15,037	77,372	76,251	50,069
Governmental & Institutional Tariff	4,687	4,326	2,890	19,602	20,779	16,573
Portfolio Total	**141,982**	**145,540**	**89,639**	**444,250**	**472,366**	**323,031**

The previously reported VTD savings from prior years, for the following programs, have changed since the PY9 final annual report was submitted:

Energy Efficient Products – SWE audit activities recommended an adjustment of -55 MWh/year, -62 MWh/year, and -44 MWh/year to the gross verified savings for Met-Ed, Penelec, and West Penn Power respectively because impacts for one specific package or rebated lamps were calculated with an incorrect pack size. The adjustments were also carried through for net verified impacts, and amounted to -20 MWh, -21 MWh, and -12 MWh for Met Ed, Penelec, and West Penn Power respectively.

2.7.2 Lifetime Energy Savings by Program

Table 20, Table 21, Table 22, and Table 23 present the PYTD and P3TD 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[4], and in part to maintain consistency between verified impacts, measure lives, and incremental costs for all sampled projects. For the residential upstream lighting program, the measure life is reduced to replicate the effect of a dual-baseline benefits stream[5]. To develop the modified measured lives, we perform dual-baseline calculations for five archetypal lamps in the most common baseline wattage bins (72W, 53W, 53W, 29W, and 25W) and perform dual-baseline calculations with lower baseline wattages (23W, 18W, 15W, 9W, and 9W respectively) post 2020. The modified measure life is the product of the original measure life and the ratio of

[4] For example, a project may consist of various measures with different lifetimes can have different realization rates by measure.
[5] See also comments in Section 2.10.

the net-present value of delta-Watt-years for the dual-baseline stream to a single-baseline stream.

Table 20: 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)
Appliance Turn-in	38,703	17,416	74,553	34,983
Energy Efficient Homes	223,978	187,744	463,701	387,439
Energy Efficient Products	271,107	91,241	492,125	175,875
Low Income Energy Efficiency	77,022	77,022	136,520	136,520
C&I Energy Solutions for Business - Small	382,853	242,540	547,865	349,733
C&I Energy Solutions for Business - Large	582,345	365,637	1,015,672	601,447
Governmental & Institutional Tariff	14,022	8,982	17,630	11,374
Portfolio Total	**1,590,029**	**990,583**	**2,748,066**	**1,697,373**

Table 21: Lifetime Energy Savings by Program for Penelec

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Appliance Turn-in	36,603	17,203	70,526	32,469
Energy Efficient Homes	232,029	195,132	423,963	357,266
Energy Efficient Products	264,921	92,660	498,061	174,945
Low Income Energy Efficiency	82,259	82,259	145,707	145,707
C&I Energy Solutions for Business - Small	488,637	368,806	734,612	572,421
C&I Energy Solutions for Business - Large	766,935	616,155	972,187	773,881
Governmental & Institutional Tariff	12,987	9,845	24,743	19,802
Portfolio Total	**1,884,371**	**1,382,061**	**2,869,799**	**2,076,490**

Table 22: 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)
Appliance Turn-in	13,210	6,737	24,221	13,124
Energy Efficient Homes	64,225	52,822	131,508	106,764
Energy Efficient Products	107,602	32,318	202,882	70,219
Low Income Energy Efficiency	24,279	24,279	45,708	45,708
C&I Energy Solutions for Business - Small	194,585	147,074	315,581	234,407
C&I Energy Solutions for Business - Large	125,400	91,662	166,320	116,252
Governmental & Institutional Tariff	30	23	20,038	15,076
Portfolio Total	**529,329**	**354,915**	**906,258**	**601,550**

Table 23: Lifetime Energy Savings by Program for WPP

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Appliance Turn-in	47,492	22,796	93,291	46,154
Energy Efficient Homes	89,258	76,944	323,438	270,767
Energy Efficient Products	297,086	89,383	493,784	149,324
Low Income Energy Efficiency	68,164	68,164	122,086	122,086
C&I Energy Solutions for Business - Small	421,095	275,451	630,795	448,303
C&I Energy Solutions for Business - Large	337,933	223,058	476,643	328,233
Governmental & Institutional Tariff	64,804	43,293	146,098	110,654
Portfolio Total	**1,325,833**	**799,089**	**2,286,135**	**1,475,520**

The previously reported VTD lifetime savings from prior years, for the following programs, have changed since the PY9 final annual report was submitted:

Energy Efficient Products – SWE audit activities recommended an adjustment of -55 MWh/year, -62 MWh/year, and -44 MWh/year to the gross verified savings for Met-Ed, Penelec, and West Penn Power respectively because impacts for one specific package or rebated lamps were calculated with an incorrect pack size. The adjustments were also carried through for lifetime gross and net verified impacts, and amounted to -320 MWh Gross/-119 MWh Net, -367 MWh Gross/-124 MWh Net, and -201 MWh Gross/-53 MWh Net for the VTD lifetime impacts of Met Ed, Penelec, and West Penn Power respectively.

2.8 Summary of Demand Impacts by Program

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

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

2.8.1 Energy Efficiency

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. Unlike Phase I and Phase II Act 129 reporting, the peak demand impacts

from energy efficiency in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. Figure 18, Figure 19, Figure 20, and Figure 21 present summaries of the PYTD demand savings by energy efficiency program for Met-Ed, Penelec, Penn Power, and WPP respectively for Program Year 10.

Figure 18: PYTD Demand Savings by Energy Efficiency Program for Met-Ed

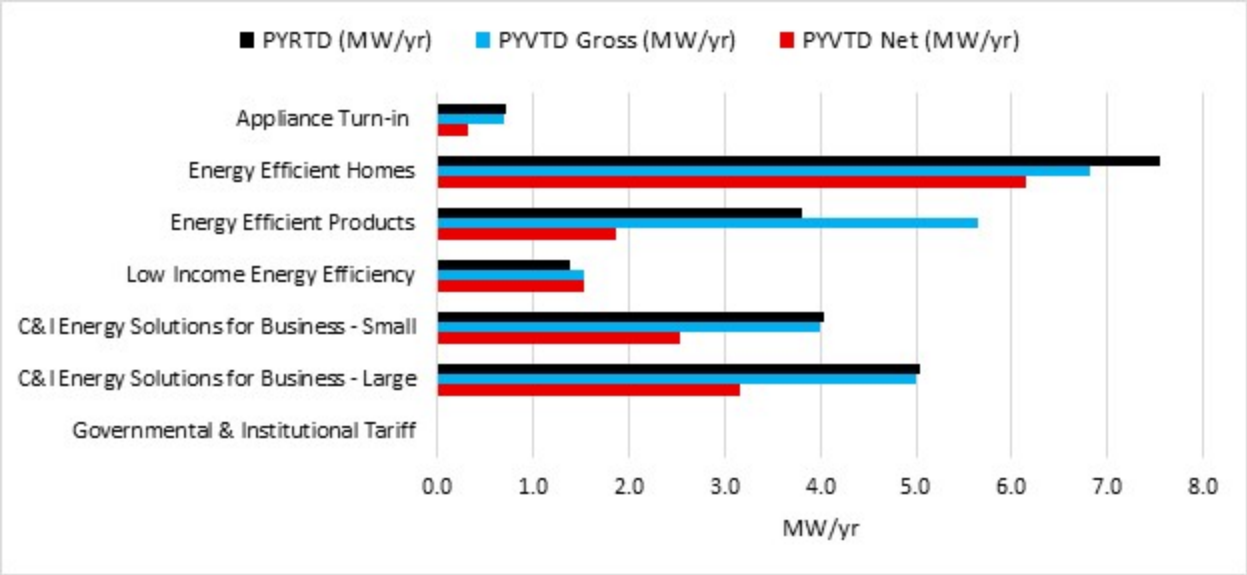


Figure 19: PYTD Demand Savings by Energy Efficiency Program for Penelec

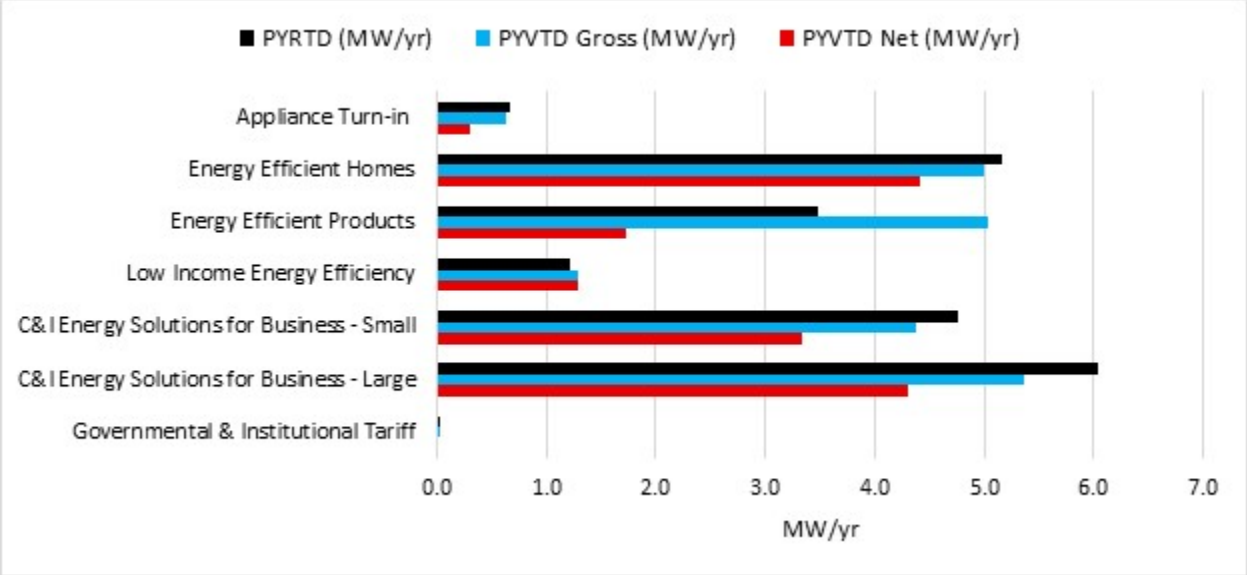


Figure 20: PYTD Demand Savings by Energy Efficiency Program for Penn Power

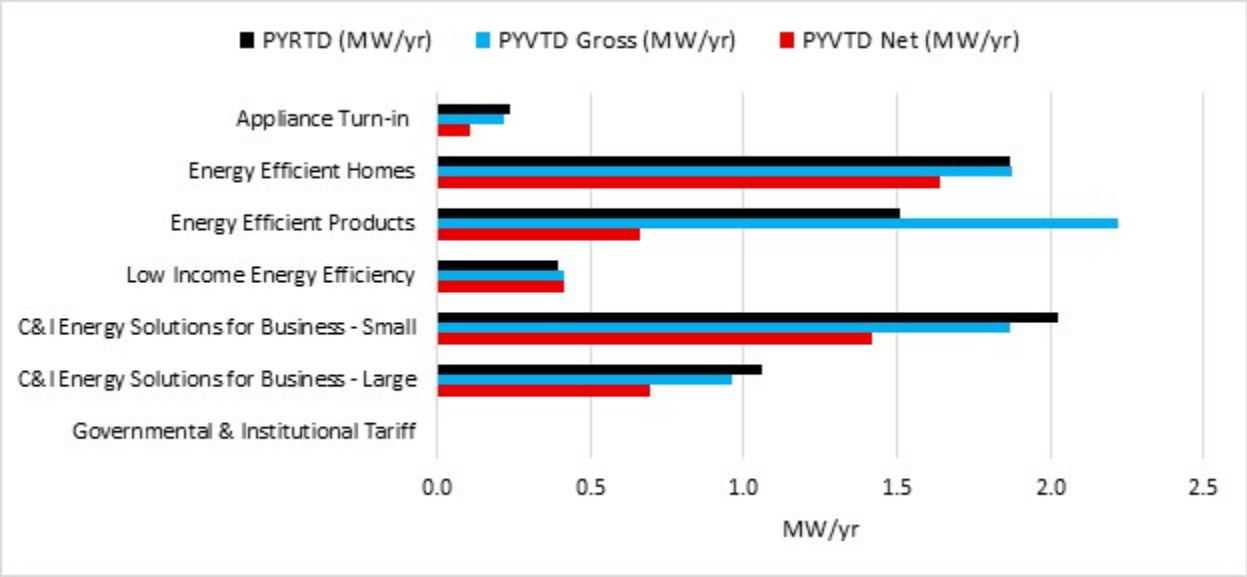


Figure 21: PYTD Demand Savings by Energy Efficiency Program for WPP

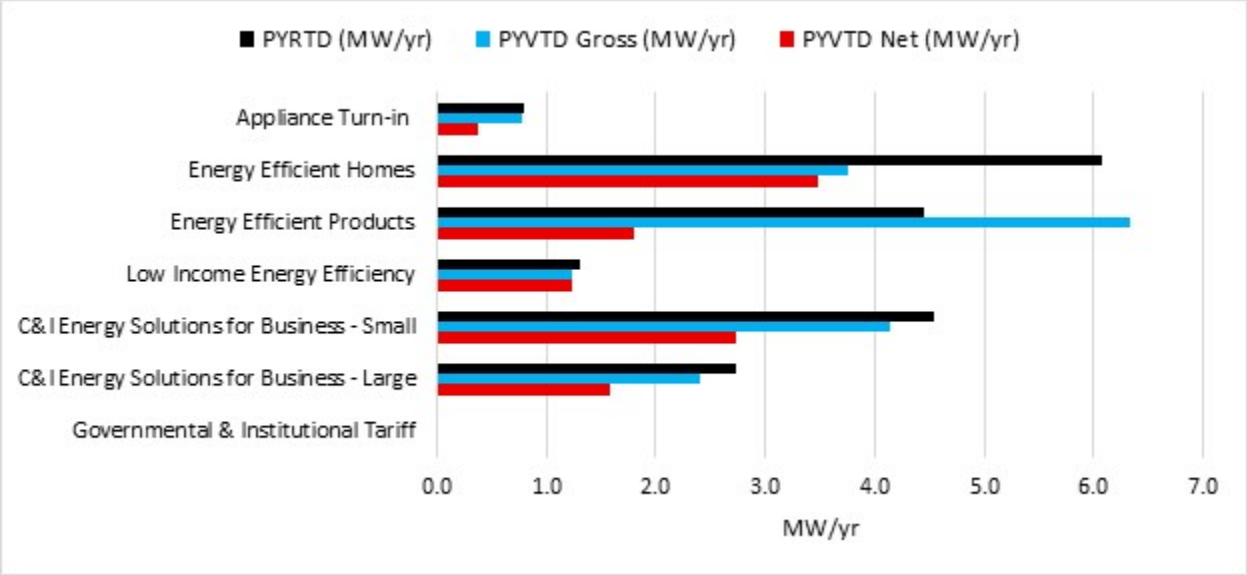


Figure 22, Figure 23, Figure 24, and Figure 25 present summaries of the P3TD demand savings by energy efficiency program for Met-Ed, Penelec, Penn Power, and WPP respectively for Phase III of Act 129.

Figure 22: P3TD Demand Savings by Energy Efficiency Program for Met-Ed

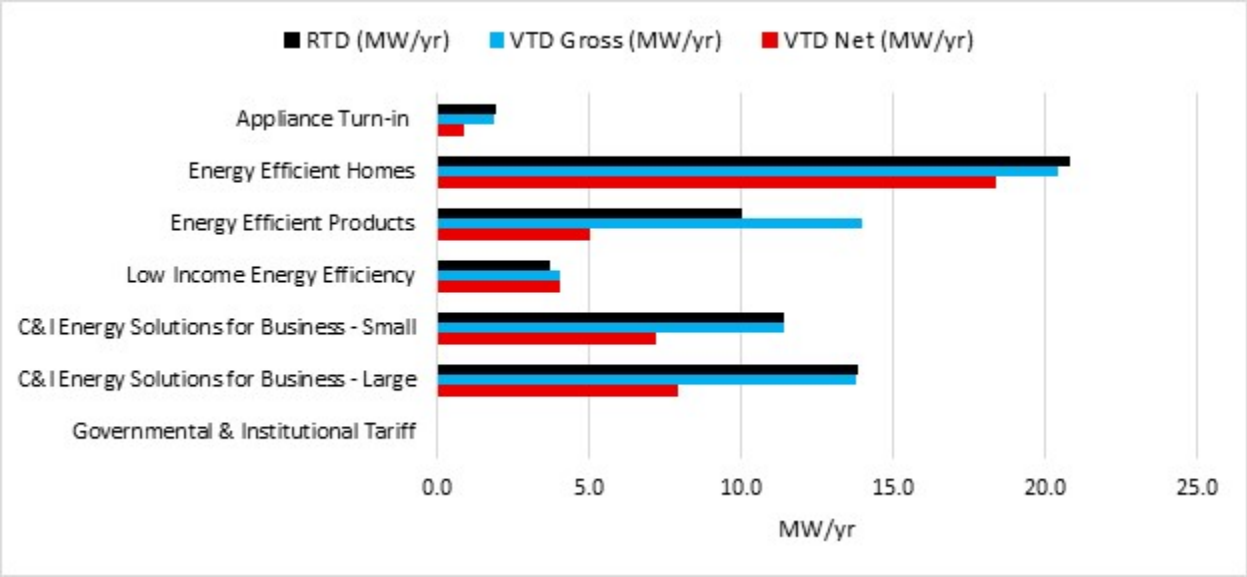


Figure 23: P3TD Demand Savings by Energy Efficiency Program for Penelec

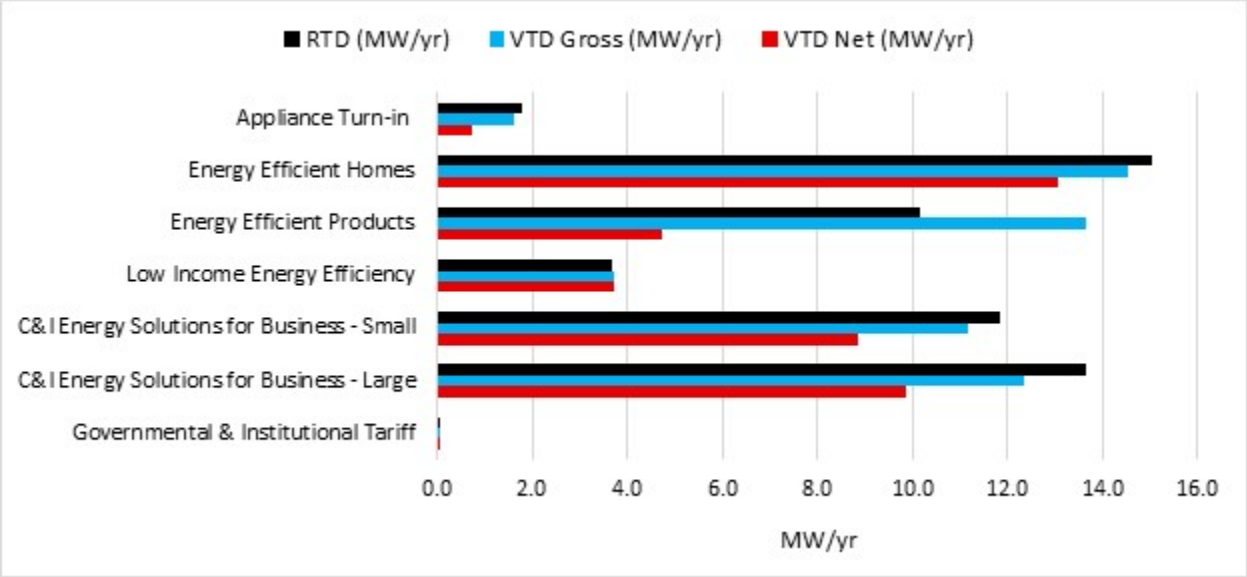


Figure 24: P3TD Demand Savings by Energy Efficiency Program for Penn Power

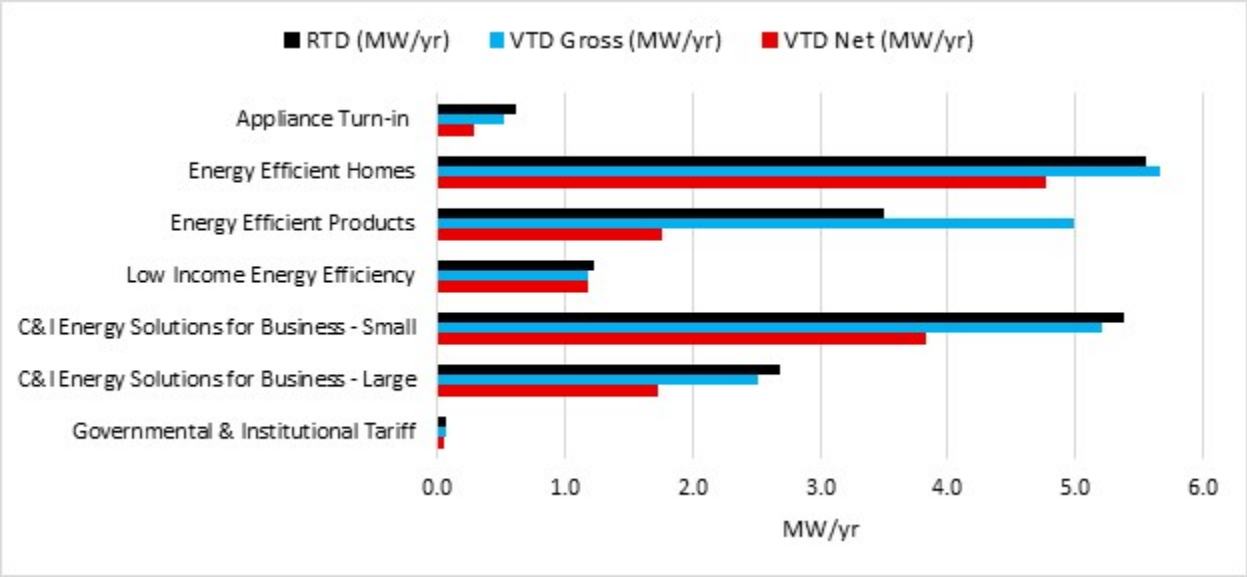
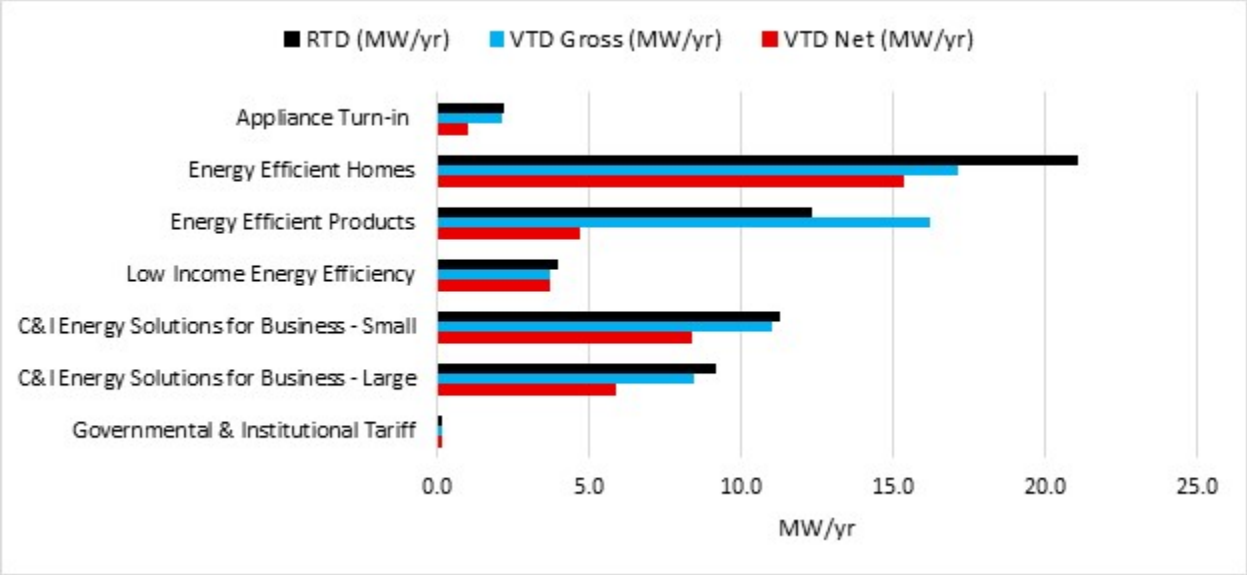


Figure 25: P3TD Demand Savings by Energy Efficiency Program for WPP



Summaries of the peak demand impacts by energy efficiency program through the current reporting period are presented in Table 24, Table 25, Table 26, and Table 27 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 24: 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)
Appliance Turn-in	0.72	0.70	0.32	1.95	1.86	0.89
Energy Efficient Homes	7.54	6.81	6.14	20.81	20.42	18.38
Energy Efficient Products	3.80	5.64	1.86	10.02	13.99	5.05
Low Income Energy Efficiency	1.39	1.53	1.53	3.73	4.02	4.02
C&I Energy Solutions for Business - Small	4.04	4.00	2.54	11.38	11.44	7.22
C&I Energy Solutions for Business - Large	5.04	5.00	3.16	13.84	13.76	7.93
Governmental & Institutional Tariff	0.01	0.01	0.00	0.02	0.02	0.01
Portfolio Total	22.53	23.69	15.55	61.75	65.51	43.50

Table 25: 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)
Appliance Turn-in	0.67	0.63	0.30	1.78	1.63	0.74
Energy Efficient Homes	5.16	5.00	4.41	15.04	14.54	13.06
Energy Efficient Products	3.48	5.04	1.72	10.15	13.66	4.73
Low Income Energy Efficiency	1.22	1.28	1.28	3.67	3.72	3.72
C&I Energy Solutions for Business - Small	4.76	4.38	3.34	11.86	11.16	8.88
C&I Energy Solutions for Business - Large	6.03	5.36	4.31	13.67	12.36	9.88
Governmental & Institutional Tariff	0.02	0.02	0.02	0.06	0.06	0.04
Portfolio Total	21.33	21.72	15.37	56.22	57.13	41.04

Table 26: 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)
Appliance Turn-in	0.24	0.22	0.11	0.62	0.53	0.28
Energy Efficient Homes	1.87	1.87	1.64	5.56	5.66	4.77
Energy Efficient Products	1.51	2.22	0.66	3.49	4.98	1.77
Low Income Energy Efficiency	0.40	0.42	0.42	1.24	1.18	1.18
C&I Energy Solutions for Business - Small	2.03	1.87	1.42	5.37	5.20	3.83
C&I Energy Solutions for Business - Large	1.06	0.96	0.69	2.69	2.51	1.72
Governmental & Institutional Tariff	0.00	0.00	0.00	0.06	0.07	0.05
Portfolio Total	7.10	7.56	4.94	19.03	20.13	13.61

Table 27: 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)
Appliance Turn-in	0.79	0.77	0.37	2.18	2.12	1.02
Energy Efficient Homes	6.07	3.74	3.49	21.07	17.12	15.37
Energy Efficient Products	4.45	6.32	1.79	12.32	16.19	4.68
Low Income Energy Efficiency	1.31	1.24	1.24	3.96	3.70	3.70
C&I Energy Solutions for Business - Small	4.53	4.14	2.74	11.27	11.01	8.39
C&I Energy Solutions for Business - Large	2.73	2.39	1.57	9.20	8.44	5.86
Governmental & Institutional Tariff	0.00	0.00	0.00	0.18	0.18	0.15
Portfolio Total	19.89	18.61	11.20	60.17	58.76	39.17

The previously reported VTD demand reductions from prior years, for the following programs, have changed since the PY9 final annual report was submitted:

Energy Efficient Products – SWE audit activities recommended an adjustment of -0.0070 MW/year, -0.0071 MW/year, and -0.0059 MW/year to the gross verified savings for Met-Ed, Penelec, and West Penn Power respectively because impacts for one specific package or rebated lamps were calculated with an incorrect pack size. The adjustments were also carried through for net verified impacts, and amounted to -0.0026 MW/year, -0.0024 MW/year, and -0.0016 MW/year for Met Ed, Penelec, and West Penn Power respectively.

2.8.2 Demand Response

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

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

The peak demand impacts from demand response in this report are presented at the system level and reflect adjustments to account for transmission and distribution losses. Table 28 lists the line loss multipliers by EDC and by sector. These values are taken from Table 1-4 of the 2016 PA TRM.

Table 28: 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

Table 29 summarizes the PYVTD and VTD demand reductions for each of the demand response programs in the EE&C plan and for the demand response portfolio as a whole. VTD demand reductions are the average performance across all Phase III demand response events independent of how many events occurred in a given program year. The relative precision columns in Table 29 indicate the margin of error (at the 90% confidence interval) around the PYVTD and VTD demand reductions.

Table 29: Verified Gross Demand Response Impacts by Program

EDC	Program	PYVTD Gross MW	Relative Precision	VTD Gross MW	Relative Precision
Met-Ed	Residential Behavioral Demand Response	6.2	11%	4.1	11%
Met-Ed	C&I Demand Response Program – Small	5.1	10%	4.3	8%
Met-Ed	C&I Demand Response Program – Large	42.8	6%	42.9	5%
Penn Power	Residential Behavioral Demand Response	2.1	11%	2.1	8%
Penn Power	C&I Demand Response Program – Small	0.0	0%	0.1	58%
Penn Power	C&I Demand Response Program – Large	44.0	29%	39.7	26%
WPP	Residential Behavioral Demand Response	3.1	12%	2.0	12%
WPP	C&I Demand Response Program – Small	1.2	11%	1.7	21%
WPP	C&I Demand Response Program – Large	134.3	16%	115.9	15%

2.9 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 III. Combined Heat and Power (CHP) and solar water heating are the only fuel switching measures offered by the Companies in Phase III. There was one rebate approved by Penelec for a CHP project in PY10.

Table 30: Phase III to Date Fuel Switching Summary

	Met-Ed	Penelec	Penn Power	WPP
Fuel Switching Measures Offered	CHP, Solar Water Heater			
Fuel Switching Measures Implemented	None	CHP	None	CHP
VTD Energy Savings Achieved via Fuel Switching (MWh/yr)	0	15,024	0	14,003
P3TD Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	0	55,178	0	4,779
P3TD Incentive Payments for Fuel Switching Measures ($1000)	0	575	0	420

2.10 Summary of Cost-Effectiveness Results

A detailed breakdown of portfolio finances and cost-effectiveness is presented in 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) PY10 costs and benefits are expressed in 2018 dollars. Net present value costs and benefits for P3TD financials are expressed in 2016 dollars.

Table 31: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)	
1	EDC Incentives to Participants [1]	9,789		24,842	
2	EDC Incentives to Trade Allies	0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	26,398		38,035	
4	**Incremental Measure Costs (Just row 3 for Appliance Recycling)**	35,899		62,088	
		EDC	CSP	EDC	CSP
5	Design & Development [2]	10	178	13	1,443
6	Administration, Management, and Technical Assistance [3]	755	2,672	2,022	7,448
7	Marketing [4]	43	1,236	117	3,134
8	Program Delivery [5]	209	5,528	640	15,457
9	EDC Evaluation Costs	1,024		2,321	
10	SWE Audit Costs	256		960	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**11,911**		**33,554**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**47,810**		**110,172**	
14	Total NPV Lifetime Electric Energy Benefits	48,782		120,581	
15	Total NPV Lifetime Electric Capacity Benefits	17,074		44,981	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	7,953		14,569	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	1,713		177	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**75,522**		**180,309**	
19	**TRC Benefit-Cost Ratio [8]**	**1.58**		**1.64**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

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

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

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

* Rows 1-11 are presented in nominal dollars (PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020); P3TD = $2016

Table 32: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)	
1	EDC Incentives to Participants [1]	9,845		24,313	
2	EDC Incentives to Trade Allies	0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	32,384		40,579	
4	**Incremental Measure Costs (Just row 3 for Appliance Recycling)**	41,973		64,205	
		EDC	CSP	EDC	CSP
5	Design & Development [2]	10	90	12	1,304
6	Administration, Management, and Technical Assistance [3]	663	2,416	1,760	7,054
7	Marketing [4]	38	842	113	2,265
8	Program Delivery [5]	239	4,673	768	13,777
9	EDC Evaluation Costs	899		2,085	
10	SWE Audit Costs	232		870	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	10,103		30,007	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	2,785		2,443	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**54,862**		**119,737**	
14	Total NPV Lifetime Electric Energy Benefits	54,183		117,697	
15	Total NPV Lifetime Electric Capacity Benefits	12,407		34,155	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	7,767		15,692	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	1,388		-1,590	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**75,745**		**165,955**	
19	**TRC Benefit-Cost Ratio [8]**	**1.38**		**1.39**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars (PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020); P3TD = $2016

Table 33: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)	
1	EDC Incentives to Participants [1]	3,605		8,822	
2	EDC Incentives to Trade Allies	0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	8,869		10,608	
4	**Incremental Measure Costs (Just row 3 for Appliance Recycling)**	12,383		19,189	
		EDC	CSP	EDC	CSP
5	Design & Development [2]	3	44	4	388
6	Administration, Management, and Technical Assistance [3]	247	733	686	2,049
7	Marketing [4]	14	307	32	782
8	Program Delivery [5]	102	1,498	282	4,633
9	EDC Evaluation Costs	221		627	
10	SWE Audit Costs	72		270	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**3,242**		**9,753**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**15,625**		**37,454**	
14	Total NPV Lifetime Electric Energy Benefits	15,326		37,870	
15	Total NPV Lifetime Electric Capacity Benefits	7,406		16,645	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	2,656		5,026	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	816		-577	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**26,205**		**58,964**	
19	**TRC Benefit-Cost Ratio [8]**	**1.68**		**1.57**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars (PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020); P3TD = $2016

Table 34: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)	
1	EDC Incentives to Participants [1]	8,479		23,984	
2	EDC Incentives to Trade Allies	0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	21,980		30,593	
4	**Incremental Measure Costs (Just row 3 for Appliance Recycling)**	30,142		53,692	
		EDC	CSP	EDC	CSP
5	Design & Development [2]	13	205	15	1,559
6	Administration, Management, and Technical Assistance [3]	789	2,733	2,319	8,161
7	Marketing [4]	32	1,186	101	3,351
8	Program Delivery [5]	227	5,356	667	15,198
9	EDC Evaluation Costs	1,032		2,349	
10	SWE Audit Costs	240		900	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**11,814**		**34,620**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	233		204	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**42,189**		**124,699**	
14	Total NPV Lifetime Electric Energy Benefits	38,440		110,236	
15	Total NPV Lifetime Electric Capacity Benefits	19,831		47,090	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	6,079		13,745	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	48		-2,836	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**64,399**		**168,235**	
19	**TRC Benefit-Cost Ratio [8]**	**1.53**		**1.35**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars (PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020); P3TD = $2016

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. It is important to note that TRC costs are materially different from the EDC

spending and rate recovery tables presented later in the report. TRC costs include estimates of the full cost incurred by program participants to install efficient equipment, not just the portion covered by the EDC rebate. Table 36, Table 37, Table 38, and Table 39 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 PY10, cost and benefits are expressed in 2018 dollars.

The TRCs for residential lighting presented in this report reflect a dual baseline protocol for residential lighting measures consistent with the current TRM. The TRM specifies that "*calculations for bulbs expected to be installed or remain in use past 2020. For these bulbs, [post EISA 2007 baseline wattages] should be used for the savings calculations until 2020, followed by the [post 2020 baseline wattages] for the remainder of the measure life."* The Companies note that since the TRM was adopted in 2015, there is growing uncertainty about the likelihood of DOE enforcement of EISA 2020 standard changes as well as the availability of pre 2020 baseline bulbs in the market. This has resulted in most states not adopting the prospective change in standards in cost effectiveness calculations, resulting in higher lifetime savings and benefits.

If TRCs were to not use the dual baselines, gross and net TRCs for the Energy Efficient Products program would increase by 50% and 44%, portfolio gross TRCs would increase by 5 to 10% and portfolio net TRCs would increase by 4.6%, as averaged over all four FirstEnergy EDCs. Gross and Net TRCs for the Portfolio with and without dual baseline treatment are presented in the following table:

Table 35 – Portfolio TRC with and without Dual Baseline Calculations

	Gross		Net	
EDC	Dual Baseline	Without Dual Baseline	Dual Baseline	Without Dual Baseline
Met-Ed	1.58	2.05	1.40	1.47
Penelec	1.38	1.42	1.30	1.35
Penn Power	1.68	1.65	1.52	1.59
WPP	1.53	1.40	1.35	1.41
Average	1.54	1.63	1.39	1.46

The Companies believe that the TRC values for the Demand Response Programs may be overstated due to data sources and calculation methodology associated with cost effectiveness reporting of DR programs for Act 129. There are several reasons for the apparent high TRC values. One reason is that startup costs have been incurred in previous years and are not reflected in PY10. This by itself does not bias TRC results in any way, but TRC measurements in PY10-12 do not reflect startup costs incurred in the first two years of the Phase.

Using annual capacity prices instead of summer-only capacity prices, assuming 100% of the DR event savings equate to 100% avoided capacity, and including transmission and distribution

avoided costs in the cost effectiveness determination of DR programs for Act 129 are several other reasons for the artificially high TRC values.

As in prior reports, the Companies present rational, alternative cost-effectiveness calculations that yield more realistic TRC ratios.

First, the TRC Order specifies, for Demand Response, the that *"All peak demand reduction values would be multiplied by the avoided cost of generation capacity ($/kW-year for the Annual Product Type) for the delivery year as set by PJM's Base Residual Auction."* The Companies abide by the TRC order, but note that in 2018, PJM clearing prices are available for multiple Capacity Products: a) Base DR/EE (Summer-Only) Resources; b) Base Generation Resources; and c) Annual Resources. The Summer-Only value is approximately 8% lower than other annual product values and the "most comparable" product to the Summer-Only Act 129 DR Program. The reported TRC for the Companies' DR programs would be similarly lower if the difference in valuation between year-round and summer-only resources were considered.

Second is that in 2017, 2018, and 2019, Act 129 DR events in PY10 occurred on three of five critical peak days, as defined by PJM. It is reasonable to prorate DR program benefits by a factor of 3/5, given that the DR program had no impact on two of five PJM critical peak days. This would reduce the average DR TRC by 40%.

Third, Avoided Transmission and Distribution (T&D) prices comprise 20% to 41% of total avoided costs associated with demand response in PY10, depending on customer sector. The Companies have previously recommended, and continue to recommend the exclusion of all avoided T&D costs from cost effectiveness tests for demand response because the Phase III Act 129 DR Program is solely targeting PJM's peak load periods for Capacity or Generation and does not provide the necessary benefits needed to avoid costs on the T&D systems. If T&D benefits were to be excluded, the average TRC for Large C&I DR programs offered by the three Companies in PY10 would decrease by 20%, while the TRC for residential and Small C&I customers would decrease by 41%.

The combination of these alternative calculations would reduce TRC by 56% to 67% for Large C&I and residential/Small C&I customers respectively. In addition, there is evidence that larger customers manage loads or peak shave on high load days to reduce peak load share costs in subsequent years. While ADM has not performed an assessment of net-to-gross for the program, this would further reduce TRC. The Companies formally report the higher TRC values following Commission directives for the DR programs but continue to offer these alternative scenarios for consideration.

Table 36: PY10 Gross TRC Ratios by Program ($1,000) for Met-Ed[1]

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$1,636	$809	2.02	$827
Energy Efficient Homes	$16,850	$9,676	1.74	$7,174
Energy Efficient Products	$17,256	$10,237	1.69	$7,019
Low Income Energy Efficiency	$4,421	$3,687	1.20	$734
Residential Subtotal	**$40,164**	**$24,409**	**1.65**	**$15,755**
C&I Energy Solutions for Business - Small	$12,809	$8,792	1.46	$4,017
C&I Energy Solutions for Business - Large	$18,735	$12,936	1.45	$5,799
Governmental & Institutional Tariff	$353	$335	1.06	$19
C&I Demand Response Program – Small	$485	$116	4.20	$370
C&I Demand Response Program – Large	$2,976	$1,223	2.43	$1,752
Non-Residential Subtotal	**$35,358**	**$23,401**	**1.51**	**$11,957**
Portfolio Total	**$75,522**	**$47,810**	**1.58**	**$27,712**

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

Table 37: PY10 Gross TRC Ratios by Program ($1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$1,464	$751	1.95	$713
Energy Efficient Homes	$16,065	$8,961	1.79	$7,104
Energy Efficient Products	$15,572	$9,290	1.68	$6,282
Low Income Energy Efficiency	$4,234	$3,653	1.16	$581
Residential Subtotal	**$37,334**	**$22,654**	**1.65**	**$14,681**
C&I Energy Solutions for Business - Small	$14,459	$11,327	1.28	$3,133
C&I Energy Solutions for Business - Large	$23,641	$20,530	1.15	$3,111
Governmental & Institutional Tariff	$310	$351	0.88	-$41
Non-Residential Subtotal	**$38,411**	**$32,208**	**1.19**	**$6,203**
Portfolio Total	**$75,745**	**$54,862**	**1.38**	**$20,884**

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

Table 38: PY10 Gross TRC Ratios by Program ($1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$529	$280	1.89	$249
Energy Efficient Homes	$5,099	$3,134	1.63	$1,965
Energy Efficient Products	$6,370	$3,130	2.04	$3,240
Low Income Energy Efficiency	$1,267	$979	1.29	$288
Residential Subtotal	**$13,264**	**$7,522**	**1.76**	**$5,742**
C&I Energy Solutions for Business - Small	$6,084	$4,372	1.39	$1,713
C&I Energy Solutions for Business - Large	$3,792	$3,075	1.23	$717
Governmental & Institutional Tariff	$1	$17	0.06	-$16
C&I Demand Response Program – Small	$0	$7	0.00	-$7
C&I Demand Response Program – Large	$3,063	$632	4.85	$2,431
Non-Residential Subtotal	**$12,941**	**$8,103**	**1.60**	**$4,837**
Portfolio Total	**$26,205**	**$15,625**	**1.68**	**$10,579**

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

Table 39: PY10 Gross TRC Ratios by Program ($1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$1,883	$873	2.16	$1,010
Energy Efficient Homes	$7,303	$6,604	1.11	$699
Energy Efficient Products	$17,575	$10,628	1.65	$6,947
Low Income Energy Efficiency	$3,618	$3,347	1.08	$271
Residential Subtotal	**$30,380**	**$21,453**	**1.42**	**$8,927**
C&I Energy Solutions for Business - Small	$13,092	$9,601	1.36	$3,490
C&I Energy Solutions for Business - Large	$9,978	$7,625	1.31	$2,353
Governmental & Institutional Tariff	$1,492	$1,185	1.26	$307
C&I Demand Response Program – Small	$110	$43	2.55	$67
C&I Demand Response Program – Large	$9,346	$2,282	4.10	$7,064
Non-Residential Subtotal	**$34,019**	**$20,737**	**1.64**	**$13,282**
Portfolio Total	**$64,399**	**$42,189**	**1.53**	**$22,209**

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

Table 40, Table 41, Table 42, and Table 43 present PY10 cost-effectiveness for Met-Ed, Penelec, Penn Power, and WPP respectively, using net verified savings to calculate benefits.

Table 40: PY10 Net TRC Ratios by Program ($1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$736	$809	0.91	-$73
Energy Efficient Homes	$14,042	$9,362	1.50	$4,680
Energy Efficient Products	$5,636	$4,584	1.23	$1,052
Low Income Energy Efficiency	$4,421	$3,687	1.20	$734
Residential Subtotal	**$24,835**	**$18,442**	**1.35**	**$6,393**
C&I Energy Solutions for Business - Small	$8,105	$6,017	1.35	$2,088
C&I Energy Solutions for Business - Large	$11,754	$8,639	1.36	$3,116
Governmental & Institutional Tariff	$226	$231	0.98	-$4
C&I Demand Response Program – Small	$485	$116	4.20	$370
C&I Demand Response Program – Large	$2,976	$1,223	2.43	$1,752
Non-Residential Subtotal	**$23,547**	**$16,226**	**1.45**	**$7,321**
Portfolio Total	**$48,382**	**$34,668**	**1.40**	**$13,715**
[1] Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020				

Table 41: PY10 Net TRC Ratios by Program ($1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$688	$751	0.92	-$63
Energy Efficient Homes	$13,464	$9,014	1.49	$4,450
Energy Efficient Products	$5,287	$4,503	1.17	$783
Low Income Energy Efficiency	$4,234	$3,653	1.16	$581
Residential Subtotal	**$23,672**	**$17,921**	**1.32**	**$5,752**
C&I Energy Solutions for Business - Small	$10,907	$8,902	1.23	$2,005
C&I Energy Solutions for Business - Large	$19,124	$14,542	1.32	$4,582
Governmental & Institutional Tariff	$235	$285	0.83	-$50
Non-Residential Subtotal	**$30,266**	**$23,729**	**1.28**	**$6,537**
Portfolio Total	**$53,939**	**$41,650**	**1.30**	**$12,289**
[1] Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020				

Table 42: PY10 Net TRC Ratios by Program ($1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$270	$280	0.96	-$10
Energy Efficient Homes	$4,147	$2,942	1.41	$1,204
Energy Efficient Products	$1,873	$1,350	1.39	$523
Low Income Energy Efficiency	$1,267	$979	1.29	$288
Residential Subtotal	**$7,557**	**$5,551**	**1.36**	**$2,005**
C&I Energy Solutions for Business - Small	$4,595	$3,382	1.36	$1,213
C&I Energy Solutions for Business - Large	$2,755	$2,271	1.21	$484
Governmental & Institutional Tariff	$1	$17	0.05	-$17
C&I Demand Response Program – Small	$0	$7	0.00	-$7
C&I Demand Response Program – Large	$3,063	$632	4.85	$2,431
Non-Residential Subtotal	**$10,414**	**$6,310**	**1.65**	**$4,104**
Portfolio Total	**$17,970**	**$11,861**	**1.52**	**$6,109**
[1] Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020				

Table 43: PY10 Net TRC Ratios by Program ($1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$904	$873	1.04	$31
Energy Efficient Homes	$6,185	$6,293	0.98	-$108
Energy Efficient Products	$5,008	$4,819	1.04	$189
Low Income Energy Efficiency	$3,618	$3,347	1.08	$271
Residential Subtotal	**$15,714**	**$15,332**	**1.02**	**$382**
C&I Energy Solutions for Business - Small	$8,562	$6,844	1.25	$1,717
C&I Energy Solutions for Business - Large	$6,551	$5,269	1.24	$1,281
Governmental & Institutional Tariff	$997	$818	1.22	$179
C&I Demand Response Program – Small	$110	$43	2.55	$67
C&I Demand Response Program – Large	$9,346	$2,282	4.10	$7,064
Non-Residential Subtotal	**$25,566**	**$15,257**	**1.68**	**$10,309**
Portfolio Total	**$41,280**	**$30,589**	**1.35**	**$10,691**
[1] Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020				

Table 44, Table 45, Table 46, and Table 47 summarize cost-effectiveness by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Phase III of Act 129. P3TD costs and benefits are expressed in 2016 dollars regardless of program or reporting year.

Table 44: P3TD Gross TRC Ratios by Program ($1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$4,342	$2,073	2.09	$2,269
Energy Efficient Homes	$38,947	$22,484	1.73	$16,464
Energy Efficient Products	$41,472	$23,578	1.76	$17,894
Low Income Energy Efficiency	$8,872	$9,998	0.89	-$1,126
Residential Subtotal	**$93,634**	**$58,133**	**1.61**	**$35,501**
C&I Energy Solutions for Business - Small	$33,756	$18,977	1.78	$14,779
C&I Energy Solutions for Business - Large	$45,596	$29,943	1.52	$15,653
Governmental & Institutional Tariff	$621	$561	1.11	$60
C&I Demand Response Program – Small	$639	$227	2.81	$411
C&I Demand Response Program – Large	$6,064	$2,330	2.60	$3,733
Non-Residential Subtotal	**$86,675**	**$52,039**	**1.67**	**$34,636**
Portfolio Total	**$180,309**	**$110,172**	**1.64**	**$70,137**

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

Table 45: P3TD Gross TRC Ratios by Program ($1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$3,680	$1,949	1.89	$1,731
Energy Efficient Homes	$34,424	$19,709	1.75	$14,715
Energy Efficient Products	$42,673	$20,586	2.07	$22,087
Low Income Energy Efficiency	$9,159	$9,931	0.92	-$772
Residential Subtotal	**$89,936**	**$52,175**	**1.72**	**$37,761**
C&I Energy Solutions for Business - Small	$31,763	$26,440	1.20	$5,323
C&I Energy Solutions for Business - Large	$43,374	$39,993	1.08	$3,381
Governmental & Institutional Tariff	$881	$1,128	0.78	-$248
Non-Residential Subtotal	**$76,018**	**$67,562**	**1.13**	**$8,456**
Portfolio Total	**$165,955**	**$119,737**	**1.39**	**$46,217**

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

Table 46: P3TD Gross TRC Ratios by Program ($1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$1,188	$716	1.66	$472
Energy Efficient Homes	$11,206	$7,812	1.43	$3,394
Energy Efficient Products	$13,849	$6,704	2.07	$7,145
Low Income Energy Efficiency	$2,706	$3,013	0.90	-$307
Residential Subtotal	**$28,949**	**$18,245**	**1.59**	**$10,705**
C&I Energy Solutions for Business - Small	$15,030	$10,181	1.48	$4,849
C&I Energy Solutions for Business - Large	$9,116	$7,404	1.23	$1,712
Governmental & Institutional Tariff	$703	$471	1.49	$232
C&I Demand Response Program – Small	$15	$28	0.54	-$13
C&I Demand Response Program – Large	$5,151	$1,126	4.58	$4,025
Non-Residential Subtotal	**$30,015**	**$19,210**	**1.56**	**$10,805**
Portfolio Total	**$58,964**	**$37,454**	**1.57**	**$21,509**

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

Table 47: P3TD Gross TRC Ratios by Program ($1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$4,770	$2,324	2.05	$2,445
Energy Efficient Homes	$27,158	$19,826	1.37	$7,333
Energy Efficient Products	$42,118	$25,172	1.67	$16,946
Low Income Energy Efficiency	$7,902	$9,476	0.83	-$1,574
Residential Subtotal	**$81,948**	**$56,798**	**1.44**	**$25,151**
C&I Energy Solutions for Business - Small	$33,004	$29,618	1.11	$3,386
C&I Energy Solutions for Business - Large	$31,749	$26,472	1.20	$5,277
Governmental & Institutional Tariff	$6,707	$7,765	0.86	-$1,058
C&I Demand Response Program – Small	$311	$142	2.19	$169
C&I Demand Response Program – Large	$14,515	$3,905	3.72	$10,610
Non-Residential Subtotal	**$86,286**	**$67,901**	**1.27**	**$18,385**
Portfolio Total	**$168,235**	**$124,699**	**1.35**	**$43,536**

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

Table 48, Table 49, Table 50, and Table 51 present P3TD 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 2016 dollars.

Table 48: P3TD Net TRC Ratios by Program ($1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$2,085	$2,073	1.01	$12
Energy Efficient Homes	$32,258	$21,234	1.52	$11,023
Energy Efficient Products	$14,935	$11,111	1.34	$3,824
Low Income Energy Efficiency	$8,872	$9,998	0.89	-$1,126
Residential Subtotal	**$58,150**	**$44,417**	**1.31**	**$13,734**
C&I Energy Solutions for Business - Small	$21,194	$12,991	1.63	$8,203
C&I Energy Solutions for Business - Large	$26,212	$18,207	1.44	$8,005
Governmental & Institutional Tariff	$398	$413	0.96	-$16
C&I Demand Response Program – Small	$639	$227	2.81	$411
C&I Demand Response Program – Large	$6,064	$2,330	2.60	$3,733
Non-Residential Subtotal	**$54,506**	**$34,169**	**1.60**	**$20,337**
Portfolio Total	**$112,656**	**$78,586**	**1.43**	**$34,070**

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

Table 49: P3TD Net TRC Ratios by Program ($1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$1,659	$1,949	0.85	-$291
Energy Efficient Homes	$28,957	$19,348	1.50	$9,609
Energy Efficient Products	$14,722	$9,847	1.50	$4,876
Low Income Energy Efficiency	$9,159	$9,931	0.92	-$772
Residential Subtotal	**$54,497**	**$41,076**	**1.33**	**$13,421**
C&I Energy Solutions for Business - Small	$25,021	$21,549	1.16	$3,472
C&I Energy Solutions for Business - Large	$34,434	$30,165	1.14	$4,268
Governmental & Institutional Tariff	$718	$973	0.74	-$256
Non-Residential Subtotal	**$60,172**	**$52,687**	**1.14**	**$7,485**
Portfolio Total	**$114,669**	**$93,763**	**1.22**	**$20,906**

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

Table 50: P3TD Net TRC Ratios by Program ($1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$631	$716	0.88	-$84
Energy Efficient Homes	$8,929	$6,983	1.28	$1,946
Energy Efficient Products	$4,925	$3,138	1.57	$1,787
Low Income Energy Efficiency	$2,706	$3,013	0.90	-$307
Residential Subtotal	**$17,191**	**$13,850**	**1.24**	**$3,341**
C&I Energy Solutions for Business - Small	$11,044	$7,659	1.44	$3,385
C&I Energy Solutions for Business - Large	$6,167	$5,170	1.19	$997
Governmental & Institutional Tariff	$529	$379	1.39	$150
C&I Demand Response Program – Small	$15	$28	0.54	-$13
C&I Demand Response Program – Large	$5,151	$1,126	4.58	$4,025
Non-Residential Subtotal	**$22,906**	**$14,361**	**1.59**	**$8,545**
Portfolio Total	**$40,097**	**$28,211**	**1.42**	**$11,886**
[1] Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020				

Table 51: P3TD Net TRC Ratios by Program ($1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	$2,296	$2,324	0.99	-$28
Energy Efficient Homes	$22,438	$18,381	1.22	$4,057
Energy Efficient Products	$12,092	$11,374	1.06	$719
Low Income Energy Efficiency	$7,902	$9,476	0.83	-$1,574
Residential Subtotal	**$44,728**	**$41,555**	**1.08**	**$3,174**
C&I Energy Solutions for Business - Small	$25,163	$23,888	1.05	$1,275
C&I Energy Solutions for Business - Large	$20,811	$18,671	1.11	$2,140
Governmental & Institutional Tariff	$5,362	$6,391	0.84	-$1,029
C&I Demand Response Program – Small	$311	$142	2.19	$169
C&I Demand Response Program – Large	$14,515	$3,905	3.72	$10,610
Non-Residential Subtotal	**$66,163**	**$52,997**	**1.25**	**$13,165**
Portfolio Total	**$110,891**	**$94,552**	**1.17**	**$16,339**
[1] Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020				

2.11 Comparison of Performance to Approved EE&C Plan

Table 52, Table 53, Table 54, and Table 55 present PY10 expenditures, by program, compared to the budget estimates set forth in the EE&C plan for PY10 for Met-Ed, Penelec, Penn Power, and WPP. All of the dollars in these tables are presented in 2018 dollars

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Table 52: Comparison of PYTD Expenditures to EE&C Plan ($1,000) Met-Ed

Program	PY10 Budget from EE&C Plan	PY10 Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	$ 1,137.30	$ 1,097.31	0.96
Energy Efficient Homes Program	$ 6,436.68	$ 6,567.29	1.02
Energy Efficient Products Program	$ 4,793.54	$ 3,463.94	0.72
Low Income Energy Efficiency Program	$ 3,738.82	$ 3,676.26	0.98
C&I Energy Solutions for Business Program - Small	$ 4,429.89	$ 2,325.72	0.53
C&I Demand Response Program - Small	$ 199.84	$ 124.10	0.62
C&I Energy Solutions for Business Program - Large	$ 3,988.88	$ 3,090.33	0.77
C&I Demand Response Program - Large	$ 1,792.91	$ 1,257.70	0.70
Governmental & Institutional Tariff Program	$ 345.76	$ 97.50	0.28
Total	**$ 26,863.63**	**$ 21,700.13**	**0.81**

Table 53: Comparison of PYTD Expenditures to EE&C Plan ($1,000) Penelec

Program	PY10 Budget from EE&C Plan	PY10 Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	$ 1,186.33	$ 1,005.78	0.85
Energy Efficient Homes Program	$ 6,026.12	$ 6,049.22	1.00
Energy Efficient Products Program	$ 4,522.51	$ 2,953.77	0.65
Low Income Energy Efficiency Program	$ 4,140.44	$ 3,637.95	0.88
C&I Energy Solutions for Business Program - Small	$ 4,713.40	$ 2,718.35	0.58
C&I Energy Solutions for Business Program - Large	$ 3,636.33	$ 3,464.33	0.95
Governmental & Institutional Tariff Program	$ 560.95	$ 118.51	0.21
Total	**$ 24,786.09**	**$ 19,947.91**	**0.80**

Table 54: Comparison of PYTD Expenditures to EE&C Plan ($1,000) Penn Power

Program	PY10 Budget from EE&C Plan	PY10 Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	$ 274.32	$ 370.59	1.35
Energy Efficient Homes Program	$ 1,752.44	$ 1,900.40	1.08
Energy Efficient Products Program	$ 1,161.66	$ 1,040.97	0.90
Low Income Energy Efficiency Program	$ 1,239.51	$ 972.82	0.78
C&I Energy Solutions for Business Program - Small	$ 1,179.89	$ 1,141.80	0.97
C&I Demand Response Program - Small	$ 68.83	$ 7.13	0.10
C&I Energy Solutions for Business Program - Large	$ 823.81	$ 651.28	0.79
C&I Demand Response Program - Large	$ 617.20	$ 744.64	1.21
Governmental & Institutional Tariff Program	$ 116.73	$ 17.00	0.15
Total	**$ 7,234.39**	**$ 6,846.62**	**0.95**

Table 55: Comparison of PYTD Expenditures to EE&C Plan ($1,000) WPP

Program	PY10 Budget from EE&C Plan	PY10 Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	$ 1,134.19	$ 1,189.51	1.05
Energy Efficient Homes Program	$ 4,811.27	$ 3,781.23	0.79
Energy Efficient Products Program	$ 4,455.57	$ 3,629.73	0.81
Low Income Energy Efficiency Program	$ 3,935.81	$ 3,332.61	0.85
C&I Energy Solutions for Business Program - Small	$ 4,704.72	$ 3,308.65	0.70
C&I Demand Response Program - Small	$ 253.47	$ 45.51	0.18
C&I Energy Solutions for Business Program - Large	$ 3,162.01	$ 2,129.33	0.67
C&I Demand Response Program - Large	$ 2,281.24	$ 2,634.17	1.15
Governmental & Institutional Tariff Program	$ 461.61	$ 242.26	0.52
Total	**$ 25,199.89**	**$ 20,292.99**	**0.81**

Table 56, Table 57, Table 58, and Table 59 present P3TD expenditures, by program, compared to the budget estimates set forth in the EE&C plan through PY10 for Met-Ed, Penelec, Penn Power, and WPP respectively. All of the dollars in Table 16 are presented in 2016 dollars.

Please note that the Companies' acquisition costs through Phase III PY10 have been heavily influenced by results to date significantly exceeding plan projections in lower cost programs (e.g. lighting, EE kits, behavioral). The Companies' anticipate that their acquisition costs will increase through the end of Phase III as participation among higher cost programs and measures increase to offset the reduction in lighting that will occur in the remainder of Phase III

Table 56: Comparison of P3TD Expenditures to EE&C Plan ($1,000) Met-Ed

Program	Phase III Budget from EE&C Plan through PY10	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	$ 3,240.90	$ 2,810.74	0.87
Energy Efficient Homes Program	$ 18,256.49	$ 17,017.12	0.93
Energy Efficient Products Program	$ 12,253.99	$ 7,868.35	0.64
Low Income Energy Efficiency Program	$ 10,559.40	$ 9,946.77	0.94
C&I Energy Solutions for Business Program - Small	$ 11,597.15	$ 6,232.49	0.54
C&I Demand Response Program - Small	$ 411.63	$ 235.26	0.57
C&I Energy Solutions for Business Program - Large	$ 9,566.38	$ 7,857.85	0.82
C&I Demand Response Program - Large	$ 3,694.45	$ 2,387.73	0.65
Governmental & Institutional Tariff Program	$ 830.57	$ 236.72	0.29
Total	**$ 70,410.95**	**$ 54,593.03**	**0.78**

Table 57: Comparison of P3TD Expenditures to EE&C Plan ($1,000) Penelec

Program	Phase III Budget from EE&C Plan through PY10	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	$ 3,368.73	$ 2,590.45	0.77
Energy Efficient Homes Program	$ 17,043.90	$ 15,448.06	0.91
Energy Efficient Products Program	$ 11,697.31	$ 7,387.91	0.63
Low Income Energy Efficiency Program	$ 11,627.81	$ 9,896.43	0.85
C&I Energy Solutions for Business Program - Small	$ 12,116.76	$ 7,142.62	0.59
C&I Energy Solutions for Business Program - Large	$ 8,672.44	$ 7,875.14	0.91
Governmental & Institutional Tariff Program	$ 1,407.85	$ 411.71	0.29
Total	**$ 65,934.80**	**$ 50,752.32**	**0.77**

Table 58: Comparison of P3TD Expenditures to EE&C Plan ($1,000) Penn Power

Program	Phase III Budget from EE&C Plan through PY10	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	$ 777.21	$ 940.02	1.21
Energy Efficient Homes Program	$ 4,997.24	$ 5,151.01	1.03
Energy Efficient Products Program	$ 2,927.33	$ 2,120.94	0.72
Low Income Energy Efficiency Program	$ 3,548.47	$ 2,964.71	0.84
C&I Energy Solutions for Business Program - Small	$ 3,216.57	$ 2,914.27	0.91
C&I Demand Response Program - Small	$ 138.40	$ 28.05	0.20
C&I Energy Solutions for Business Program - Large	$ 1,968.00	$ 1,675.71	0.85
C&I Demand Response Program - Large	$ 1,241.48	$ 1,278.32	1.03
Governmental & Institutional Tariff Program	$ 320.05	$ 207.21	0.65
Total	**$ 19,134.76**	**$ 17,280.25**	**0.90**

Table 59: Comparison of P3TD Expenditures to EE&C Plan ($1,000) WPP

Program	Phase III Budget from EE&C Plan through PY10	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	$ 3,227.40	$ 3,151.02	0.98
Energy Efficient Homes Program	$ 13,603.65	$ 13,948.99	1.03
Energy Efficient Products Program	$ 11,503.09	$ 8,789.98	0.76
Low Income Energy Efficiency Program	$ 11,091.05	$ 9,432.68	0.85
C&I Energy Solutions for Business Program - Small	$ 11,635.39	$ 7,651.97	0.66
C&I Demand Response Program - Small	$ 516.88	$ 144.56	0.28
C&I Energy Solutions for Business Program - Large	$ 8,212.60	$ 5,927.85	0.72
C&I Demand Response Program - Large	$ 4,651.91	$ 4,348.56	0.93
Governmental & Institutional Tariff Program	$ 1,126.84	$ 1,415.62	1.26
Total	**$ 65,568.81**	**$ 54,811.23**	**0.84**

Table 60, Table 61, Table 62, and Table 63 compare PYTD verified gross program savings compare to the energy savings projections filed in the EE&C plan for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 60: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Met-Ed

Program	EE&C Plan Projections for PY10	PY10 VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,129	4,956	0.81
Energy Efficient Homes Program	34,737	57,355	1.65
Energy Efficient Products Program	23,829	41,050	1.72
Low Income Energy Efficiency Program	7,741	13,231	1.71
C&I Energy Solutions for Business Program - Small	28,842	26,386	0.91
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	35,836	40,147	1.12
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	1,202	954	0.79
Total	**138,317**	**184,080**	**1.33**

Table 61: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Penelec

Program	EE&C Plan Projections for PY10	PY10 VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,925	4,677	0.68
Energy Efficient Homes Program	29,819	46,916	1.57
Energy Efficient Products Program	24,965	40,726	1.63
Low Income Energy Efficiency Program	7,491	11,917	1.59
C&I Energy Solutions for Business Program - Small	29,706	33,323	1.12
C&I Energy Solutions for Business Program - Large	32,047	52,161	1.63
Governmental & Institutional Tariff Program	1,521	875	0.58
Total	**132,475**	**190,594**	**1.44**

Table 62: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Penn Power

Program	EE&C Plan Projections for PY10	PY10 VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	1,645	1,683	1.02
Energy Efficient Homes Program	8,498	14,173	1.67
Energy Efficient Products Program	6,906	16,683	2.42
Low Income Energy Efficiency Program	2,086	3,552	1.70
C&I Energy Solutions for Business Program - Small	8,581	13,121	1.53
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	7,605	8,503	1.12
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	474	2	0.00
Total	**35,795**	**57,717**	**1.61**

Table 63: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for WPP

Program	EE&C Plan Projections for PY10	PY10 VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,671	6,038	0.91
Energy Efficient Homes Program	29,943	28,790	0.96
Energy Efficient Products Program	22,930	44,483	1.94
Low Income Energy Efficiency Program	7,050	10,441	1.48
C&I Energy Solutions for Business Program - Small	30,296	28,645	0.95
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	27,120	22,816	0.84
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	1,459	4,326	2.96
Total	**125,470**	**145,540**	**1.16**

Table 64, Table 65, Table 66, and Table 67 compare Phase III verified gross program savings compare to the energy savings projections filed in the EE&C plan for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 64: Comparison of Phase III Actual Program Savings to EE&C Plan Projections for Phase III for Met-Ed

Program	EE&C Plan through PY10	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	18,388	13,562	0.74
Energy Efficient Homes Program	104,141	171,171	1.64
Energy Efficient Products Program	69,927	102,598	1.47
Low Income Energy Efficiency Program	22,994	34,754	1.51
C&I Energy Solutions for Business Program - Small	76,570	75,279	0.98
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	88,884	101,423	1.14
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	3,003	1,832	0.61
Total	**383,907**	**500,620**	**1.30**

Table 65: Comparison of Phase III Actual Program Savings to EE&C Plan Projections for Phase III for Penelec

Program	EE&C Plan through PY10	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	20,776	12,385	0.60
Energy Efficient Homes Program	89,365	134,113	1.50
Energy Efficient Products Program	73,743	112,143	1.52
Low Income Energy Efficiency Program	22,060	34,838	1.58
C&I Energy Solutions for Business Program - Small	77,773	75,366	0.97
C&I Energy Solutions for Business Program - Large	79,794	106,175	1.33
Governmental & Institutional Tariff Program	3,881	2,661	0.69
Total	**367,393**	**477,681**	**1.30**

Table 66: Comparison of Phase III Actual Program Savings to EE&C Plan Projections for Phase III for Penn Power

Program	EE&C Plan through PY10	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	4,935	4,102	0.83
Energy Efficient Homes Program	25,473	40,739	1.60
Energy Efficient Products Program	19,821	37,724	1.90
Low Income Energy Efficiency Program	6,190	10,110	1.63
C&I Energy Solutions for Business Program - Small	23,819	34,994	1.47
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	18,840	22,587	1.20
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	1,382	1,945	1.41
Total	**100,461**	**152,201**	**1.52**

Table 67: Comparison of Phase III Actual Program Savings to EE&C Plan Projections for Phase III for WPP

Program	EE&C Plan through PY10	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	20,012	16,423	0.82
Energy Efficient Homes Program	89,721	134,090	1.49
Energy Efficient Products Program	67,575	114,484	1.69
Low Income Energy Efficiency Program	20,812	31,382	1.51
C&I Energy Solutions for Business Program - Small	75,463	78,957	1.05
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	73,147	76,251	1.04
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	3,790	20,779	5.48
Total	**350,520**	**472,366**	**1.35**

Overall, the Companies exceeded their annual MWh targets while staying within budget. Participation levels in the Appliance Turn-In program were lower than planned amounts for all four PA Companies. As of this writing this is not a major concern, as marketing efforts can be increased if participation continues to fall short of targets.

All other residential programs generally exceeded expectations, while remaining within budget (normalized to MWh). Part of the reason for the apparent over performance of the Energy Efficient Homes and Low Income Energy Efficiency programs is attributable to the Home Energy Reports ("HER") program component. On average, HER customers saved 10% to 15% more than the 180 kWh/home that was used in portfolio planning assumptions. This may be due to a number of reasons including increased savings with the duration of messaging and weather-related factors. Energy efficiency kits also constituted a greater proportion of the Energy Efficient Homes program, with approximately ten percent more participation than planned. This tends to increase savings and cost-effectiveness as kits are generally more cost effective than the direct install and new homes program components. The Energy Efficient Products program was buoyed by higher than expected participation in the upstream lighting component, and also by cross-sector sales (which are only accounted for in the verified impacts, not in planned or reported impacts). The Companies monitor overall spending and achievements for the residential sector as well as specific achievements in the low-income sector. As of this writing there are no significant program changes pending.

Please note that the Companies' acquisition costs through Phase III PY10 have been heavily influenced by results to date significantly exceeding plan projections in lower cost programs (e.g. lighting, EE kits, behavioral). The Companies' anticipate that their acquisition costs will increase through the end of Phase III as participation among higher cost programs and measures increase to offset the reduction in lighting that will occur in the remainder of Phase III.

The Commercial and Industrial Programs, overall, are meeting or exceeding planned energy savings, while staying on budget. Participation for the small rate-restricted Government and Institutional Tariff Program was volatile, as expected for such programs. West Penn Power continues to have higher savings than planned, the other three EDCs short of participation and savings targets, and Penn Power in particular had just one participant this year. The Companies monitor overall spending and achievements for the nonresidential sector as well as specific achievements in the GNI sector. As of this writing there are no significant program changes pending

Costs for the Commercial and Industrial Demand Response Programs were generally comparable to budgeted amounts in the EE&C plan.

2.12 FINDINGS AND RECOMMENDATIONS

The impact and process evaluation activities completed by the ADM and Tetra Tech team led to recommendations for program improvement. Table 68 lists the overarching recommendations that affect more than one program, the evaluation activity(s) that uncovered the finding, and the ADM and Tetra Tech team's recommendation(s) to the Companies to address the finding. As the tracking and reporting system affects all programs, the overarching comments address this key operational element. Program specific recommendations can be found in subsections 3.1.7, 3.2.7, 3.3.7, 3.4.7, and 3.5.7.

Table 68: Summary of Evaluation Recommendations

Evaluation Activity	Finding	Recommendation
Tracking and Reporting	The EDCs have scheduled weekly meetings between the tracking and reporting team and the EDC impact evaluator to discuss tracking and reporting issues and to implement automated quality checks for data uploaded by ICSPs.	These meetings have generally improved data quality and have allowed the EDC evaluator to gain a better understanding of data flow through each program. Continue to meet as needed to maintain data quality.
Tracking and Reporting	Reported Impacts for several residential programs are underestimated by ICSPs.	Although it is possible to request that ICSPs update calculation assumptions and reprogram ex ante values, it is more cost effective to "true-up" ex ante values in the tracking and reporting system by adding a layer of expected realization rates within the tracking system. That way management can obtain an accurate gauge of program progress without incurring reprogramming costs from multiple vendors.
Evaluation Risk	As custom projects contribute increasing amounts to nonresidential sector energy savings, the risk of volatile realization rates also increases.	Continue, or even increase, up-front evaluation activities for large projects to minimize evaluation risk.

3 Evaluation Results by Program

This section documents the gross impact, net impact, and process evaluation activities conducted in Phase III along with the outcomes of those activities. Not every program receives an evaluation every year. Planned evaluation activities for Phase III are shown in **Error! Reference source not found.**. Activities shown beyond this program year are subject to change, but the table provides the reader with a general idea of the frequency and timing of evaluation activities. In Figure 26 below, the letter "G" denotes gross impact evaluation, "N" denotes net impact evaluation, and "P" denotes process evaluation.

Figure 26: Evaluation Activity Matrix

Program/ Initiative	PY8			PY9			PY10			PY11			PY12		
	G	N	P	G	N	P	G	N	P	G	N	P	G	N	P
Res Appliance Turn-In	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓		
Res Appliances	✓	✓	✓	✓			✓	✓	✓	✓	✓	✓	✓		
Res HVAC	✓	✓	✓	✓			✓			✓	✓	✓	✓		
Res Upstream Lighting	✓	✓	✓	✓			✓	✓	✓	✓			✓		
Res Upstream Electronics	✓		✓	✓			✓	✓	✓	✓			✓		
Res EE Kits	✓	✓	✓	✓			✓	✓	✓	✓			✓		
Res Direct Install	✓			✓			✓	✓	✓				✓		
Res Home Energy Reports	✓		✓	✓			✓		✓	✓			✓		
Res New Homes	✓			✓		✓	✓	✓	✓	✓			✓		
Res Behavioral DR				✓			✓		✓	✓			✓		
Res LI Appliance Turn-In	✓		✓	✓		✓	✓		✓	✓			✓		
Res LI Appliance Rebates	✓		✓	✓			✓			✓		✓	✓		
Res LI Kits	✓			✓			✓			✓			✓		
Res LI Home Energy Reports	✓		✓	✓			✓		✓	✓			✓		
Res LI Direct Install	✓		✓	✓			✓			✓		✓	✓		
C&I Appliance Recycling	✓			✓			✓			✓			✓		
C&I Audits/DI				✓						✓			✓		
C&I Kits															
C&I Lighting	✓	✓	✓	✓			✓	✓	✓	✓			✓		
C&I Prescriptive	✓	✓	✓	✓			✓	✓	✓	✓			✓		
C&I Custom	✓	✓	✓	✓			✓	✓	✓	✓			✓		
Small CI Behavioral										✓		✓	✓		
Small CI DR				✓		✓	✓			✓		✓	✓		
Large CI DR				✓		✓	✓			✓		✓	✓		

3.1 Appliance Turn-In Program

The Companies have retained ARCA to administer the Appliance Turn-In Program. Through this program, residential customers are eligible for a cash incentive and disposal of up to two large older inefficient appliances (refrigerators or freezers); and two Room Air Conditioners (RAC) or

dehumidifiers per household per calendar year. All units must be working and meet established size requirements. The participation count for reporting purposes is the count of rebate applications, which corresponds to appliance pick-up events.

3.1.1 Participation and Reported Savings by Customer Segment

Table 69 presents the participation counts, reported energy and demand savings, and incentive payments for the Appliance Turn-In Program in PY10 by customer segment and EDC. This program serves only the residential customer segment. The EE&C portfolios include separate Appliance Turn-In program components, also administered by ARCA, to serve the low-income residential and the nonresidential customer segments.

Table 69: Appliance Turn-In 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	5,008	4,485	1,641	5,682
PYRTD MWh/yr	5,041	4,940	1,837	6,068
PYRTD MW/yr	0.72	0.67	0.24	0.79
PYTD Incentives ($1000)	287.98	255.25	90.48	316.25

3.1.2 Gross Impact Evaluation

The impact evaluation of this program is described in detail in Appendix D.1. Table 70 summarizes program verified impacts and realization rates for each EDC.

Table 70: Appliance Turn-In Program Gross Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliance Turn-In	4,956	0.70	98.3%	97.9%
Penelec	Appliance Turn-In	4,677	0.63	94.7%	94.6%
Penn Power	Appliance Turn-In	1,683	0.22	91.6%	91.7%
WPP	Appliance Turn-In	6,038	0.77	99.5%	98.2%

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. Although verification rates determined through surveys were approximately 100%, the realization rates are generally lower than 100% because the part-use factors are lower than the TRM default values, and the calculated unit energy consumptions were lower than what would expect from application of default parameters in the TRM.

3.1.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY8, PY9, and also updated results in PY10. The net impact evaluation for this program is described in Appendix

D.2. Table 71 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC. The NTG results are similar to PY8.

Table 71: Appliance Turn-In Program Net Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Appliance Turn-In	4,956	45.0%	2,230
Penelec	Appliance Turn-In	4,677	47.0%	2,198
Penn Power	Appliance Turn-In	1,683	51.0%	858
WPP	Appliance Turn-In	6,038	48.0%	2,898

3.1.3.1 High-Impact Measure Research

The Appliance Turn-In Initiative was not treated as a High-Impact Measure for Net Impact Evaluation purposes in PY10. However, a full net impact evaluation was conducted by Tetra Tech. Details of the net impact evaluation can be found in Appendix D.2.

3.1.4 Verified Savings Estimates

In Table 72 the realization rates and net-to-gross ratios determined by ADM are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Appliance Turn-In Program in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 72: PYTD and P3TD 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	5,041	0.72	4,940	0.67	1,837	0.24	6,068	0.79
PYVTD Gross	4,956	0.70	4,677	0.63	1,683	0.22	6,038	0.77
PYVTD Net	2,230	0.32	2,198	0.30	858	0.11	2,898	0.37
RTD	13,859	1.95	13,331	1.78	4,820	0.62	16,951	2.18
VTD Gross	13,562	1.86	12,385	1.63	4,102	0.53	16,423	2.12
VTD Net	6,487	0.89	5,599	0.74	2,181	0.28	7,921	1.02

3.1.5 Process Evaluation

The appliance turn-in program process evaluation relied on program staff and ICSP interviews as well as participant customer surveys. The survey was streamlined given that the program design has not changed since the PY8 evaluation, and was administered through a combination of web and phone. The researchable issues for process evaluation related to customer satisfaction and program awareness. The results of both of these metrics remain similar to Phase II, suggesting that program operation was stable during Phase III. The results are also similar across the FirstEnergy EDCs. The sample for the survey was randomly selected for each EDC.The sample design is shown in Table 73.

Table 73: ATI Program Process Evaluation Sample Design

EDC	Population Size	Achieved Sample Size	Response Rate
Met-Ed	5,008	851	20.0%
Penelec	4,485	717	20.0%
Penn Power	1,641	302	21.0%
WPP	5,682	870	21.0%

Key findings and recommendations are listed in Section 3.1.7.

3.1.6 Cost-Effectiveness Reporting[6] [7]

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 2018 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

[6] Any negative values reflected within this section are due to issues such as, but not limited to, reversals of prior period accruals, accounting journal entries, and/or revenues received from participation in historic capacity auctions during prior Phases of Act 129.
[7] Certain cost categories presented in the "Summary of Program Finances" tables reflect allocated percentages of actual costs.

Table 74: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	288		789		288		789	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	**Incremental Measure Costs (Just row 3 for Appliance Recycling)**	**0**		**0**		**0**		**0**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	1	1	98	1	1	1	98
6	Administration, Management, and Technical Assistance [3]	51	112	147	305	51	112	147	305
7	Marketing [4]	9	137	37	357	9	137	37	357
8	Program Delivery [5]	0	450	0	1,122	0	450	0	1,122
9	EDC Evaluation Costs	30		79		30		79	
10	SWE Audit Costs	19		72		19		72	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**809**		**2,218**		**809**		**2,218**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**809**		**2,073**		**809**		**2,073**	
14	Total NPV Lifetime Electric Energy Benefits	1,292		3,247		581		1,556	
15	Total NPV Lifetime Electric Capacity Benefits	344		1,095		155		530	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**1,636**		**4,342**		**736**		**2,085**	
19	**TRC Benefit-Cost Ratio [8]**	**2.02**		**2.09**		**0.91**		**1.01**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 75: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	255		687		255		687	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	**Incremental Measure Costs (Just row 3 for Appliance Recycling)**	**0**		**0**		**0**		**0**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	1	1	91	1	1	1	91
6	Administration, Management, and Technical Assistance [3]	57	102	163	280	57	102	163	280
7	Marketing [4]	6	121	33	320	6	121	33	320
8	Program Delivery [5]	0	409	0	1,033	0	409	0	1,033
9	EDC Evaluation Costs	32		86		32		86	
10	SWE Audit Costs	21		78		21		78	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**751**		**2,085**		**751**		**2,085**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**751**		**1,949**		**751**		**1,949**	
14	Total NPV Lifetime Electric Energy Benefits	1,158		2,744		544		1,240	
15	Total NPV Lifetime Electric Capacity Benefits	306		936		144		418	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**1,464**		**3,680**		**688**		**1,659**	
19	**TRC Benefit-Cost Ratio [8]**	**1.95**		**1.89**		**0.92**		**0.85**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 76: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	90		241		90		241	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	**Incremental Measure Costs (Just row 3 for Appliance Recycling)**	**0**		**0**		**0**		**0**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	0	0	36	0	0	0	36
6	Administration, Management, and Technical Assistance [3]	13	41	38	113	13	41	38	113
7	Marketing [4]	5	44	12	115	5	44	12	115
8	Program Delivery [5]	0	163	0	415	0	163	0	415
9	EDC Evaluation Costs	7		20		7		20	
10	SWE Audit Costs	5		19		5		19	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**280**		**767**		**280**		**767**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**280**		**716**		**280**		**716**	
14	Total NPV Lifetime Electric Energy Benefits	422		935		215		497	
15	Total NPV Lifetime Electric Capacity Benefits	107		253		54		134	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**529**		**1,188**		**270**		**631**	
19	**TRC Benefit-Cost Ratio [8]**	**1.89**		**1.66**		**0.96**		**0.88**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 77: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	316		884		316		884	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	**Incremental Measure Costs (Just row 3 for Appliance Recycling)**	**0**		**0**		**0**		**0**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	1	1	113	1	1	1	113
6	Administration, Management, and Technical Assistance [3]	51	122	153	345	51	122	153	345
7	Marketing [4]	9	152	37	418	9	152	37	418
8	Program Delivery [5]	0	490	0	1,270	0	490	0	1,270
9	EDC Evaluation Costs	30		79		30		79	
10	SWE Audit Costs	17		66		17		66	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**873**		**2,482**		**873**		**2,482**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**873**		**2,324**		**873**		**2,324**	
14	Total NPV Lifetime Electric Energy Benefits	1,500		3,738		720		1,801	
15	Total NPV Lifetime Electric Capacity Benefits	383		1,031		184		495	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**1,883**		**4,770**		**904**		**2,296**	
19	**TRC Benefit-Cost Ratio [8]**	**2.16**		**2.05**		**1.04**		**0.99**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.1.7 Status of Recommendations

The process evaluation activities in PY10 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.

Finding #1: *FirstEnergy program staff reports that the program is running well.* This program has been running for multiple years and has been operating smoothly. The relationship with ARCA is effective, with good communication, timely and accurate reporting, and high customer satisfaction.

Finding #2: *ARCA, the Conservation Service Provider, reports the program has been operating effectively, performance indicators are meeting or exceeding targets, and the rare instances of low satisfaction are addressed promptly.* ARCA believes the working relationship with FirstEnergy is excellent and the program's performance is in line with that of other utilities in similar geographic areas. ARCA continues to pursue ways to maximize customer satisfaction (e.g., user-friendly interfaces) and minimize implementation barriers (e.g., coordinating delivery and pick up with retailers).

Finding #3: *Bill inserts continue to be the most common source of program information* In PY10, approximately 58 percent (1,506 out of 2,605) of sampled program participants who completed a customer survey indicated bill inserts as a source of program information. In PY8 and PY9, 60 percent and 58 percent of survey participants, respectively, indicated bill inserts as a source of program information.

Finding #4: *Program satisfaction remains high.* About 79 percent of respondents (2,128 out of 2,696) reported they were "very satisfied" with program overall, with a mean score of 4.7 out of 5. This is the same mean rating as PY9. Of the few customers who express dissatisfaction (25 out of 2,696), slow processing of rebates (possibly due to timing of survey fielding), a bad pick-up experience and scheduling issues are mentioned most often

Recommendation #1: Continue to market the program through bill inserts and other marketing channels to promote program participation. Along with providing FirstEnergy with the design for the bill inserts, ARCA books ad spots for television, radio, and other outlets. They enact marketing activities that include emails, search engine optimization, and direct mail. ARCA also provides materials to retailers through Honeywell, which implements FirstEnergy's appliance rebate program.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Work with ARCA, the Conservation Service Provider, to maximize program participation and customer satisfaction.* ARCA continually looks for ways to improve implementation and the customer experience. This includes increased marketing efforts across multiple media outlets (i.e., television, radio, web, mail), the addition of evening and weekend pick-up options for those not available during the weekdays, updates to the online scheduling tool so customers can more easily adjust their pick-up times and rolling out new program amenities such as texting options for appointment reminders

EDC Status Report #2: Recommendation accepted, and the Companies note that marketing activities currently include television, radio, web ads, social media ads, email, and direct mail outreach channels.

3.2 ENERGY EFFICIENT HOMES PROGRAM

Energy Efficiency Homes Program has seven distinct components: Energy Efficiency Kits, Online Audits, School Education, Behavioral Home Energy Reports, Behavioral Demand Response, Residential Energy Audits, and New Homes.

Energy Efficiency Kits is administered by Power Direct. In this program, customers must request to receive a kit filled with energy savings measures.

The Online Audit component is administered by both PowerDirect and Oracle (as of April 2018) and Aclara previous to April 2018. Customers complete a questionnaire with questions about their home and receive tips for how to save energy. This is also available via telephone for customers without internet access. Upon completion of the audit, Power Direct sends a kit with energy savings measures.

AM Conservation Group (AMCG) administers the School Education program. Students receive a 25-minute performance delivered by professionally trained actors around energy conservation. Teachers also use a corresponding curriculum to continue to teach about energy conservation topics. Parents are then encouraged to request a kit filled with energy-savings measures and 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 Companies have retained GoodCents to administer the Direct Install (branded as Home Audit) component in Phase III. Through this program component, customers receive 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.

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 efficiencies through the installation of efficient building shell measures, HVAC systems, appliances, lighting, or 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).

The program also includes a Behavioral Demand Response (BDR) program component, which is administered by Oracle. The BDR program component is discussed separately in Section 3.8. However, costs and benefits for BDR are included in the EE Homes cost effectiveness tables in Section 3.2.6.

3.2.1 Participation and Reported Savings by Customer Segment

Table 78 presents the participation counts, reported energy and demand savings, and incentive payments for the Energy Efficient Homes Program in PY10 by customer segment and 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 78: 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	201,029	212,396	40,980	174,170
PYRTD MWh/yr	52,988	43,349	12,878	33,459
PYRTD MW/yr	7.54	5.16	1.87	6.07
PYTD Incentives ($1000)	3,885.31	3,985.13	1,224.09	1,449.48

3.2.2 Gross Impact Evaluation

Each program component is treated as a separate evaluation initiative. The gross impact evaluation of the EE Kits Initiative is described in Appendix E. The impact evaluation of the HER Initiative is described in Appendix E. The impact evaluation of the Res DI Initiative is described in Appendix G. The impact evaluation of the Res NC Initiative is described in Table 79 summarizes program verified impacts and realization rates for each EDC.

Table 79: EEH Program Gross Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	EE Kits	27,137	3.13	118.6%	123.8%
Met-Ed	Home Energy Reports	29,134	3.28	101.6%	72.5%
Met-Ed	Direct Install	140	0.01	96.3%	90.2%
Met-Ed	New Homes	944	0.39	74.0%	81.4%
Met-Ed Total		**57,355**	**6.81**	**108%**	**90%**
Penelec	EE Kits	32,521	3.33	119.7%	124.6%
Penelec	Home Energy Reports	14,038	1.57	89.0%	65.9%
Penelec	Direct Install	193	0.02	100.7%	90.6%
Penelec	New Homes	165	0.08	72.2%	92.2%
PenelecTotal		**46,916**	**5.00**	**108%**	**97%**
Penn Power	EE Kits	6,873	0.80	119.6%	128.5%
Penn Power	Home Energy Reports	6,398	0.72	109.3%	95.2%
Penn Power	Direct Install	85	0.01	102.7%	100.3%
Penn Power	New Homes	818	0.34	68.3%	71.0%
Penn PowerTotal		**14,173**	**1.87**	**110%**	**100%**
WPP	EE Kits	5,545	0.70	116.7%	122.7%
WPP	Home Energy Reports	21,040	2.35	80.6%	51.2%
WPP	Direct Install	141	0.02	97.5%	103.2%
WPP	New Homes	2,064	0.68	83.9%	75.7%
WPP Total		**28,790**	**3.74**	**86%**	**62%**

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 higher than 100% due to higher in-service rates than planning estimates. Home Energy Reports energy savings varied from reported values due to differences in data validation and the cross-participation corrections.

3.2.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for the EE Kits Initiative in PY8. The net impact evaluation for the EE Kits Initiative is described in Appendix E.2. NTG studies for the New Homes and Direct Install initiatives were completed in PY10. The New Homes Program is estimated to have an NTG ratio of 73%, as described in Appendix H.2.1. This value is somewhat higher than the 60% estimate that was applied in PY9, derived from a literature review of other residential new construction programs.

Due to limited participation in the Direct Install initiative, Tetra Tech surveyed participants spanning both PY9 and PY10. A self report methodology was applied, as described in Appendix H.2.1. The NTG for this initiative is estimated to be 101%, with spillover essentially cancelling free ridership.

The NTG for the HER program is estimated to be 1.0, which is a feature of the randomized control trial gross impact evaluation approach[8].

Table 80 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 80: EEH Program Net Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	EE Kits	27,137	82.0%	22,246
Met-Ed	Home Energy Reports	29,134	100.0%	29,134
Met-Ed	Direct Install	140	95.0%	133
Met-Ed	New Homes	944	73.0%	689
Met-Ed Total		**57,355**	**91.0%**	**52,203**
Penelec	EE Kits	32,521	83.1%	27,020
Penelec	Home Energy Reports	14,038	100.0%	14,038
Penelec	Direct Install	193	103.0%	199
Penelec	New Homes	165	73.0%	120
Penelec Total		**46,916**	**88.2%**	**41,377**
Penn Power	EE Kits	6,873	82.0%	5,639
Penn Power	Home Energy Reports	6,398	100.0%	6,398
Penn Power	Direct Install	85	100.0%	85
Penn Power	New Homes	818	73.0%	597
Penn Power Total		**14,173**	**89.7%**	**12,719**
WPP	EE Kits	5,545	89.0%	4,933
WPP	Home Energy Reports	21,040	100.0%	21,040
WPP	Direct Install	141	104.0%	147
WPP	New Homes	2,064	73.0%	1,507
WPP Total		**28,790**	**96.0%**	**27,627**

3.2.3.1 High-Impact Measure Research

The EE Kits Initiative, which includes the EE Kits distributed in the Energy Efficient Homes Program, was treated as a High-Impact Measure for Net Impact Evaluation purposes in PY8. Details of the net impact evaluation can be found in Appendix E.2. No Initiatives from this program have been designated as high impact measures for PY10, as the only other program element with high impacts is Home Energy Reports, which has a net-to-gross of approximately 1.0 (and deemed to be such) as a consequence of the gross impact evaluation methodology.

3.2.4 Verified Savings Estimates

In Table 81 the realization rates and net-to-gross ratios determined by 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 PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

[8] This estimation assumes that non-participant spillover is negligible.

Table 81: PYTD and P3TD 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	52,988	7.54	43,349	5.16	12,878	1.87	33,459	6.07
PYVTD Gross	57,355	6.81	46,916	5.00	14,173	1.87	28,790	3.74
PYVTD Net	52,203	6.14	41,377	4.41	12,719	1.64	27,627	3.49
RTD	155,353	20.81	119,153	15.04	36,062	5.56	133,180	21.07
VTD Gross	171,171	20.42	134,113	14.54	40,739	5.66	134,090	17.12
VTD Net	156,970	18.38	120,532	13.06	36,480	4.77	125,094	15.37

3.2.5 Process Evaluation

Process evaluation activities were conducted for the EE Kits and Home Energy Reports program components in PY8, and for New Homes in PY9. In PY10, Tetra Tech conducted process evaluations for Online Audit Kits, Behavioral Demand Response, Audit/Direct Install and Home Energy Reports components in PY10. The participant survey and other evaluation activity sample design for multi-year process evaluation effort is shown in Table 82.

Table 82: EEH Program Process Evaluation Sample Design

EDC / Measure	Latest Activity	Population Size	Achieved Sample Size	Response Rate
ME - EE Kits	Participant Surveys (PY8)	61,344	172	14%
PN - EE Kits	Participant Surveys (PY8)	54,474	171	14%
PP - EE Kits	Participant Surveys (PY8)	16,105	181	15%
WP - EE Kits	Participant Surveys (PY8)	58,301	193	16%
ME - Online Audit Kits	Participant Surveys (PY10)	3,077	97	9%
PN - Online Audit Kits	Participant Surveys (PY10)	2,198	71	6%
PP - Online Audit Kits	Participant Surveys (PY10)	792	72	9%
WP - Online Audit Kits	Participant Surveys (PY10)	5,303	90	8%
ME - Behavioral	Participant Surveys (PY10)	121,988	56	6%
PN - Behavioral	Participant Surveys (PY10)	119,567	70	8%
PP - Behavioral	Participant Surveys (PY10)	22,164	70	8%
WP - Behavioral	Participant Surveys (PY10)	140,869	64	7%
ME - Behavioral DR	Participant Surveys (PY10)	125,016	109	5%
ME - Behavioral DR	Opt-Out Surveys (PY10)	5,306	84	3%
PP - Behavioral DR	Participant Surveys (PY10)	30,989	121	5%
PP - Behavioral DR	Opt-Out Surveys (PY10)	86	14	16%
WP - Behavioral DR	Participant Surveys (PY10)	49,898	140	3%
WP - Behavioral DR	Opt-Out Surveys (PY10)	3,511	109	3%
ALL EDCs - In-Home Audits	Participant Surveys (PY10)	1,128	331	29%
	Auditor Interviews (PY10)	16	11	69%
	Audit Ride-Alongs (PY10)	16	3	6%
All EDCs - New Homes	Builder Surveys (PY9)	43	9	21%
	Rater Surveys (PY9)	27	4	33%
Program Total		**822,218**	**2,242**	**7.6%**

Key findings and recommendations are listed in Section 3.2.7.

3.2.5.1 Energy Efficiency and Online Audit Kits

The Energy Efficient Homes programs contains several subprograms that deliver kits of energy-efficient measures to customers through different channels. The opt-in Energy Efficiency Kits, School Education Kits and Online Audit with Kits components have been evaluated in PY8, and the Online Audit Kits were again evaluated in PY10. Each evaluation began with program staff and ICSP interviews, and the bulk of the evaluation was conducted through participant surveys. The participant survey was administered through a combination of web and phone. Researchable issues for the kits sub-programs focused on participant satisfaction, program marketing, and awareness. The sample for the survey was randomly selected for each EDC.

In regard to the Online Audit with Kits, which was evaluated in PY10, program staff believe the program is running well and the working relationship with the ICSP is effective. The software tool was updated in April 2018 to be embedded into each EDC's website, instead of being hosted on a separate site. FirstEnergy reports being more satisfied with the updated tool, as it is more seamless for their customers. Likewise, PowerDirect noted they have been working well with FirstEnergy for eight years on this program and process have been streamlined well. More recently, the ICSP has worked to improve data transfer processes, which have helped stay within promised shipping windows for the kits.

3.2.5.2 Home Energy Reports

In the PY10 process evaluation effort for Home Energy Report, Tetra Tech conducted both qualitative and quantitative research as part of the process evaluation activities. The qualitative research included semi-structured interviews with FirstEnergy program managers and the program implementer. A survey of participating customers was the primary source of data to assess experiences of participants and their engagement with the program. The survey was primarily a quantitative study, but evaluators asked open-ended questions to provide context for the quantitative results.

FirstEnergy and ICSP staff noted a low drop-out rate, and low volume of feedback from participants to the program, suggesting that there are not issues that cause participants to be dissatisfied. Both FirstEnergy and the ICSP felt the program design was working well, which is unchanged since Phase II. The participant survey provided consistent findings. The participant survey researched customer engagement with the home energy reports, energy-saving behaviors, and barriers to energy-saving behaviors. The survey sample was randomly selected for each EDC from all customers receiving home energy reports, including a stratum for the low-income subprogram.

3.2.5.3 Behavioral Demand Response

The process evaluation activities, findings, and recommendations for this program component are discussed in Section 3.8.4 and Section 3.8.6.

3.2.5.4 New Homes

The process evaluation effort, conducted previously in PY9, included a documentation review and interviews. The documentation review included reviews of sample rebate applications, of the program website, and of FirstEnergy's program implementation plan. FirstEnergy program managers were interviewed first, followed by an interview with managers at Performance Systems Development, Inc. (PSD), the program implementer. Tetra Tech also conducted in-depth interviews with ten participating builders and five participating HERS raters. Both the builders and raters reported high satisfaction rates with program communications via PSD, and had positive feedback regarding steps that PSD has taken to reduce the rebate application burden. PSD was seen as a resource for disseminating information about the recent efficiency code update in Pennsylvania, although both builders and raters report widespread code enforcement in Pennsylvania. Tetra Tech also conducted surveys and interviews with builders and raters in PY10, but focused on net impact evaluation.

3.2.5.5 In Home Audits

The process evaluation effort for In-Home Audits occurred during both PY9 and PY10 and included semi-structured interviews with the FirstEnergy program manager, representatives of the ICSP, home energy auditors, in-home energy audit ride-alongs, and a review of program data and marketing materials. The research also included structured surveys with program participants. The evaluation team interviewed the FirstEnergy program manager and the program implementer to review program design, understand how the program has evolved since its inception, identify lessons learned from the implementation, and ascertain any challenges going forward. The focus of the auditor interviews was to assess how the program is working from their perspective. The ride-alongs provided an opportunity to directly observe a participant's experience with the program and how the audit is performed.

The quantitative survey captured customers' perceptions of, and experiences with, the program; awareness and attitudes of energy efficiency and conservation; participation in other FirstEnergy programs; customer satisfaction; and possible areas for improvement from the customer's perspective.

3.2.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented 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 2018 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars. Note that the program costs and benefits include costs and benefits for the Behavioral Demand Response program component. The Behavioral Demand Response benefits and costs are also reported individually in Section 3.8.5.

Table 83: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	3,885		9,812		3,885		9,812	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	3,109		4,201		2,795		3,341	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**6,994**		**14,013**		**6,680**		**13,153**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	2	51	3	684	2	51	3	684
6	Administration, Management, and Technical Assistance [3]	205	885	570	3,145	205	885	570	3,145
7	Marketing [4]	19	304	44	808	19	304	44	808
8	Program Delivery [5]	0	927	0	2,407	0	927	0	2,407
9	EDC Evaluation Costs	219		428		219		428	
10	SWE Audit Costs	69		250		69		250	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**2,682**		**8,340**		**2,682**		**8,340**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**9,676**		**22,484**		**9,362**		**21,234**	
14	Total NPV Lifetime Electric Energy Benefits	7,657		21,399		6,436		17,934	
15	Total NPV Lifetime Electric Capacity Benefits	2,758		7,761		2,405		6,392	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	2,203		2,052		1,806		1,657	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	4,232		7,735		3,394		6,276	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**16,850**		**38,947**		**14,042**		**32,258**	
19	**TRC Benefit-Cost Ratio [8]**	**1.74**		**1.73**		**1.50**		**1.52**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 84: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	3,985		9,102		3,985		9,102	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	2,911		3,165		2,965		3,092	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**6,897**		**12,267**		**6,950**		**12,193**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	2	2	3	614	2	2	3	614
6	Administration, Management, and Technical Assistance [3]	187	772	545	3,009	187	772	545	3,009
7	Marketing [4]	18	309	45	751	18	309	45	751
8	Program Delivery [5]	0	529	0	1,799	0	529	0	1,799
9	EDC Evaluation Costs	181		373		181		373	
10	SWE Audit Costs	63		239		63		239	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**2,064**		**7,378**		**2,064**		**7,378**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**8,961**		**19,709**		**9,014**		**19,348**	
14	Total NPV Lifetime Electric Energy Benefits	7,565		19,350		6,378		16,394	
15	Total NPV Lifetime Electric Capacity Benefits	1,762		5,772		1,489		4,848	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	2,467		2,199		2,050		1,819	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	4,271		7,104		3,547		5,896	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**16,065**		**34,424**		**13,464**		**28,957**	
19	**TRC Benefit-Cost Ratio [8]**	**1.79**		**1.75**		**1.49**		**1.50**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 85: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	1,224		3,083		1,224		3,083	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	1,233		1,976		1,042		1,414	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**2,457**		**5,060**		**2,266**		**4,497**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	7	1	170	1	7	1	170
6	Administration, Management, and Technical Assistance [3]	64	196	216	706	64	196	216	706
7	Marketing [4]	5	96	11	255	5	96	11	255
8	Program Delivery [5]	0	265	0	852	0	265	0	852
9	EDC Evaluation Costs	21		143		21		143	
10	SWE Audit Costs	20		76		20		76	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**676**		**2,429**		**676**		**2,429**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**3,134**		**7,812**		**2,942**		**6,983**	
14	Total NPV Lifetime Electric Energy Benefits	2,099		5,816		1,738		4,722	
15	Total NPV Lifetime Electric Capacity Benefits	918		2,646		781		2,049	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	529		567		434		442	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	1,552		2,178		1,194		1,716	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**5,099**		**11,206**		**4,147**		**8,929**	
19	**TRC Benefit-Cost Ratio [8]**	**1.63**		**1.43**		**1.41**		**1.28**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 86: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	1,449		6,578		1,449		6,578	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	2,823		3,945		2,512		3,073	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**4,272**		**10,522**		**3,961**		**9,650**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	2	22	3	709	2	22	3	709
6	Administration, Management, and Technical Assistance [3]	205	912	645	3,427	205	912	645	3,427
7	Marketing [4]	9	112	28	561	9	112	28	561
8	Program Delivery [5]	0	806	0	2,168	0	806	0	2,168
9	EDC Evaluation Costs	200		405		200		405	
10	SWE Audit Costs	63		232		63		232	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**2,332**		**8,177**		**2,332**		**8,177**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**6,604**		**19,826**		**6,293**		**18,381**	
14	Total NPV Lifetime Electric Energy Benefits	2,918		14,918		2,546		12,577	
15	Total NPV Lifetime Electric Capacity Benefits	1,410		5,694		1,231		4,557	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	443		557		394		447	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	2,531		5,990		2,013		4,857	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**7,303**		**27,158**		**6,185**		**22,438**	
19	**TRC Benefit-Cost Ratio [8]**	**1.11**		**1.37**		**0.98**		**1.22**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.2.7 Status of Recommendations

The findings and recommendations from the PY10 process evaluation efforts are listed below. Findings and recommendations from previous process evaluation efforts are available in the PY8 and PY9 annual reports.

3.2.7.1 Online Audit Kits

Finding #1: *Customers express high satisfaction with aspects of the program*. Between 67 and 78 percent are "very satisfied" or "extremely satisfied" with each of five aspects of the program—the program overall, the length of time it took to answer the questions in the audit, the information and tips received on how to save energy, the products in the kit, and the time it took to receive the kit. Customers are most satisfied with the products included in the kit. A smaller percentage of customers express high satisfaction with the tips on how to save energy.

Finding #2: *Customers report that it was easy to both log in to the online*[9] *audit tool and answer the questions in the online audit*. Over 95 percent reported that it was "somewhat easy" or "very easy" to log in to the tool and to answer the questions.

Finding #3: *Customers found the charts shown in the online audit tool somewhat useful*. Less than one-half of survey participants reported that the charts showing where they use energy in their home and how their energy use compares to their neighbors were "very useful" or extremely useful". Most indicated that these charts were only "somewhat useful."

Finding #4: *Customers were likely to implement energy-saving tips received through the audit that did not require a large financial investment.* Customers were most likely to adjust their behavior to save energy, install energy efficient lighting, and change the temperature on their thermostat after seeing these tips in the online tool. While almost one-half of participants saw tips to buy energy efficient appliances and one-fourth received a suggestion to add insulation to the home, these tips were not as likely to be implemented (implemented by 21 percent and 6 percent, respectively).

Finding #5: *The participant survey resulted in an overall net-to-gross (NTG) ratio of 98 percent for the PY10 program. NTG values for individual FirstEnergy EDCs ranged from 81 to 113 percent.* Over the years, surveys have shown that this program component tends to generate more spillover than many other program components.

Recommendation #1: *Seek ways to continue providing energy conservation kits to customers.* Among all aspects of the program, customers reported the highest levels of satisfaction with the products included in the kit. Additionally, almost all surveyed customers installed at least one item from their kit. While the On-Line Audit program is not being continued in PY11, other outlets for distributing kits or energy efficient items (e.g., educational or outreach events) may effectively promote energy conservation and further bolster FirstEnergy's strong relationship with customers.

EDC Status Report #1: Recommendation accepted. The Companies intend to continue the remaining Kit offerings through PY11.

[9] Throughout this report, we refer to the program as the "On-Line Audit program" and the tool itself as the "online audit".

Recommendation #2: *Seek ways to raise awareness of, or engagement with, the online audit tool.* Those who remembered completing the online audit found it easy to use and a source of useful information. Additionally, almost 80 percent of customers implemented at least one tip they received after completing the online audit. With the program ending in PY10, messaging that directs customers to the tool to understand their energy usage or demonstrations at educational or outreach events may encourage energy-saving behaviors and further strengthen customer satisfaction.

EDC Status Report #2: Recommendation accepted. The Companies will continue to have access to the audit tool once the program is discontinued, and will provide customers access to the tool as part of the Home Energy Reports program component.

3.2.7.2 In-Home Audits

The process evaluation resulted in several noteworthy findings and recommendations. Not all findings and recommendations have a one-to-one correspondence, therefore the findings are disclosed first, followed by recommendations.

Finding #1: *Customers express high satisfaction with all aspects of the program*. Across five program aspects, the percentage of respondents who rated each either "very satisfied" or "extremely satisfied" ranged from 62 percent to 87 percent. The lowest satisfaction was with the amount of time it took to receive the rebate and the highest satisfaction was with the scheduling of the audit. More than one-half (52 percent) reported that their opinion of the company improved as a result of their participation in the program, and 68 percent said they have recommended the program to others since participating.

Finding #2: *Bill inserts continue to be the most common source of program information.* Approximately 48 percent of survey respondents cited bill inserts as the method by which they learned about the program. One-half of the respondents indicated they would like to continue receiving bill inserts for program information, along with email notifications (50.3 and 50.9 percent respectively.

Finding #3: *Auditors expressed concern about being able to meet the direct install requirements in the future as more households install LEDs on their own and there is less opportunity to meet the 350 kWh savings requirement.* Auditors would like to see more measure options available to help reach that threshold.

Finding #4: *Auditors report the biggest barrier to program participation is the upfront cost of the audit.* They also said the time it takes to receive the rebate is often too long for customers to cover the costs while they wait for reimbursement, which can be two to three months.

Finding #5: *Participants seemed most engaged during the audit when feeling the air leaks from the blower door test and seeing the varying temperature readings that result from those leaks.* During the ride-alongs, the auditor engaged the residents by having him or her walk through the home and participate in checking for air leaks, assessment of insulation, and temperature readings provided by an infrared laser thermometer. The infrared laser thermometer was a tool bought personally by the auditor because he found it useful for communication during the audit. It is not a tool provided by the program.

Finding #6: *Both the FirstEnergy program manager and ICSP staff report that the program is running smoothly and achieving its goals.* The FirstEnergy program manager said the ICSP is providing new ideas to increase participation and they run successful marketing campaigns. Per the ICSP, *"for the first time in several years we are meeting goals (MW and kW)".*

Finding #7: *The participant survey resulted in an overall net-to-gross (NTG) ratio of 101 percent for the PY9/PY10 program.* NTG values for individual FirstEnergy electric distribution companies range from 95 to 104 percent.

Recommendation #1: *Continue to market the program through bill inserts and other marketing channels to promote program participation.* Per participant feedback, also utilize email to inform customers of the programs available.

EDC Status Report #1: Recommendation Accepted.

Recommendation #2: *Encourage auditors to use technologies that help illustrate potential energy loss or savings to improve customer engagement.* For example, the auditor hosting the audit ride-alongs uses a *laser temperature infrared thermometer to spot-read temperatures in rooms to show the effects of air leaks on the temperature of the room.* During the auditor interviews, two other auditors stated this is, and would be, a helpful tool for all auditors to have when conducting the audits. Use of a tool like this effectively engages customers and strengthens the energy education component of the audit.

EDC Status Report #2: Recommendation Accepted.

Recommendation #3: *Work with the ICSP to find ways to reduce the length of time to process rebates*. Improper or inconsistent completion of the steps in the audit software can delay the rebate process. Having the ICSP review the proper submission of data in the software with auditors can help eliminate this as a potential source of delay and increase consistency. Working with the ICSP to expand the use of instant rebates or other avenues for rebate submission could also reduce the length of time to process rebates and alleviate the participant burden of the upfront cost.

EDC Status Report #1: Recommendation Accepted. The Companies will investigate methods for reducing rebate processing time.

3.2.7.3 Home Energy Reports

The process evaluation resulted in several noteworthy findings and recommendations. Not all findings and recommendations have a one-to-one correspondence, therefore the findings are disclosed first, followed by recommendations.

Finding #1: *Customers express high satisfaction with FirstEnergy and the program raises satisfaction for many.* About 80 percent are "very satisfied" or "extremely satisfied" with the overall quality of service provided by their EDC. One-quarter say their opinion of their Electric Distribution Company (EDC) has improved since they have been receiving Home Energy Reports (HERs). Low-income participants are more apt to report increased satisfaction (31 percent).

Finding #2: *Customers' readership of the HERs is high and reported to be steady throughout the year*. Among participants who were surveyed, almost one-half say that "someone (in the household) reads the entire report." Less than 5 percent say "no one reads the report." Readership of the paper and electronic HERs (eHERs) is very similar, and there are no meaningful differences by participant type (low-income, residential). Of those who receive eHERs, which are sent monthly, almost three-quarters read "all or almost all" of the twelve reports in the past year.

Finding #3: *Most participants comprehend general energy-saving guidance from the reports, but accurate recall of HER-recommended thermostat-settings is relatively low*. Survey participants enumerate a long list of energy-saving ideas that are broadly consistent with tips promoted through the HERs—from energy-efficient lighting to getting HVAC tune-ups or hanging clothes to dry. However, fewer customers accurately recall more specific recommendations. Slightly less than one-half accurately recall that HERs recommend a winter thermostat setting of 68 degrees and less than one-quarter correctly cited the summer recommendation of 72 degrees. More than one-third respond "don't know."

Finding #4: *Most participants find information in the HERs useful.* Almost 60 percent find the charts and other information in the HERs "somewhat useful," and about one in four say they are either "very" or "extremely useful." The report's comparison of one's own energy use now with the same time a year ago receives the highest share of useful ratings, followed by energy-saving tips. Low-income and residential participants rate the usefulness of the reports very similarly.

Finding #5: *The HERs have prompted energy-saving actions among more than one-half of participants*. Changing light bulbs to energy-efficient types, installing energy-efficient appliances, and adjusting the thermostat are the behaviors or actions cited most often.

Finding #6: *Cost continues to be a barrier to saving energy for most participants*. Almost one-half of participants, and 62 percent of low-income participants cite the "cost of doing things to save energy" is a challenge. The age or condition of a home and changing the habits of other household members are mentioned by about one-quarter of participants.

Finding #7: *A small percentage of customers engage the online audit, or Home Energy Analyzer (HEA), but those who access the tool tend to complete it.* About 5 percent of the program's treatment group accessed the online audit during PY10. However, nearly one-half of those who logged-in to the audit proceeded to complete the questionnaire. Program participants accounted for almost one-third of all HEA completions during PY10.

Finding #8: *The program is operating effectively from the perspective of FirstEnergy and Oracle, the Conservation Service Provider*. Both parties remarked on an effective and smooth

working relationship, and neither envisioned significant challenges ahead. The program continues to meet energy-saving goals, there are no observable signs of customer fatigue, and Oracle continues to develop "fresh" content to the reports for participants

Recommendation #1: *Continue sending the HERs and eHERs to low-income and residential participants.* While a minority do not read the reports or express doubts about the neighbor comparisons, a majority find them useful. Many focus on the content they find most helpful in managing their energy consumption, such as the historical comparisons with their own energy use.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Continue to promote the HEA tool among participants.* Most customers who start the online audit complete all the questions, find them easy to answer, and receive useful information. Further, information provided by an online audit should help address questions that participants often raise as concerns or ideas for improvement—i.e., What equipment in my home is using the most energy? How should I prioritize my energy-saving actions?

EDC Status Report #2: Recommendation accepted.

Recommendation #3: *Continue to develop new data tables or charts to keep report content fresh and useful.* Oracle began including peak-daily-use charts late in PY10. Energy consumption charts showing *when* a household uses the most energy, or energy consumption standardized by weather data were cited by some customers as ideas for improvement. These ideas were mentioned by a very small number of customers, but they may be valued by many more when the data are presented to them.

EDC Status Report #3: Recommendation accepted.

3.2.7.4 Behavioral Demand Response

The process evaluation findings and recommendations for Behavioral Demand Response are discussed in Section 3.8.6.

3.2.7.5 New Homes

Tetra Tech's PY10 evaluation effort for New Homes focused on net impact analysis. However, there were a few process evaluation findings and associated recommendations, which are listed below.

Finding #1: *The program influenced builders to increase the efficiency of new homes under the IECC 2009 code.* Net-to-gross for builders was estimated at 73 percent for PY10. Builders credited the program for increasing their efficiency above code.

Finding #2: *Most builders report that they do not plan to exceed IECC 2015 code without the program's influence.* Builders report that they plan to build 27 percent[10] of their homes to exceed the new code through the end of Phase III. Since the program plans to add a requirement that builders exceed IECC 2015 even though that is not a TRM requirement in Phase III, this minimizes the chance that builders will be free riders during the period when the state code and the TRM are not aligned.

Finding #3: *Builders look to the program and industry organizations to learn about home energy use, including code.* Builders repeatedly mentioned that the program provided valuable information and that program staff was helpful and responsive. Builders also mentioned other organizations such as regional homebuilder organizations and the Pennsylvania Housing Research Center (PHRC) as resources for information.

Recommendation #1: *Work with builders to improve the efficiency of new homes above IECC 2015.* The program implementer mentioned plans to update program eligibility starting in PY12, and Tetra Tech supports this plan and timeline. Increasing program eligibility requirements will be critical to maintaining a healthy net-to-gross ratio since code compliance would result in free ridership if the program stayed with the TRM. It is reasonable to allow some time for homes to be completed that were permitted before the code change and to allow some time for code enforcement to begin.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Partner with organizations that educate builders and promote efficiency to help promote the program.* Builders mentioned homebuilder organizations such as the Pennsylvania Builders Association as well as the Pennsylvania Housing Research Center (PHRC) at Pennsylvania State University as resources they use for learning about energy codes and energy efficiency. These organizations provide FirstEnergy with additional communication channels that builders trust.

EDC Status Report #2: Recommendation accepted.

[10] Weighted by builders' savings contribution in PY10.

3.3 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 include 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 retailers for point of sale price cuts for customers purchasing energy efficient light bulbs and ENERGY STAR® qualified computers, printers, monitors, and televisions. The Companies have retained Honeywell to administer the program.

For the appliances component of the program, the participant count is equal to the sum of Appliances rebated by the program. For the HVAC component, the participant count is equal to the sum of HVAC units and HVAC tune-ups rebated by the program. For the upstream electronics component of the program, the participant count is equal to the number of electronics equipment sold. For Upstream Lighting component of the program, the participant count is equal to the number of packs sold.

3.3.1 Participation and Reported Savings by Customer Segment

This program serves primarily the residential customer segment. However, some small commercial and GNI contributions result from “cross sector” sales, where a small fraction of the efficient lighting is purchased from participating retailers and installed in nonresidential settings. Table 87, Table 88, Table 89, and Table 90 present the participation counts, reported energy and demand savings, and incentive payments for the EEP Program in PY10 by customer segment and EDC.

Table 87: EEP Program Participation and Reported Impacts for Met-Ed

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	390,984	17,380	10,597	418,961
PYRTD MWh/yr	27,252	1,123	685	29,061
PYRTD MW/yr	3.58	0.13	0.08	3.80
PYTD Incentives ($1000)	2,250.79	60.66	36.98	2,348

Table 88: EEP Program Participation and Reported Impacts for Penelec

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	345,972	15,642	9,538	371,152
PYRTD MWh/yr	27,376	1,172	715	29,264
PYRTD MW/yr	3.28	0.12	0.08	3.48
PYTD Incentives ($1000)	1,815.65	53.26	32.48	1,901

Table 89: EEP Program Participation and Reported Impacts for Penn Power

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	115,304	5,082	3,099	123,485
PYRTD MWh/yr	11,245	482	294	12,021
PYRTD MW/yr	1.42	0.06	0.03	1.51
PYTD Incentives ($1000)	706.79	19.50	11.89	738

Table 90: EEP Program Participation and Reported Impacts for WPP

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	332,655	14,257	8,693	355,605
PYRTD MWh/yr	29,559	1,203	734	31,495
PYRTD MW/yr	4.20	0.15	0.09	4.45
PYTD Incentives ($1000)	2,230.53	52.97	32.30	2,316

3.3.2 Gross Impact Evaluation

This program is disaggregated into four initiatives for evaluation. The impact evaluation of the Upstream Lighting initiative is described in detail in Appendix I. The impact evaluation of the Upstream Electronics initiative is described in detail in Appendix J. The impact evaluation of the Res HVAC initiative is described in detail in Appendix K. The impact evaluation of the Res Appliances initiative is described in detail in Appendix L. Table 91 summarizes program verified impacts and realization rates for each EDC.

Table 91: EEP Program Gross Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Upstream Lighting	35,707	4.54	141.0%	151.1%
Met-Ed	Upstream Electronics	422	0.04	113.2%	112.7%
Met-Ed	HVAC	1,796	0.47	162.4%	141.9%
Met-Ed	Appliances	3,126	0.59	138.8%	138.4%
Met-Ed Total		**41,050**	**5.64**	**141%**	**148%**
Penelec	Upstream Lighting	36,254	4.22	137.1%	151.4%
Penelec	Upstream Electronics	210	0.02	114.1%	115.4%
Penelec	HVAC	1,977	0.34	206.2%	104.5%
Penelec	Appliances	2,284	0.46	135.6%	133.4%
PenelecTotal		**40,726**	**5.04**	**139%**	**145%**
Penn Power	Upstream Lighting	15,112	1.89	138.9%	149.6%
Penn Power	Upstream Electronics	144	0.02	114.0%	113.2%
Penn Power	HVAC	576	0.15	140.9%	137.2%
Penn Power	Appliances	851	0.17	139.6%	137.4%
Penn PowerTotal		**16,683**	**2.22**	**139%**	**147%**
WPP	Upstream Lighting	37,709	5.06	139.0%	145.7%
WPP	Upstream Electronics	633	0.07	114.6%	115.4%
WPP	HVAC	2,999	0.58	194.7%	123.5%
WPP	Appliances	3,143	0.61	138.1%	136.2%
WPP Total		**44,483**	**6.32**	**141%**	**142%**

The gross realization rates for energy savings were driven primarily by the realization rates of the upstream lighting programs. The reported impacts for upstream lighting are somewhat conservative because reported impacts do not include additional savings contributions from cross sector sales.

3.3.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY10. The net impact evaluation of the Upstream Lighting Initiative is described in Appendix I.2. The net impact evaluation of the Upstream Electronics Initiative as described in Appendix J.2. The net impact evaluation for the Res HVAC Initiative is described in Appendix K.2. The NTG evaluation for the Res Appliances Initiative is described in Appendix L.2. Table 92 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 92: EEP Program Net Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Upstream Lighting	35,707	29.0%	10,355
Met-Ed	Upstream Electronics	422	58.3%	246
Met-Ed	HVAC	1,796	45.0%	808
Met-Ed	Appliances	3,126	52.0%	1,625
Met-Ed Total		**41,050**	**31.8%**	**13,035**
Penelec	Upstream Lighting	36,254	31.0%	11,239
Penelec	Upstream Electronics	210	58.3%	122
Penelec	HVAC	1,977	52.0%	1,028
Penelec	Appliances	2,284	48.0%	1,097
Penelec Total		**40,726**	**33.1%**	**13,486**
Penn Power	Upstream Lighting	15,112	26.0%	3,929
Penn Power	Upstream Electronics	144	58.3%	84
Penn Power	HVAC	576	56.0%	322
Penn Power	Appliances	851	47.0%	400
Penn Power Total		**16,683**	**28.4%**	**4,736**
WPP	Upstream Lighting	37,709	23.0%	8,673
WPP	Upstream Electronics	633	58.3%	369
WPP	HVAC	2,999	49.0%	1,469
WPP	Appliances	3,143	50.0%	1,571
WPP Total		**44,483**	**27.2%**	**12,083**

3.3.3.1 High-Impact Measure Research

The Upstream Lighting Initiative was identified as a High-Impact Measure, and researched for net-to-gross in PY8. The net impact evaluation of the Upstream Lighting Initiative is described in Appendix I.2.

3.3.4 Verified Savings Estimates

In Table 93 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 PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 93: PYTD and P3TD 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	29,061	3.80	29,264	3.48	12,021	1.51	31,495	4.45
PYVTD Gross	41,050	5.64	40,726	5.04	16,683	2.22	44,483	6.32
PYVTD Net	13,035	1.86	13,486	1.72	4,736	0.66	12,083	1.79
RTD	78,603	10.02	89,813	10.15	28,473	3.49	89,895	12.32
VTD Gross	102,598	13.99	112,143	13.66	37,724	4.98	114,484	16.19
VTD Net	36,342	5.05	38,194	4.73	13,058	1.77	32,044	4.68

3.3.5 Process Evaluation

Process evaluation activities were conducted for various components of this program in each of the first three program years of Phase III, as summarized in in Table 94 below. PY10 process evaluation activities focused on point of sale lighting and electronics program components.

Table 94: EEP Program Process Evaluation Sample Design

EDC	Measure	Latest Activity	Population Size	Achieved Sample Size	Response Rate
Met-Ed	Appliances and HVAC	Customer Surveys (PY8)	3,424	150	27%
Penelec	Appliances and HVAC		2,736	144	27%
Penn Power	Appliances and HVAC		785	117	26%
WPP	Appliances and HVAC		4,167	146	26%
Met-Ed	Appliances	Retailer Surveys (PY9)	282	20	34%
Penelec	Appliances		350	13	24%
Penn Power	Appliances		242	23	40%
WPP	Appliances		88	15	29%
Met-Ed	Lighting	Customer General Population Survey (PY10)	391,882	233	19.2%
Penelec	Lighting		352,700	146	22.3%
Penn Power	Lighting		114,596	255	21.1%
WPP	Lighting		321,468	237	18.6%
All EDCs	Lighting	Retailer Interviews (PY10)	275	140	52.7%
All EDCs	Lighting	Shelf Stocking Study (PY10)	275	17	4.4%
All EDCs	Electronics	Retailer Interviews (PY10)	11	5	45.5%
Program Total			**1,193,281**	**1,661**	**25.5%**

Process evaluation efforts for each program component are summarized below. Key findings and recommendations are listed in Section 3.3.7.

3.3.5.1 Appliances & HVAC

The appliances and HVAC sub-programs were combined for process evaluation since they are both downstream delivery that provide incentives directly to customers. The process evaluation kicked off with interviews of FirstEnergy and ICSP program staff. The evaluation followed up with a participant customer survey, delivered by web and phone. Researchable issues focused on program awareness and marketing, interactions with contractors and retailers, satisfaction, and participation in the low-income appliance component. The survey sample was randomly selected for each EDC. In PY9, the evaluation team conducted additional activities to inform the process evaluation, including a survey of participating retailers. Related results and recommendations are included in Section 3.3.7.

3.3.5.2 Lighting

The lighting sub-program process evaluation began with interviews with FirstEnergy and ICSP program staff. Additionally, the evaluation included a web survey of FirstEnergy residential

customers to gather information on their awareness, perception, and preference of different types of lighting, purchase behaviors, and awareness of the FirstEnergy program. Because the program provides a discount on the purchase price as opposed to a customer incentive, participants do not need to be aware of the program to participate. The survey reached customers who likely participated, as well as some who did not. Tetra Tech also conducted shelf stocking studies at 12 participating and five nonparticipating stores. The purpose of these visits was to collect data to evaluate three market progress indicators (MPIs) identified in the Pennsylvania Evaluation Framework:

- Are program products readily available and identifiable on store shelves?
- Are there direct alternatives to program products, whether efficient or inefficient?
- How do the prices of program products compare to similar non-program products?

Tetra Tech also conducted 140 telephone surveys with participating retail stores. The process evaluation component of the survey was designed to gather information on the energy-efficient lighting products sold, sales trends over the past year, expectations about future LED sales, program marketing activities, customer preferences, and suggestions on how to improve the program. Related results and recommendations are included in Section 3.3.7.

Program staff feel the Lighting subprogram is running smoothly: They have a good relationship with retail partners and they are happy with the ICSP. Likewise, the ICSP said communication with FirstEnergy is going well, and they do not have difficulties maintaining a sufficient number of participating stores. The ICSP markets the Lighting subprogram with email and direct mail campaigns and the subcomponents of the EEP program are cross-promoted. The ICSP tries to participate in a community event promoting the program every month.

3.3.5.3 Electronics

The electronics sub-program process evaluation began with interviews with FirstEnergy and ICSP program staff. Additionally, all eleven participating retailers were invited to participate in telephone interviews, of which five participated. The survey included net-to-gross and process evaluation components, similar to those fielded to lighting retailers. Related results and recommendations are included in Section 3.3.7.

Discussion with the FirstEnergy staff in PY10 revealed that the program is running as expected despite not yet reaching its goals. They have a good working relationship with Best Buy (the sole participating retailer) and have no concerns about the measures eligible through the program. They do not have plans to make any changes to measure offerings or incentive levels for PY11. Honeywell, the ICSP, believes the program is running smoothly and they have a good working relationship with FirstEnergy and Best Buy. Enrolling stores in the program is a challenge because of the data processing requirements.

3.3.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 96, Table 97, Table 98, and Table 99 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 2018 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

The TRCs presented in this report are considered conservative, as they reflect a dual baseline protocol for residential lighting measures consistent with the current TRM. The TRM specifies that "*calculations for bulbs expected to be installed or remain in use past 2020. For these bulbs, [post EISA 2007 baseline wattages] should be used for the savings calculations until 2020, followed by the [post 2020 baseline wattages] for the remainder of the measure life."* The Companies note that since the TRM was adopted in 2015, there is growing uncertainty about the likelihood of DOE enforcement of EISA 2020 standard changes as well as the availability of pre 2020 baseline bulbs in the market. This has resulted in most states not adopting the prospective change in standards in cost effectiveness calculations, resulting in higher lifetime savings and benefits.

If TRCs were to not use the dual baselines, gross and net TRCs for the Energy Efficient Products program would increase by 50%, on average, per EDC. Gross and Net TRCs for the EE Products programs, with and without dual baseline treatment are presented in the following table:

Table 95 – Energy Efficient Products Program TRC with and without Dual Baseline Calculations

	Gross		Net	
EDC	Dual Baseline	Without Dual Baseline	Dual Baseline	Without Dual Baseline
Met-Ed	1.69	2.51	1.23	1.76
Penelec	1.68	2.54	1.17	1.73
Penn Power	2.04	3.11	1.39	2.04
WPP	1.65	2.44	1.04	1.44
Average	1.76	2.65	1.21	1.74

Table 96: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	2,348		5,472		2,348		5,472	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	6,773		9,738		1,120		513	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**9,122**		**15,210**		**3,468**		**5,985**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	1	1	140	1	1	1	140
6	Administration, Management, and Technical Assistance [3]	108	231	140	506	108	231	140	506
7	Marketing [4]	8	57	22	240	8	57	22	240
8	Program Delivery [5]	0	539	0	1,501	0	539	0	1,501
9	EDC Evaluation Costs	143		322		143		322	
10	SWE Audit Costs	27		102		27		102	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,116**		**2,974**		**1,116**		**2,974**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**10,237**		**23,578**		**4,584**		**11,111**	
14	Total NPV Lifetime Electric Energy Benefits	9,468		22,799		3,153		8,292	
15	Total NPV Lifetime Electric Capacity Benefits	2,790		8,343		966		3,098	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	5,203		12,030		1,509		4,088	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-205		-1,699		8		-544	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**17,256**		**41,472**		**5,636**		**14,935**	
19	**TRC Benefit-Cost Ratio [8]**	**1.69**		**1.76**		**1.23**		**1.34**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 97: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	1,901		4,894		1,901		4,894	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	6,336		8,824		1,550		593	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**8,237**		**13,718**		**3,451**		**5,487**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	1	1	150	1	1	1	150
6	Administration, Management, and Technical Assistance [3]	109	219	151	515	109	219	151	515
7	Marketing [4]	8	40	21	209	8	40	21	209
8	Program Delivery [5]	0	511	0	1,547	0	511	0	1,547
9	EDC Evaluation Costs	137		309		137		309	
10	SWE Audit Costs	27		103		27		103	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,052**		**3,007**		**1,052**		**3,007**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**9,290**		**20,586**		**4,503**		**9,847**	
14	Total NPV Lifetime Electric Energy Benefits	8,874		24,165		3,069		8,419	
15	Total NPV Lifetime Electric Capacity Benefits	2,369		8,435		840		2,957	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	4,808		13,060		1,490		4,299	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-479		-2,988		-113		-952	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**15,572**		**42,673**		**5,287**		**14,722**	
19	**TRC Benefit-Cost Ratio [8]**	**1.68**		**2.07**		**1.17**		**1.50**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 98: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	738		1,606		738		1,606	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	2,089		2,799		309		152	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**2,827**		**4,405**		**1,047**		**1,757**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	0	0	33	0	0	0	33
6	Administration, Management, and Technical Assistance [3]	24	69	4	134	24	69	4	134
7	Marketing [4]	2	10	5	37	2	10	5	37
8	Program Delivery [5]	0	162	0	389	0	162	0	389
9	EDC Evaluation Costs	30		67		30		67	
10	SWE Audit Costs	6		23		6		23	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**303**		**693**		**303**		**693**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**3,130**		**6,704**		**1,350**		**3,138**	
14	Total NPV Lifetime Electric Energy Benefits	3,584		7,979		1,067		2,860	
15	Total NPV Lifetime Electric Capacity Benefits	1,030		2,307		324		853	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,981		4,319		515		1,454	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-225		-756		-33		-242	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**6,370**		**13,849**		**1,873**		**4,925**	
19	**TRC Benefit-Cost Ratio [8]**	**2.04**		**2.07**		**1.39**		**1.57**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 99: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	2,316		5,782		2,316		5,782	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	6,999		10,080		1,189		35	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**9,314**		**15,862**		**3,505**		**5,817**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	1	1	163	1	1	1	163
6	Administration, Management, and Technical Assistance [3]	121	256	239	577	121	256	239	577
7	Marketing [4]	9	143	23	456	9	143	23	456
8	Program Delivery [5]	0	597	0	1,721	0	597	0	1,721
9	EDC Evaluation Costs	158		344		158		344	
10	SWE Audit Costs	28		107		28		107	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,314**		**3,631**		**1,314**		**3,631**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**10,628**		**25,172**		**4,819**		**11,374**	
14	Total NPV Lifetime Electric Energy Benefits	9,884		23,108		2,916		6,790	
15	Total NPV Lifetime Electric Capacity Benefits	3,008		9,402		915		2,776	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	5,207		12,805		1,198		3,238	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-524		-3,196		-21		-711	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**17,575**		**42,118**		**5,008**		**12,092**	
19	**TRC Benefit-Cost Ratio [8]**	**1.65**		**1.67**		**1.04**		**1.06**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.3.7 Status of Recommendations

The process evaluation activities in PY10 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 are available in the PY8 and PY9 annual reports.

3.3.7.1 Upstream Lighting

The PY10 process evaluation resulted in several noteworthy findings and recommendations. Not all findings and recommendations have a one-to-one correspondence, therefore the findings are disclosed first, followed by recommendations

Finding #1: *The Lighting subprogram is running well and is ahead of schedule to reach its Phase III savings goals.* The program is running smoothly and achieving its savings goals. Also, relationships with retail stores are good, and FirstEnergy and Honeywell both feel they have a good working relationship.

Finding #2: *Awareness of energy-efficient lighting products among general population survey participants is high*. Most customers are "very familiar" or “extremely familiar” with CFLs (73 percent), and almost all are at least “somewhat familiar” with LEDs (93 percent). Most believe that LEDs are more energy-efficient than CFLs (83 percent).

Finding #3: *Usage of LEDs in the home is high.* Over 80 percent of surveyed customers who are familiar with LEDs report having ever used LEDs in their homes, and more than one-half of customers who plan to install bulbs in their homes in the next 12 months are “very likely” or “extremely likely” to install LEDs (58 percent). More than one-half of customers prefer LEDs over CFLs because of the shape of the bulb, the look of the bulb, because the bulbs do not produce heat, and there is no mercury in LEDs.

Finding #4: *Customers consider LED bulbs a “bargain” at $3.18 and “starting to get expensive” at $6.74.* LED bulbs priced at $2.31 or below were considered so cheap they would question the quality of the bulb, and a price of $7.97 or higher is too expensive to buy.

Finding #5: *Awareness of program-sponsored price discounts is low.* Overall, one in five customers who purchased a program-eligible lighting product was aware that the price of the bulbs they purchased had been discounted. This is an increase from PY8 results where one in ten customers were aware of the discounts. Over one-half recall seeing signs, displays, or other materials near the bulbs that provided information about lighting characteristics; however, only six percent recall seeing EDC or FirstEnergy branded materials.

Finding #6: *Six percent of customers have visited their EDC’s website to find lighting information.* Of those that have, 88 percent found the information they were looking for, but also reported the website as being the least influential program aspect in their decision to purchase LEDs. Those that did not find what they were looking for on the website said cost and information on which bulbs work best were what they were seeking.

Finding #7: *Price is one of the factors customers consider when shopping for lighting.* Eighty-one percent of retailers mentioned price as the main factor customers consider when shopping for lighting; however, customers mentioned other factors beyond price. The wattage of the bulb and lumens or brightness were also important to customers (78 percent and 70 percent, respectively).

Finding #8: *One in five participating retail stores said they interacted with Honeywell during PY10.* For those that had not, 44 percent reported having instead worked with Greenlite Lighting, an LED manufacturer. Honeywell is the program implementer and is responsible for managing retail store relationships, but they have enlisted the help of Greenlite Lighting to increase program awareness and participation.

Finding #9: *ENERGY STAR® certified LEDs accounted for more than one-half of total annual lighting sales among participating retailers (58 percent).* However, sales ranged widely by retail store, accounting for 1 percent to 100 percent of lighting sales.

Finding #10: *Without the price discount, 87 percent of retailers said their sales of ENERGY STAR certified LEDs would have been lower.* Over two-thirds rated the level of program influence a four or five on a scale of one to five, where one means "little or no influence" and five means "extremely influential."

Finding #11: *Satisfaction with the Lighting subprogram among participating retailers is high.* Almost 70 percent are "very satisfied" or "extremely satisfied" with the program. Suggestions for ways the program could be even more useful to their stores included increasing the amount of program information provided and increasing marketing efforts. Having a dedicated program representative and more program-provided displays were also mentioned.

Finding #12: *Program products are more readily available than non-program alternatives.* The shelf-stocking study found more program products available than other ENERGY STAR certified lights, other efficient lights, or inefficient alternatives.

Finding #13: *Program incentives make program products cost-competitive with inefficient alternatives.* The prices gathered through the shelf-stocking study show average program product prices are close to inefficient alternatives. Program products appear to be less expensive than even non-ENERGY STAR certified efficient products. The shelf-stocking study also found other efficient light prices exceeded the point where customers reported in the general population study that they would consider a product to be expensive, while program product prices were within the range that customers would consider purchasing the product.

Recommendation #1: *Ensure Honeywell develops a direct working relationship with all participating retail stores to ensure sufficient information and program materials are made available.* The retailer survey found that roughly one-quarter of stores surveyed worked primarily with Greenlite Lighting rather than Honeywell. This may result in missed opportunities for proper training and program promotion at the stores.

EDC Status Report #1: Recommendation accepted.

3.3.7.2 Upstream Electronics

The PY10 process evaluation resulted in several noteworthy findings and recommendations. Not all findings and recommendations have a one-to-one correspondence, therefore the findings are disclosed first, followed by recommendations

Finding #1: *The Electronics subprogram is not reaching its savings goals, but this is not a concern for PY10 because savings goals are at the program and portfolio level, and the Lighting*

subprogram is overachieving. Honeywell's focus has been on trying to increase the number of participating retail stores and develop a good working relationship with Best Buy, its only participating retail chain in PY10.

Finding #2: *It has been a challenge to sign up retail stores for the Electronics subprogram*. Best Buy is the only retail store participating in the Electronics subprogram. Honeywell has approached other retailers but received feedback indicating that the amount of time it takes for the stores to submit invoices for eligible electronics costs more than the amount in rebates they receive. One big chain told Honeywell they would have to hire additional staff to participate.

Finding #3: *Retail store awareness of the Electronics subprogram is low.* Just over one-third (35 percent) of all retail store respondents that sold program-eligible equipment were aware of the program. Almost two-thirds of those that were not previously aware of the program said they would be interested in participating in the future (64 percent). For those not interested, the most frequently mentioned reason was that those decisions are made at the corporate level.

Recommendation #1: *Continue efforts to increase retail store participation in the Electronics subprogram*. Begin with increased marketing of the program and outreach efforts to increase awareness of the program.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Look for additional ways to reduce the submission burden for stores*. One of the key barriers mentioned by retail stores for not participating is the requirement to provide monthly sales data. Another key barrier is that decisions are being made at the corporate level.

EDC Status Report #2: Recommendation under consideration. The Companies note that basic measurement and verification will require some amount of data collection and regular reporting.

3.4 LOW INCOME ENERGY EFFICIENCY PROGRAM

The Low Income Energy Efficiency Program (LIEEP) has six distinct components, 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.

The *Low Income Appliance Turn-In* (LI ATI) component is administered by ARCA. The program is implemented in parallel with the main residential Appliance Turn-In 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:

- Low Income EE Kits administered by PowerDirect
- Low Income School Education Program administered by AM Conservation Group (AMCG)

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. Each kit is treated as a participant.

The *Low Income Appliance Rebates* (LI Appliances) component is administered by Honeywell and provides for 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 to low-income qualified customers.

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

3.4.1 Participation and Reported Savings by Customer Segment

Table 100 presents the participation counts, reported energy and demand savings, and incentive payments for the Appliance Turn-In Program in PY10 by customer segment and EDC. This program serves only the residential customer segment. The EE&C portfolios include separate Appliance Turn-In program components, also administered by ARCA, to serve the low-income residential and the nonresidential customer segments.

Table 100: LIEEP Participation and Reported Impacts

Parameter	Met-Ed LI Residential	Penelec LI Residential	Penn Power LI Residential	WPP LI Residential
PYTD # Participants	31,297	35,507	8,548	30,270
PYRTD MWh/yr	11,093	10,924	3,418	9,896
PYRTD MW/yr	1.39	1.22	0.40	1.31
PYTD Incentives ($1000)	85.87	103.01	32.74	82.72

3.4.2 Gross Impact Evaluation

The gross impact evaluation of this program is described in detail in Appendix D.1. Table 101 summarizes program verified impacts and realization rates for each EDC.

Table 101: LIEEP Gross Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliances	21	0.00	121.6%	111.5%
Met-Ed	Appliance Turn-In	952	0.14	107.7%	104.6%
Met-Ed	Direct Install	1,607	0.18	103.4%	112.3%
Met-Ed	Home Energy Reports	3,760	0.42	136.9%	97.3%
Met-Ed	Kits	6,891	0.79	117.0%	119.9%
Met-Ed	New Homes	0	0.00	74.0%	81.4%
Met-Ed Total		**13,231**	**1.53**	**119%**	**110%**
Penelec	Appliances	40	0.01	121.5%	114.4%
Penelec	Appliance Turn-In	1,036	0.15	93.6%	94.1%
Penelec	Direct Install	2,137	0.21	95.3%	97.8%
Penelec	Home Energy Reports	1,881	0.21	106.8%	79.9%
Penelec	Kits	6,822	0.70	118.0%	122.6%
Penelec	New Homes	0	0.00	72.2%	92.2%
PenelecTotal		**11,917**	**1.28**	**109%**	**105%**
Penn Power	Appliances	9	0.00	112.5%	103.1%
Penn Power	Appliance Turn-In	292	0.04	86.9%	85.4%
Penn Power	Direct Install	611	0.07	96.9%	99.5%
Penn Power	Home Energy Reports	605	0.07	80.4%	70.9%
Penn Power	Kits	2,029	0.24	120.6%	130.1%
Penn Power	New Homes	5	0.00	68.3%	71.0%
Penn PowerTotal		**3,552**	**0.42**	**104%**	**105%**
WPP	Appliances	27	0.00	116.4%	107.5%
WPP	Appliance Turn-In	779	0.11	92.8%	92.2%
WPP	Direct Install	1,701	0.18	97.6%	99.0%
WPP	Home Energy Reports	2,130	0.24	88.5%	55.5%
WPP	Kits	5,796	0.71	118.9%	120.9%
WPP	New Homes	8	0.00	83.9%	75.7%
WPP Total		**10,441**	**1.24**	**105%**	**94%**

The gross realization rates for energy savings were driven primarily by the two largest components, Home Energy Reports and Kits. Appliance Turn-In 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. Although verification rates determined through surveys were approximately 100%, the realization rates are generally lower than 100% because the part-use factors are lower than the TRM default values, and the calculated unit energy consumptions were lower than what would expect from application of default parameters in the TRM. Realization rates were closest to 100% for the Direct Install component, despite the fact that it is the most complex of the six distinct programmatic efforts and includes dozens of potential measures. This is in part due to close coordination between FirstEnergy and ADM in tracking and reporting and program quality assurance activities.

3.4.3 Net Impact Evaluation

Net impact evaluation was not formally conducted for this program in PY10, in accordance with our revaluation plan. NTG results are available for the Appliance Turn-In program component. The NTG for the Low Income Energy Efficiency Program is estimated as 1.0 at this time for the purpose net cost effectiveness calculations.

3.4.4 Verified Savings Estimates

In Table 102 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 PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 102: PYTD and P3TD 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	11,093	1.39	10,924	1.22	3,418	0.40	9,896	1.31
PYVTD Gross	13,231	1.53	11,917	1.28	3,552	0.42	10,441	1.24
PYVTD Net	13,231	1.53	11,917	1.28	3,552	0.42	10,441	1.24
RTD	30,481	3.73	31,603	3.67	9,914	1.24	29,890	3.96
VTD Gross	34,754	4.02	34,838	3.72	10,110	1.18	31,382	3.70
VTD Net	34,754	4.02	34,838	3.72	10,110	1.18	31,382	3.70

3.4.5 Process Evaluation

Tetra Tech conducted a process evaluation for this program in PY8. The process evaluation for the Low Income WARM and Multifamily components began with an interview of the program manager. These components do not rely on an ICSP for delivery. The evaluation centered on a phone survey of customers, and also involved interviews with contractors. The survey sample was randomly selected for each EDC.

Process evaluations for the Appliance Rebate, Behavioral, and Kits sub-programs were conducted with the similar Non-Low Income programs in the Energy Efficient Products and Energy Efficient Homes programs, respectively. Findings and recommendations for those program components are reported in those sections. The sample design is shown in Table 103. Please note that the population counts in the table are from PY8, not PY10.

Table 103: LIP Program Process Evaluation Sample Design

EDC	Population Size	Achieved Sample Size	Response Rate
Met-Ed	1,551	80	30.0%
Penn Power	2,433	85	38.0%
Penelec	842	73	36.0%
WPP	1,954	101	35.0%

Key findings and recommendations are listed in Section 3.4.7.

3.4.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 104, Table 105, Table 106, and Table 107 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 2018 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 104: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	86		278		86		278	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	10		28		10		28	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**96**		**306**		**96**		**306**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	2	2	2	201	2	2	2	201
6	Administration, Management, and Technical Assistance [3]	144	579	463	1,086	144	579	463	1,086
7	Marketing [4]	6	158	14	371	6	158	14	371
8	Program Delivery [5]	108	2,422	320	7,359	108	2,422	320	7,359
9	EDC Evaluation Costs	119		317		119		317	
10	SWE Audit Costs	52		199		52		199	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**3,590**		**10,332**		**3,590**		**10,332**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**3,687**		**9,998**		**3,687**		**9,998**	
14	Total NPV Lifetime Electric Energy Benefits	2,564		6,001		2,564		6,001	
15	Total NPV Lifetime Electric Capacity Benefits	620		1,723		620		1,723	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	547		488		547		488	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	690		660		690		660	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**4,421**		**8,872**		**4,421**		**8,872**	
19	**TRC Benefit-Cost Ratio [8]**	**1.20**		**0.89**		**1.20**		**0.89**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 105: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	103		268		103		268	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	15		22		15		22	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**118**		**290**		**118**		**290**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	2	2	3	219	2	2	3	219
6	Administration, Management, and Technical Assistance [3]	163	552	521	1,120	163	552	521	1,120
7	Marketing [4]	6	130	13	317	6	130	13	317
8	Program Delivery [5]	138	2,363	423	7,120	138	2,363	423	7,120
9	EDC Evaluation Costs	123		347		123		347	
10	SWE Audit Costs	55		209		55		209	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**3,535**		**10,292**		**3,535**		**10,292**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**3,653**		**9,931**		**3,653**		**9,931**	
14	Total NPV Lifetime Electric Energy Benefits	2,564		6,385		2,564		6,385	
15	Total NPV Lifetime Electric Capacity Benefits	567		1,721		567		1,721	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	492		434		492		434	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	610		619		610		619	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**4,234**		**9,159**		**4,234**		**9,159**	
19	**TRC Benefit-Cost Ratio [8]**	**1.16**		**0.92**		**1.16**		**0.92**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 106: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	33		106		33		106	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	6		8		6		8	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**39**		**114**		**39**		**114**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	0	1	54	1	0	1	54
6	Administration, Management, and Technical Assistance [3]	49	149	156	283	49	149	156	283
7	Marketing [4]	2	45	4	107	2	45	4	107
8	Program Delivery [5]	58	580	174	2,108	58	580	174	2,108
9	EDC Evaluation Costs	41		112		41		112	
10	SWE Audit Costs	16		59		16		59	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**940**		**3,059**		**940**		**3,059**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**979**		**3,013**		**979**		**3,013**	
14	Total NPV Lifetime Electric Energy Benefits	762		1,939		762		1,939	
15	Total NPV Lifetime Electric Capacity Benefits	184		491		184		491	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	146		140		146		140	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	175		136		175		136	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**1,267**		**2,706**		**1,267**		**2,706**	
19	**TRC Benefit-Cost Ratio [8]**	**1.29**		**0.90**		**1.29**		**0.90**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 107: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	83		242		83		242	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	14		22		14		22	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**97**		**264**		**97**		**264**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	2	2	2	197	2	2	2	197
6	Administration, Management, and Technical Assistance [3]	141	480	455	968	141	480	455	968
7	Marketing [4]	5	154	13	403	5	154	13	403
8	Program Delivery [5]	120	2,178	350	6,898	120	2,178	350	6,898
9	EDC Evaluation Costs	124		338		124		338	
10	SWE Audit Costs	44		169		44		169	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**3,250**		**9,791**		**3,250**		**9,791**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**3,347**		**9,476**		**3,347**		**9,476**	
14	Total NPV Lifetime Electric Energy Benefits	2,131		5,537		2,131		5,537	
15	Total NPV Lifetime Electric Capacity Benefits	535		1,453		535		1,453	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	429		383		429		383	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	523		529		523		529	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**3,618**		**7,902**		**3,618**		**7,902**	
19	**TRC Benefit-Cost Ratio [8]**	**1.08**		**0.83**		**1.08**		**0.83**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.4.7 Status of Recommendations

There were no process evaluation activities for this program in PY10. Findings and recommendations from previous process evaluation efforts are available in the PY8 and PY9 annual reports.

3.5 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 is implemented jointly by Sodexo and ARCA. The Sodexo portion of the program includes downstream incentives for customers that install energy efficient equipment. Major program components include lighting (both new construction and retrofits), custom HVAC upgrades, compressed air projects, process improvements, and prescriptive HVAC, refrigeration, and food-service measures. The incentives for most downstream measures are proportional to the reported energy savings. The ARCA portion of the program included refrigerator, freezer, and room air conditioner recycling.

3.5.1 Participation and Reported Savings by Customer Segment

Table 108 and Table 109 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Small Program in PY10 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 108: 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	502	72	574	777	170	947
PYRTD MWh/yr	24,124	2,573	26,697	25,214	5,570	30,784
PYRTD MW/yr	3.70	0.33	4.04	3.89	0.86	4.76
PYTD Incentives ($1000)	1,044.21	126.52	1,170.73	1,204.40	271.97	1,476.37

Table 109: 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	300	31	331	658	139	797
PYRTD MWh/yr	12,682	1,189	13,871	26,764	4,509	31,273
PYRTD MW/yr	1.87	0.16	2.03	3.74	0.79	4.53
PYTD Incentives ($1000)	632.82	59.57	692.39	1,307.52	233.39	1,540.91

3.5.2 Gross Impact Evaluation

The ESB-Small Program was disaggregated into four sampling initiatives for gross impact evaluation, as described in Appendix C. The Appliance Turn-In program component, administered by ARCA, was evaluated as a separate initiative. The gross impact evaluation for the Appliance Turn-In initiative is described in detail in Appendix S. Lighting improvements were grouped into the C/I Lighting initiative, and evaluated according to PA TRM protocols as

described in detail in Appendix P. Prescriptive HVAC and appliance projects were grouped into the Prescriptive Initiative. The evaluation of Prescriptive projects is described in Appendix R. 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 Q. The program also has a Direct Install Initiative. Evaluation activities for the Direct Install Initiative are described in Appendix T. For all EDCs, the Lighting initiative attributed for the majority of program savings, followed by the Custom initiative. The Prescriptive and Appliance Turn-In initiatives accounted for small fractions of overall program impacts. Table 110 summarizes program verified impacts and realization rates for each EDC.

Table 110: ESB-Small Program Gross Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Lighting	24,258	3.76	99%	101%
Met-Ed	Custom	714	0.07	102%	84%
Met-Ed	Prescriptive	1,337	0.16	100%	79%
Met-Ed	Appliance Turn-In	77	0.01	113%	90%
Met-Ed	Direct Install	0	0.00	100%	100%
Met-Ed Total		**26,386**	**4.00**	**99%**	**99%**
Penelec	Lighting	29,978	4.00	109%	96%
Penelec	Custom	1,695	0.30	95%	82%
Penelec	Prescriptive	1,557	0.07	105%	38%
Penelec	Appliance Turn-In	94	0.01	85%	72%
Penelec	Direct Install	0	0.00	100%	100%
PenelecTotal		**33,323**	**4.38**	**108%**	**92%**
Penn Power	Lighting	11,994	1.75	93%	92%
Penn Power	Custom	946	0.11	114%	87%
Penn Power	Prescriptive	161	0.01	98%	90%
Penn Power	Appliance Turn-In	20	0.00	99%	89%
Penn Power	Direct Install	0	0.00	100%	100%
Penn PowerTotal		13,121	1.87	95%	92%
WPP	Lighting	25,217	3.92	92%	94%
WPP	Custom	2,143	0.16	79%	56%
WPP	Prescriptive	1,175	0.05	104%	83%
WPP	Appliance Turn-In	111	0.01	107%	81%
WPP	Direct Install	0	0.00	100%	100%
WPP Total		**28,645**	**4.14**	**92%**	**91%**

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.

3.5.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY10. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2. The net impact evaluation of the Prescriptive Initiative is described in Appendix R.2. Net impact evaluation was not conducted for the Appliance Turn-In Initiative or the Direct Install Initiative. The NTG for the Appliance Turn-In Initiative is estimated to be the same as the NTG of the residential Appliance Turn-In Initiative, while the NTG of the Direct Install Initiative is estimated to be the same as for the Lighting Initiative, as all rebated projects to date were found to be lighting retrofits.

Table 111 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 111: ESB-Small Program Net Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Lighting	24,258	64.1%	15,540
Met-Ed	Custom	714	53.9%	385
Met-Ed	Prescriptive	1,337	53.9%	721
Met-Ed	Appliance Turn-In	77	45.0%	35
Met-Ed	Direct Install	0	100.0%	0
Met-Ed Total		**26,386**	**63.2%**	**16,681**
Penelec	Lighting	29,978	75.8%	22,732
Penelec	Custom	1,695	86.2%	1,461
Penelec	Prescriptive	1,557	53.3%	831
Penelec	Appliance Turn-In	94	47.0%	44
Penelec	Direct Install	0	100.0%	0
Penelec Total		**33,323**	**75.2%**	**25,067**
Penn Power	Lighting	11,994	77.1%	9,242
Penn Power	Custom	946	60.3%	570
Penn Power	Prescriptive	161	44.1%	71
Penn Power	Appliance Turn-In	20	51.0%	10
Penn Power	Direct Install	0	100.0%	0
Penn Power Total		**13,121**	**75.4%**	**9,893**
WPP	Lighting	25,217	66.8%	16,847
WPP	Custom	2,143	57.1%	1,223
WPP	Prescriptive	1,175	46.0%	540
WPP	Appliance Turn-In	111	48.0%	53
WPP	Direct Install	0	100.0%	0
WPP Total		**28,645**	**65.2%**	**18,664**

3.5.3.1 High-Impact Measure Research

The Lighting and Custom Initiatives were identified as High-Impact Measures and researched for net-to-gross in PY10. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2.

3.5.4 Verified Savings Estimates

In Table 112 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 PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 112: PYTD and P3TD 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	26,697	4.04	30,784	4.76	13,871	2.03	31,273	4.53
PYVTD Gross	26,386	4.00	33,323	4.38	13,121	1.87	28,645	4.14
PYVTD Net	16,681	2.54	25,067	3.34	9,893	1.42	18,664	2.74
RTD	76,158	11.38	77,753	11.86	36,303	5.37	77,361	11.27
VTD Gross	75,279	11.44	75,366	11.16	34,994	5.20	78,957	11.01
VTD Net	47,184	7.22	58,885	8.88	25,747	3.83	59,949	8.39

3.5.5 Process Evaluation

Tetra Tech conducted process evaluations for this program in PY8 and PY10. The process evaluation kicked off with interviews with FirstEnergy and ICSP staff. These interviews led to identification of issues that were researched through a participant survey and contractor interviews. The participant survey was conducted over the phone. Researchable issues focused on satisfaction, customer awareness and marketing, incentive levels, and program processes. Tetra Tech also conducted Vendor surveys and in-depth interviews, and benchmarking against comparable programs offered by other utilities.

Process evaluation activities were combined for the Large C&I, Small C&I, and Government and Institutional programs given the similarities in program delivery. Survey strata were based on the project type, and were defined as Custom, Lighting, or Other, with the Other category including prescriptive downstream measures (administered by Sodexo) but excluding Appliance Turn-In. The sample design from the PY10 process evaluation effort is shown in Table 113, and represents all C&I energy efficiency programs offered by each EDC.

Table 113: Combined C&I Program Process Evaluation Sample Design

Stratum	Population Size	Achieved Sample Size	Response Rate
Met-Ed Custom	46	23	56%
Met-Ed Lighting	553	125	43%
Met-Ed Prescriptive	33	14	48%
Penelec Custom	111	29	28%
Penelec Lighting	801	159	44%
Penelec Prescriptive	60	39	71%
Penn Power Custom	21	10	56%
Penn Power Lighting	275	71	47%
Penn Power Prescriptive	12	8	67%
WPP Custom	50	19	40%
WPP Lighting	651	121	37%
WPP Prescriptive	48	22	47%
Vendor Surveys	192	80	42%
Vendor Interviews	192	8	38%
Program Total	**3,045**	**728**	**43%**

Key findings and recommendations are listed in Section 3.5.7

3.5.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 114, Table 115, Table 116, and Table 117 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 2018 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 114: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	1,171		3,367		1,171		3,367	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	6,466		7,503		3,692		3,577	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**7,637**		**10,870**		**4,862**		**6,944**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	2	29	3	94	2	29	3	94
6	Administration, Management, and Technical Assistance [3]	76	309	173	985	76	309	173	985
7	Marketing [4]	0	161	0	447	0	161	0	447
8	Program Delivery [5]	65	263	201	825	65	263	201	825
9	EDC Evaluation Costs	215		456		215		456	
10	SWE Audit Costs	35		131		35		131	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,155**		**3,316**		**1,155**		**3,316**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**8,792**		**18,977**		**6,017**		**12,991**	
14	Total NPV Lifetime Electric Energy Benefits	10,863		28,207		6,878		17,710	
15	Total NPV Lifetime Electric Capacity Benefits	3,160		8,640		2,005		5,462	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,214		-3,092		-778		-1,979	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**12,809**		**33,756**		**8,105**		**21,194**	
19	**TRC Benefit-Cost Ratio [8]**	**1.46**		**1.78**		**1.35**		**1.63**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 115: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	1,476		4,197		1,476		4,197	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	8,608		11,120		6,184		7,701	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**10,085**		**15,317**		**7,660**		**11,897**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	3	32	3	96	3	32	3	96
6	Administration, Management, and Technical Assistance [3]	80	345	204	1,012	80	345	204	1,012
7	Marketing [4]	0	156	0	431	0	156	0	431
8	Program Delivery [5]	71	292	241	846	71	292	241	846
9	EDC Evaluation Costs	225		479		225		479	
10	SWE Audit Costs	38		139		38		139	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,242**		**3,451**		**1,242**		**3,451**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**11,327**		**26,440**		**8,902**		**21,549**	
14	Total NPV Lifetime Electric Energy Benefits	13,119		26,780		9,895		21,031	
15	Total NPV Lifetime Electric Capacity Benefits	3,322		8,365		2,530		6,698	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,981		-3,382		-1,518		-2,709	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**14,459**		**31,763**		**10,907**		**25,021**	
19	**TRC Benefit-Cost Ratio [8]**	**1.28**		**1.20**		**1.23**		**1.16**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 116: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	692		1,940		692		1,940	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	3,230		3,451		2,240		1,977	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**3,922**		**5,391**		**2,933**		**3,917**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	14	1	41	1	14	1	41
6	Administration, Management, and Technical Assistance [3]	35	155	62	438	35	155	62	438
7	Marketing [4]	0	31	0	87	0	31	0	87
8	Program Delivery [5]	29	121	70	343	29	121	70	343
9	EDC Evaluation Costs	54		115		54		115	
10	SWE Audit Costs	10		35		10		35	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**449**		**1,191**		**449**		**1,191**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**4,372**		**10,181**		**3,382**		**7,659**	
14	Total NPV Lifetime Electric Energy Benefits	5,138		12,521		3,881		9,235	
15	Total NPV Lifetime Electric Capacity Benefits	1,394		3,931		1,059		2,893	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-447		-1,422		-345		-1,083	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**6,084**		**15,030**		**4,595**		**11,044**	
19	**TRC Benefit-Cost Ratio [8]**	**1.39**		**1.48**		**1.36**		**1.44**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 117: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	1,541		4,083		1,541		4,083	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	6,293		8,872		3,536		5,217	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**7,834**		**12,955**		**5,077**		**9,300**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	5	98	5	166	5	98	5	166
6	Administration, Management, and Technical Assistance [3]	84	494	208	1,212	84	494	208	1,212
7	Marketing [4]	0	227	0	628	0	227	0	628
8	Program Delivery [5]	74	506	214	1,093	74	506	214	1,093
9	EDC Evaluation Costs	244		502		244		502	
10	SWE Audit Costs	36		131		36		131	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,768**		**4,158**		**1,768**		**4,158**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**9,601**		**29,618**		**6,844**		**23,888**	
14	Total NPV Lifetime Electric Energy Benefits	11,262		28,223		7,359		21,522	
15	Total NPV Lifetime Electric Capacity Benefits	3,193		8,302		2,114		6,386	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,363		-3,521		-910		-2,745	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**13,092**		**33,004**		**8,562**		**25,163**	
19	**TRC Benefit-Cost Ratio [8]**	**1.36**		**1.11**		**1.25**		**1.05**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.5.7 Status of Recommendations

The process evaluation activities in PY10 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.

Finding #1: *Satisfaction among participating customer and vendors remains high*. Average participant rating across all program aspects was 4.2 or higher for customers, and 3.8 or higher for vendors on a 1 to 5 scale where 1 was "not at all satisfied" and 5 was "very satisfied." High satisfaction with the program is also reflected by 60 percent of participants already recommending the program to others and 89 percent of customers indicating they were very likely to participate in the program in the future.

Finding #2: *Trade allies continue to be the most common source of respondent awareness of business energy efficiency programs*. Over one-half of survey participants (54 percent) learned about the program from their contractor or vendor, which is consistent with the efforts Sodexo (the Conservation Service Provider) has historically made in reaching out to contractors to make sure they are aware of the program offerings. Vendors also work extensively to promote the program; all vendors who were interviewed discuss the program with customers because it can help sell the equipment. The consensus among vendors is that about 30 percent of customers know that there are rebates available.

Finding #3: *Almost all program participants (93 percent) had no problems completing the program application*. That said, participant and vendors indicated there is room to improve and streamline the application. Satisfaction with the amount of the paperwork had the lowest satisfaction rating among vendors, and several customers and vendors reported that the application was too long and needed to be simplified.

Finding #4: *There is customer interest in retro-commissioning and advanced lighting control projects*. Both customers and vendors indicate a moderate to a high level of interest in both recommissioning and advanced lighting control projects with average interest ratings of 3.3 to 3.6, respectively. A key component to successfully incorporating these types of projects into the program is ensuring customers understand how these projects work.

Finding #5: *Customer interest in midstream[11] and behavior-type[12] programs was high, with an average interest rating of 4.1 for each*. Customers were only asked to rate their interest in these two types of programs and not asked any additional follow-up questions to be able to provide any context or comments.

Finding #6: *The secondary research that benchmarked FirstEnergy's programs with those of other utilities found that program structures were largely similar*, with program administrators targeting a broad range of small and Large C&I as well as government, nonprofit, and education customers. Some program administrators market separate programs to each segment;

[11] Midstream and upstream programs were defined as where a customer would "receive equipment at a discounted price at the time of purchase from retailers and distributors instead of completing and submitting an application for a rebate."

[12] Behavior-type programs were defined as where customers would "receive information from FirstEnergy with energy saving tips that do not require the need to purchase equipment."

however, many market to all customer segments jointly, but they distinctly plan and evaluate around subprograms behind the scenes.

Finding #7: *Measure offerings among the benchmarked programs differed slightly across program administrators, but the underlying structure remained much the same*, with each program administrator providing a range of prescriptive and custom offerings. FirstEnergy is one of a small subset of programs that explicitly lists building audits as a component of program participation. We identified variation in incentives for prescriptive and custom projects across program administrators, but these were largely the same among FirstEnergy, PECO, and PPL.

Finding #8: *The evaluation activities resulted in net-to-gross (NTG) ratios ranging from 68 to 83 percent across EDCs for the PY10 program*. The NTG, calculated from participant and vendor surveys, was highest among lighting projects and lowest among prescriptive projects. Results were similar to the PY8 evaluation, where NTG ratios ranged from 58 to 79 percent.

Recommendation #1: *Continue to promote the program utilizing diverse strategies, targeted to both customers and vendors*. Sodexo reported having different tactics depending on the time of year or the area of focus, which shows in the various ways customers hear about the program. Continue both direct and indirect contacts as a means of marketing the program and ensure this includes both customers and vendors.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Continue to look for ways to simplify the application and approval processes to reduce burden and ensure customers and vendors get paid within a timely manner*. Customers and vendors like that pre-approval is not necessary but felt that there could be better instructions on how to complete the application to reduce the time between application submittal and payment. Once the application is submitted and approved, reducing the time between payment is received will be key to customer and vendor satisfaction.

EDC Status Report #2: Recommendation accepted.

Recommendation #3: *Consider offering incentives for retro-commissioning and advanced lighting control projects and marketing these types of projects*. Customer interest appears to be high, but vendors indicated that the most common barrier to customers doing these types of projects was cost, mentioned by about 70 percent of vendors. Other barriers mentioned were having a better understanding of the work and the return-on-investment. Case studies may be a good way to promote these types of projects.

EDC Status Report #3: Recommendation accepted. The Companies note that retro-commissioning and advanced lighting controls are eligible as custom rebates, and note increased activity related to retro-commissioning in recent months. The Companies will engage the ICSP to increase awareness about these types of energy efficiency opportunities.

3.6 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 is implemented by Sodexo. The program includes downstream incentives for customers that install energy efficient equipment. Major program components include lighting (both new construction and retrofits), custom HVAC upgrades, compressed air projects, process improvements, and prescriptive HVAC, refrigeration, and food-service measures. The incentives for most downstream measures are proportional to the reported energy savings.

3.6.1 Participation and Reported Savings by Customer Segment

Table 118 and Table 119 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Small Program in PY10 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 118: 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	164	58	222	162	54	216
PYRTD MWh/yr	36,953	3,538	40,492	31,299	19,534	50,833
PYRTD MW/yr	4.54	0.50	5.04	3.68	2.35	6.03
PYTD Incentives ($1000)	1,608.19	178.42	1,786.61	1,453.96	629.05	2,083.01

Table 119: 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	37	7	44	123	43	166
PYRTD MWh/yr	8,145	560	8,705	20,925	4,179	25,104
PYRTD MW/yr	1.05	0.01	1.06	2.07	0.66	2.73
PYTD Incentives ($1000)	347.73	27.98	375.71	990.92	202.38	1,193.30

3.6.2 Gross Impact Evaluation

The ESB-Large Program was disaggregated into three sampling initiatives for gross impact evaluation, as described in Appendix C. Lighting improvements were grouped into the C/I Lighting initiative, and evaluated according to PA TRM protocols as described in detail in

Appendix P. Prescriptive HVAC and appliance projects were grouped into the Prescriptive Initiative. The evaluation of Prescriptive projects is described in Appendix R. 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 Q. For all EDCs, the Lighting Initiative attributed for the majority of program savings, followed by the Custom initiative. The Prescriptive and Appliance Turn-In initiatives accounted for small fractions of overall program impacts. Table 120 summarizes program verified impacts and realization rates for each EDC.

Table 120: ESB-Large Program Gross Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Lighting	34,630	4.59	99%	101%
Met-Ed	Custom	5,455	0.39	102%	84%
Met-Ed	Prescriptive	62	0.02	100%	79%
Met-Ed Total		**40,147**	**5.00**	**99.1%**	**99.1%**
Penelec	Lighting	29,161	3.00	109%	96%
Penelec	Custom	22,999	2.36	95%	82%
Penelec	Prescriptive	0	0.00	105%	38%
PenelecTotal		**52,161**	**5.36**	**102.6%**	**88.9%**
Penn Power	Lighting	6,409	0.68	93%	92%
Penn Power	Custom	2,093	0.28	114%	87%
Penn Power	Prescriptive	0	0.00	98%	90%
Penn PowerTotal		**8,503**	**0.96**	**97.7%**	**90.7%**
WPP	Lighting	20,705	2.15	92%	94%
WPP	Custom	2,104	0.24	79%	56%
WPP	Prescriptive	7	0.00	104%	83%
WPP Total		**22,816**	**2.39**	**90.9%**	**87.7%**

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.

3.6.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY0. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2. The net impact evaluation of the Prescriptive Initiative is described in Appendix R.2. Table 121 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 121: ESB-Large Program Net Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Lighting	34,630	64.1%	22,185
Met-Ed	Custom	5,455	53.9%	2,943
Met-Ed	Prescriptive	62	53.9%	33
Met-Ed Total		40,147	62.7%	25,160
Penelec	Lighting	29,161	75.8%	22,113
Penelec	Custom	22,999	86.2%	19,824
Penelec	Prescriptive	0	53.3%	0
Penelec Total		52,161	80.4%	41,937
Penn Power	Lighting	6,409	77.1%	4,939
Penn Power	Custom	2,093	60.3%	1,262
Penn Power	Prescriptive	0	44.1%	0
Penn Power Total		8,503	72.9%	6,200
WPP	Lighting	20,705	66.8%	13,832
WPP	Custom	2,104	57.1%	1,201
WPP	Prescriptive	7	46.0%	3
WPP Total		22,816	65.9%	15,037

3.6.3.1 High-Impact Measure Research

The Lighting and Custom Initiatives were identified as High-Impact Measures in PY10. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2.

3.6.4 Verified Savings Estimates

In Table 122 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 PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 122: PYTD and P3TD 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	40,492	5.04	50,833	6.03	8,705	1.06	25,104	2.73
PYVTD Gross	40,147	5.00	52,161	5.36	8,503	0.96	22,816	2.39
PYVTD Net	25,160	3.16	41,937	4.31	6,200	0.69	15,037	1.57
RTD	102,745	13.84	111,736	13.67	23,200	2.69	77,372	9.20
VTD Gross	101,423	13.76	106,175	12.36	22,587	2.51	76,251	8.44
VTD Net	59,042	7.93	83,796	9.88	15,426	1.72	50,069	5.86

3.6.5 Process Evaluation

The process evaluation effort for all three C&I Programs is described in Sections 3.5.5 and 3.5.7. Most practical aspects of the programs are managed as one general effort rather than three distinct programs, but applications are placed in one of three programs according to their associated rate classes.

3.6.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 123, Table 124, Table 125, and Table 126 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 2018 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 123: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	1,787		4,826		1,787		4,826	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	9,846		16,377		5,549		7,504	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**11,632**		**21,202**		**7,335**		**12,330**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	43	1	124	1	43	1	124
6	Administration, Management, and Technical Assistance [3]	67	341	136	977	67	341	136	977
7	Marketing [4]	0	106	0	291	0	106	0	291
8	Program Delivery [5]	30	468	93	1,344	30	468	93	1,344
9	EDC Evaluation Costs	221		497		221		497	
10	SWE Audit Costs	26		100		26		100	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,304**		**3,563**		**1,304**		**3,563**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**12,936**		**29,943**		**8,639**		**18,207**	
14	Total NPV Lifetime Electric Energy Benefits	16,541		38,243		10,380		22,250	
15	Total NPV Lifetime Electric Capacity Benefits	3,937		10,699		2,491		6,116	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,743		-3,346		-1,117		-2,154	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**18,735**		**45,596**		**11,754**		**26,212**	
19	**TRC Benefit-Cost Ratio [8]**	**1.45**		**1.52**		**1.36**		**1.44**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 124: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	2,083		5,025		2,083		5,025	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	14,281		17,082		11,077		12,205	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**16,364**		**22,107**		**13,160**		**17,230**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	51	1	128	1	51	1	128
6	Administration, Management, and Technical Assistance [3]	60	402	159	1,008	60	402	159	1,008
7	Marketing [4]	0	71	0	194	0	71	0	194
8	Program Delivery [5]	27	553	92	1,386	27	553	92	1,386
9	EDC Evaluation Costs	193		439		193		439	
10	SWE Audit Costs	24		90		24		90	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,381**		**3,496**		**1,381**		**3,496**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	2,785		2,443		2,401		2,106	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**20,530**		**39,993**		**14,542**		**30,165**	
14	Total NPV Lifetime Electric Energy Benefits	20,555		37,308		16,514		29,522	
15	Total NPV Lifetime Electric Capacity Benefits	4,066		8,885		3,268		7,119	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-979		-2,819		-659		-2,207	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**23,641**		**43,374**		**19,124**		**34,434**	
19	**TRC Benefit-Cost Ratio [8]**	**1.15**		**1.08**		**1.32**		**1.14**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 125: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	376		1,053		376		1,053	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	2,424		2,634		1,620		1,415	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**2,799**		**3,687**		**1,996**		**2,468**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	9	0	27	0	9	0	27
6	Administration, Management, and Technical Assistance [3]	24	74	53	214	24	74	53	214
7	Marketing [4]	0	9	0	24	0	9	0	24
8	Program Delivery [5]	12	101	28	294	12	101	28	294
9	EDC Evaluation Costs	42		95		42		95	
10	SWE Audit Costs	5		20		5		20	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**276**		**756**		**276**		**756**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**3,075**		**7,404**		**2,271**		**5,170**	
14	Total NPV Lifetime Electric Energy Benefits	3,320		7,946		2,425		5,443	
15	Total NPV Lifetime Electric Capacity Benefits	711		1,788		514		1,226	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-239		-619		-184		-502	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**3,792**		**9,116**		**2,755**		**6,167**	
19	**TRC Benefit-Cost Ratio [8]**	**1.23**		**1.23**		**1.21**		**1.19**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 126: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	1,193		3,503		1,193		3,503	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	5,263		6,436		3,007		3,315	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**6,456**		**9,938**		**4,200**		**6,818**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	29	1	100	1	29	1	100
6	Administration, Management, and Technical Assistance [3]	54	230	124	788	54	230	124	788
7	Marketing [4]	0	84	0	230	0	84	0	230
8	Program Delivery [5]	24	316	72	1,083	24	316	72	1,083
9	EDC Evaluation Costs	178		402		178		402	
10	SWE Audit Costs	19		74		19		74	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**936**		**2,874**		**936**		**2,874**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	233		204		133		117	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**7,625**		**26,472**		**5,269**		**18,671**	
14	Total NPV Lifetime Electric Energy Benefits	9,022		27,155		5,952		17,877	
15	Total NPV Lifetime Electric Capacity Benefits	1,842		6,214		1,213		4,353	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-886		-1,620		-615		-1,419	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**9,978**		**31,749**		**6,551**		**20,811**	
19	**TRC Benefit-Cost Ratio [8]**	**1.31**		**1.20**		**1.24**		**1.11**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.6.7 Status of Recommendations

Recommendations for the nonresidential programs are listed in Section 3.5.7.

3.7 GOVERNMENT AND INSTITUTIONAL TARIFF PROGRAM

The Government and Institutional Tariff Program (referred to as the GAIT Program) is offered to customers with specific rate tariffs such as schools, municipalities, and volunteer fire departments. The impacts from this program are counted toward the Companies' GNI compliance targets, although most of the GNI participation is through the ESB-Small and ESB-Large programs. The program is implemented jointly by Sodexo and ARCA. The Sodexo portion of the program includes downstream incentives for customers that install energy efficient equipment. All measures included in the other C&I EE Programs are offered in the GAIT Program. However, Lighting continues to account for the vast majority of impacts. The incentives for most downstream measures are proportional to the reported energy savings. The ARCA portion of the program included refrigerator, freezer, and room air conditioner recycling.

3.7.1 Participation and Reported Savings by Customer Segment

Table 127 presents the participation counts, reported energy and demand savings, and incentive payments for the GAIT Program in PY10 by EDC. This program serves only the GNI customer segment. Each separate rebate application is counted as one participant.

Table 127: GAIT Program Participation and Reported Impacts

Parameter	Met-Ed GNI	Penelec GNI	Penn Power GNI	WPP GNI
PYTD # Participants	46	161	1	222
PYRTD MWh/yr	967	800	2	4,687
PYRTD MW/yr	0.01	0.02	0.00	0.00
PYTD Incentives ($1000)	51.64	40.42	0.11	163.95

3.7.2 Gross Impact Evaluation

The GAIT Program was disaggregated into four sampling initiatives for gross impact evaluation, as described in Appendix C. The Appliance Turn-In program component, administered by ARCA, was evaluated as a separate initiative. The gross impact evaluation for the Appliance Turn-In initiative is described in detail in Appendix S. Lighting improvements were grouped into the C/I Lighting initiative, and evaluated according to PA TRM protocols as described in detail in Appendix P. Prescriptive HVAC and appliance projects were grouped into the Prescriptive Initiative. The evaluation of Prescriptive projects is described in Appendix R. 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 Q, however there were no custom projects in the GAIT programs this year. For all EDCs, the Lighting initiative attributed for almost the entirety of program savings. Table 128 summarizes program verified impacts and realization rates for each EDC.

Table 128: GAIT Program Gross Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Lighting	954	0.01	99%	101%
Met-Ed	Prescriptive	0	0.00	100%	79%
Met-Ed	Appliance Turn-In	0	0.00	113%	90%
Met-Ed Total		**954**	**0.01**	**98.7%**	**100.7%**
Penelec	Lighting	874	0.02	109%	96%
Penelec	Prescriptive	1	0.00	105%	38%
Penelec	Appliance Turn-In	0	0.00	85%	72%
PenelecTotal		**875**	**0.02**	**109.4%**	**95.4%**
Penn Power	Lighting	2	0.00	93%	92%
Penn Power	Prescriptive	0	0.00	98%	90%
Penn Power	Appliance Turn-In	0	0.00	99%	89%
Penn PowerTotal		**2**	**0.00**	**93.3%**	**92.4%**
WPP	Lighting	4,325	0.00	92%	94%
WPP	Prescriptive	0	0.00	104%	83%
WPP	Appliance Turn-In	1	0.00	107%	81%
WPP Total		**4,326**	**0.00**	**92.3%**	**93.5%**

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 are primarily lighting hours of use, as most of the program's impacts area attributed to lighting.

3.7.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY10. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2. The net impact evaluation of the Prescriptive Initiative is described in Appendix R.2. Net impact evaluation was not conducted for the Appliance Turn-In Initiative or the Direct Install Initiative. The NTG for the Appliance Turn-In Initiative is estimated to be the same as the NTG of the residential Appliance Turn-In Initiative. Table 129 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 129: GAIT Program Net Impact Evaluation Summary for PY10

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Lighting	954	64.1%	611
Met-Ed	Prescriptive	0	53.9%	0
Met-Ed	Appliance Turn-In	0	45.0%	0
Met-Ed Total		954	64.1%	611
Penelec	Lighting	874	75.8%	662
Penelec	Prescriptive	1	53.3%	1
Penelec	Appliance Turn-In	0	47.0%	0
Penelec		875	75.8%	663
Penn Power	Lighting	2	77.1%	2
Penn Power	Prescriptive	0	44.1%	0
Penn Power	Appliance Turn-In	0	51.0%	0
Penn Power		2	77.1%	2
WPP	Lighting	4,325	66.8%	2,889
WPP	Prescriptive	0	46.0%	0
WPP	Appliance Turn-In	1	48.0%	1
WPP		4,326	66.8%	2,890

3.7.3.1 High-Impact Measure Research

The Lighting and Custom Initiatives were identified as High-Impact Measures in PY10. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2.

3.7.4 Verified Savings Estimates

In Table 130 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 GAIT Program in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 130: PYTD and P3TD 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	967	0.01	800	0.02	2	0.00	4,687	0.00
PYVTD Gross	954	0.01	875	0.02	2	0.00	4,326	0.00
PYVTD Net	611	0.00	663	0.02	2	0.00	2,890	0.00
RTD	1,859	0.02	2,804	0.06	2,032	0.06	19,602	0.18
VTD Gross	1,832	0.02	2,661	0.06	1,945	0.07	20,779	0.18
VTD Net	1,173	0.01	2,164	0.04	1,463	0.05	16,573	0.15

3.7.5 Process Evaluation

The process evaluation effort for all three C&I Programs is described in Section 3.5.7. Most practical aspects of the programs are managed as one general effort rather than three distinct

programs, but applications are placed in one of three programs according to their associated rate classes.

3.7.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 131, Table 132, Table 133, and Table 134 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 2018 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 131: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	52		97		52		97	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	237		261		133		134	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**289**		**358**		**185**		**231**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	1	0	2	0	1	0	2
6	Administration, Management, and Technical Assistance [3]	5	13	1	53	5	13	1	53
7	Marketing [4]	0	12	0	32	0	12	0	32
8	Program Delivery [5]	2	6	7	19	2	6	7	19
9	EDC Evaluation Costs	5		34		5		34	
10	SWE Audit Costs	2		8		2		8	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**46**		**157**		**46**		**157**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**335**		**561**		**231**		**413**	
14	Total NPV Lifetime Electric Energy Benefits	397		686		254		439	
15	Total NPV Lifetime Electric Capacity Benefits	5		16		3		10	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-48		-81		-31		-52	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**353**		**621**		**226**		**398**	
19	**TRC Benefit-Cost Ratio [8]**	**1.06**		**1.11**		**0.98**		**0.96**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 132: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	40		140		40		140	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	233		366		167		264	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**273**		**506**		**207**		**404**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	2	0	6	0	2	0	6
6	Administration, Management, and Technical Assistance [3]	8	24	17	110	8	24	17	110
7	Marketing [4]	0	15	0	42	0	15	0	42
8	Program Delivery [5]	3	16	11	46	3	16	11	46
9	EDC Evaluation Costs	7		53		7		53	
10	SWE Audit Costs	3		11		3		11	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**78**		**297**		**78**		**297**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**351**		**1,128**		**285**		**973**	
14	Total NPV Lifetime Electric Energy Benefits	348		963		264		785	
15	Total NPV Lifetime Electric Capacity Benefits	16		41		12		33	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-53		-124		-41		-101	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**310**		**881**		**235**		**718**	
19	**TRC Benefit-Cost Ratio [8]**	**0.88**		**0.78**		**0.83**		**0.74**	

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

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 133: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	0		110		0		110	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		84		0		36	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**1**		**194**		**0**		**146**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	0	0	1	0	0	0	1
6	Administration, Management, and Technical Assistance [3]	4	3	3	62	4	3	3	62
7	Marketing [4]	0	4	0	10	0	4	0	10
8	Program Delivery [5]	1	3	4	10	1	3	4	10
9	EDC Evaluation Costs	2		12		2		12	
10	SWE Audit Costs	1		3		1		3	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**17**		**104**		**17**		**104**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**17**		**471**		**17**		**379**	
14	Total NPV Lifetime Electric Energy Benefits	1		734		1		552	
15	Total NPV Lifetime Electric Capacity Benefits	0		63		0		47	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		-94		0		-71	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**1**		**703**		**1**		**529**	
19	**TRC Benefit-Cost Ratio [8]**	**0.06**		**1.49**		**0.05**		**1.39**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 134: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	164		920		164		920	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	943		2,168		576		1,461	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**1,107**		**3,088**		**739**		**2,381**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	1	0	4	0	1	0	4
6	Administration, Management, and Technical Assistance [3]	8	36	13	430	8	36	13	430
7	Marketing [4]	0	12	0	32	0	12	0	32
8	Program Delivery [5]	3	10	8	32	3	10	8	32
9	EDC Evaluation Costs	6		45		6		45	
10	SWE Audit Costs	2		9		2		9	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**78**		**574**		**78**		**574**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**1,185**		**7,765**		**818**		**6,391**	
14	Total NPV Lifetime Electric Energy Benefits	1,724		7,557		1,151		6,036	
15	Total NPV Lifetime Electric Capacity Benefits	3		168		2		139	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-234		-1,018		-156		-813	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**1,492**		**6,707**		**997**		**5,362**	
19	**TRC Benefit-Cost Ratio [8]**	**1.26**		**0.86**		**1.22**		**0.84**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.7.7 Status of Recommendations

Recommendations for the nonresidential programs are listed in Section 3.5.7.

3.8 Behavioral Demand Response Program

The Behavioral Demand Response (BDR) Program is a component of the Energy Efficient Homes Program. This section lists impacts and cost effectiveness information for this program component. The impact values presented in this section are independent of the results reported in Section 3.2, but the cost effectiveness tables presented in section 3.8.5 are also included in the overall program cost effectiveness tables in Section 3.2.6.
The BDR program is administered by Oracle and is marketed as the Peak Day Alert Program. Penn Power. Met-Ed, and WPP offered BDR programs in PY10. Oracle established the program as a randomized control trial to facilitate measurement and verification. Randomly selected customers received postcards, educating them about conserving energy during peak days. Customers were then provided Peak Day Alert notifications by telephone or email, in advance of Act 129 events.

Compliance targets for demand response programs were established at the system level, which means the load reductions measured at the customer meter must be escalated to reflect transmission and distribution losses. The peak demand impacts presented in this section have been adjusted for line losses.

3.8.1 Participation and Reported Savings by Customer Segment

Table 135 presents the participation counts, reported energy and demand savings, and incentive payments for the BDR Program in PY10 by EDC. This program serves only the Residential customer segment. Each separate household is counted as one participant.

Table 135: BDR Program Participation and Reported Impacts

Parameter	Met-Ed Residential (Non-LI)	Penn Power Residential (Non-LI)	WPP Residential (Non-LI)
PYTD # Participants	126,780	27,440	52,410
PYVTD MW/yr	6.19	2.14	3.06
PYTD Incentives ($1000)	0.00	0.00	0.00
Evaluation Approach	Interval Meter Analysis with Randomized Control Trial		

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3.8.2 Gross Impact Evaluation

The gross impact evaluation for the BDR initiative is described in detail in Appendix U. The evaluation approach is similar to that of the Home Energy Reports program component, but with hourly data. Table 136 summarizes program verified impacts and realization rates for each EDC.

Table 136: Behavioral Demand Response Program Gross Impact Evaluation Summary for PY10

Event Date	Verified MW and Relative Precision @ 90% C.L.		
	Met-Ed	Penn Power	WPP
7/2/2018	6.3 ± 1.79	2.61 ± 0.57	3.97 ± 0.91
7/3/2018	3.41 ± 1.77	1.42 ± 0.57	2.18 ± 0.9
8/6/2018	4.39 ± 1.72	1.87 ± 0.56	3.29 ± 0.88
8/28/2018	8.12 ± 1.68	1.94 ± 0.55	2.78 ± 0.86
9/4/2018	7.77 ± 1.68	2.66 ± 0.56	3.51 ± 0.86
9/5/2018	7.14 ± 1.67	2.33 ± 0.55	2.63 ± 0.85
Total	6.19 ± 0.7	2.14 ± 0.23	3.06 ± 0.36

As with the other demand response programs offered by the Companies, ex ante impacts are not reported. Oracle did provide ex ante estimates however, which were quite similar to the verified impacts shown above.

3.8.3 Net Impact Evaluation

Net impact evaluation is not conducted for this program because the randomized control trial approach described above measures net program impacts.

3.8.4 Process Evaluation

Tetra Tech conducted qualitative and quantitative research for this program's process evaluation in PY10. The qualitative research included semi-structured interviews with the FirstEnergy program manager, the program implementer (Oracle), and a small number of customers in the treatment group. The primary objectives of our interviews with the FirstEnergy program manager and the program implementer were to review program design, understand how the program has evolved since its inception, identify lessons learned from the implementation, and ascertain any challenges going forward.

Qualitative interviews with customers were conducted primarily to inform the design and content of the questionnaire that was used for a survey of a larger, representative sample of customers from the treatment group. Evaluators interviewed nine customers using semi-structured topic guides between October 5 and October 18, 2018. The main objectives were to understand customers' perceptions of the program and capture their experience of the notification process so that our survey questions would use words, phrases, and concepts they understood and recognized.

A quantitative survey was conducted to gather data on customer engagement with the program, how useful the information provided by the program is, things they have done to reduce energy use, and satisfaction with the program and with FirstEnergy. The survey gathered data on why customers opted-out of the program and, for those also receiving HERs, whether they perform energy savings behaviors during event periods in addition to things they might typically do as a result of the HERs..

3.8.5 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 137, Table 138, and Table 139 for Met-Ed, Penelec, and Penn Power respectively. TRC benefits were calculated using gross verified impacts. PYTD financials are expressed in 2018 dollars and P3TD financials are expressed in the 2016 dollars. Additional discussion of TRC inputs and alternative TRC values for Demand Response programs are provided in Section 3.10.4

Table 137: Summary of Finances for the Behavioral Demand Response Program – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	0		0		0		0	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**0**		**0**		**0**		**0**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	49	0	58	0	49	0	58
6	Administration, Management, and Technical Assistance [3]	16	97	16	115	16	97	16	115
7	Marketing [4]	0	4	0	4	0	4	0	4
8	Program Delivery [5]	0	339	0	404	0	339	0	404
9	EDC Evaluation Costs	26		26		26		26	
10	SWE Audit Costs	5		5		5		5	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**537**		**630**		**537**		**630**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**537**		**2,454**		**537**		**2,454**	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	594		522		594		522	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**594**		**522**		**594**		**522**	
19	**TRC Benefit-Cost Ratio [8]**	**1.11**		**0.21**		**1.11**		**0.21**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 138: Summary of Finances for the Behavioral Demand Response Program – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	0		0		0		0	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**0**		**0**		**0**		**0**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	7	0	32	0	7	0	32
6	Administration, Management, and Technical Assistance [3]	9	13	29	63	9	13	29	63
7	Marketing [4]	0	0	0	0	0	0	0	0
8	Program Delivery [5]	0	46	0	220	0	46	0	220
9	EDC Evaluation Costs	-30		30		-30		30	
10	SWE Audit Costs	2		9		2		9	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**47**		**382**		**47**		**382**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**47**		**17,326**		**47**		**17,326**	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	205		351		205		351	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**205**		**351**		**205**		**351**	
19	**TRC Benefit-Cost Ratio [8]**	**4.35**		**0.02**		**4.35**		**0.02**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 139: Summary of Finances for the Behavioral Demand Response Program – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	0		0		0		0	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**0**		**0**		**0**		**0**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	20	0	25	0	20	0	25
6	Administration, Management, and Technical Assistance [3]	14	40	15	49	14	40	15	49
7	Marketing [4]	0	0	0	0	0	0	0	0
8	Program Delivery [5]	0	141	0	170	0	141	0	170
9	EDC Evaluation Costs	24		24		24		24	
10	SWE Audit Costs	4		4		4		4	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**245**		**287**		**245**		**287**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**245**		**2,282**		**245**		**2,282**	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	294		258		294		258	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**294**		**258**		**294**		**258**	
19	**TRC Benefit-Cost Ratio [8]**	**1.20**		**0.11**		**1.20**		**0.11**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.8.6 Status of Recommendations

The process evaluation resulted in several noteworthy findings and recommendations. Not all findings and recommendations have a one-to-one correspondence, therefore the findings are disclosed first, followed by recommendations.

Finding #1: *Customers express high satisfaction with several aspects of the program*. About 60 percent are "very satisfied" or "extremely satisfied" with each of four aspects of the program—the number of peak day alerts; the amount of notice between the peak day alert and the event; the number of hours for which they are asked to reduce energy use; and the time of day of the event.

Finding #2: *Customer engagement with the peak day alerts and performance notifications is high among those who remember receiving them.* Almost all customers who completed the survey read or listened to at least part of the peak day alerts and 72 to 80 percent read/listened to the entire message. Proportions of surveyed customers reading/listening to the performance notifications were also high.

Finding #3: *Behavioral follow-through on peak event days is high*. All but a small number of customers reported taking at least one energy-saving action during the event period. One-half took actions on "all or almost all" peak event days and another 36 percent reduced energy during "some of the events." Over 80 percent generally reduced their energy use for the full, four-hour period of the events.

Finding #4: *Customers report few barriers or difficulties to reduce energy use during peak events.* Over 90 percent said it was "somewhat easy" or "very easy" to reduce energy on peak event days.

Finding #5: *Customers are divided on the usefulness of the peak day alerts and performance notification*. About 40 percent of customers said the energy-saving tips and the efficiency rankings relative to neighbors were "extremely useful" or "very useful." More than one-half felt the energy-saving tips were just "somewhat useful." The comparison with similar homes yields the most negative reaction with 15 percent saying it was "not at all useful."

Finding #6: *Awareness and understanding of the program are relatively low despite high readership and engagement*. The proportion of customers who respond "don't know" or "do not recall" to survey questions about the peak day alerts are indicators of awareness. More than 10 percent of enrolled customers who started the customer survey did not remember receiving any peak day alerts. Of those who remember the peak day alerts, 60 percent did not recall the number of peak day events (and did not offer an estimate), 17 percent did not recall if the alert specified a time period (17 percent), and 27 percent did not remember if the alert included tips on how to reduce energy use.

Finding #7: *Customers may not be broadly aware that they can receive alerts by telephone or email (or both).* Suggestions on ways to improve the program included requests to send the peak day alerts by email instead of telephone, or vice versa; yet, both channels are utilized. Some customers expressed a preference to be notified by text message.

Finding #8: *Customers' suggestions to improve the program clustered around a handful of topics*. These included more advance notice of peak days, more accurate comparisons with neighbors, and performance information based on their own usage or using more easily understood metrics.

Finding #1 (Opt-Out Surveys): *Customers who opted-out of the program are nonetheless highly satisfied with FirstEnergy*. One in four customers were "extremely satisfied" with the overall quality of service provided by their EDC and another 48 percent were "very satisfied

Finding #2 (Opt-Outs): *Opt-out rates are about 8 to 11 percent across EDCs, which is higher than a traditional, behavioral change program (~1 percent).* Both the FirstEnergy Program Manager and ICSP representatives noted that opt-outs increase following consecutive day events

Finding #3 (Opt-Outs): *Reasons for opting-out of the program fall into three main categories.* Most often customers were receiving too many notifications (40 percent); they were already doing what they could to conserve energy (21 percent); and they did not believe the peak day events were important (16 percent).

Finding #4 (Opt-Outs): *Customers may be opting out of the program inadvertently*. Almost one-quarter of surveyed customers who were flagged as "opted-out" in the participant list did not recall requesting that they be excluded from the program.

Recommendation #1: *Raise awareness about the program and understanding of peak day events with additional messaging*.

- *Increase awareness of the program with a reminder mailing, such as a postcard, reminder letter, or email.* In PY10, there was a 4- to 6-week interval between the welcome letter and peak day alert. A reminder mailing during a long hiatus can prepare customers for the first alert and may reduce opt-outs.
- *A notice between events can clarify key elements of the program that are a source of customer concern.* Customers' suggestions for program improvement include more advance notice of peak event days and a wider variety of tips. A postcard or email sent "off-event" or following an event can explain how some, but not all, hot summer days become "peak event days," or why cycling down an air conditioner can be the most effective response.

EDC Status Report #1: Recommendation under consideration. The Companies will consider if the recommendation may be accommodated in the contract with the ICSP, and the program budget.

Recommendation #2: *Allow customers to express a preferred communication channel. Explain that both telephone and email are available and consider offering a text message option.*

EDC Status Report #2: Recommendation accepted.

Recommendation #3: *Work with the ICSP to offer additional energy-saving suggestions in the peak day alerts or emphasize how and why the tips currently provided are the most effective response to a peak day event.*

EDC Status Report #3: Recommendation under consideration. The Companies will engage the ICSP in this effort. One concern is that additional tips may erode the impacts of concise messaging that targets the most effective customer actions.

Recommendation #4: *Work with the ICSP to improve instructions on how to opt-out of the* program. Language or instructions stating how to "opt-out of the program" or "if you prefer not to participate in the program" instead of "to cancel future notifications" may reduce accidental or misinformed opt-outs.

EDC Status Report #4: Recommendation accepted.

Recommendation #5: *Work with the ICSP to develop performance metrics more applicable or useful to participants.* The neighbor comparison is a source of low satisfaction and disbelief among customers. Feedback showing comparisons with their own performance (e.g., peak day vs. non-peak day) or energy saved per degree increase in temperature setting on a thermostat can be informative and use a standard of measurement with broader acceptance.

EDC Status Report #5: Recommendation accepted

3.9 C&I Demand Response Program - Small

The C&I Demand Response Program – Small (SDR Program) is a load curtailment program that is available to all Small C&I customers. The program, for both the Large and Small C&I sectors is managed as one program by the Companies, and is implemented by Enel X in Penn Power, and by both Enel X and CPower in Met-Ed and WPP. The program offers incentives for load reductions during event hours. Most customers reduce loads by rescheduling industrial processes to off-event hours or by changing operations during event hours.

Compliance targets for demand response programs were established at the system level, which means the load reductions measured at the customer meter must be grossed up to reflect transmission and distribution losses. The peak demand impacts presented in this section have been adjusted for line losses.

3.9.1 Participation and Reported Savings by Customer Segment

Table 140 presents the participation counts, reported demand savings, and incentive payments for the SDR Program in PY10 by EDC. Each separate facility is counted as one participant.

Table 140: C&I Demand Response Program – Small, Program Participation and Impacts

Parameter	Met-Ed Small C&I (Non-GNI)	Met-Ed GNI	Met-Ed Total	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	36	21	57	0	0	0	12	2	14
PYVTD MW/yr	2.25	2.81	5.06	0.00	0.00	0.00	1.16	0.00	1.15
PYTD Incentives ($1000)	15,173	18,902	34,075	0	0	0	8,601	-37	8,564
Evaluation Approach	Apply weighted average of three lowest-RRMSE CBL algorithms, selected from 12 candidates.								

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3.9.2 Gross Impact Evaluation

3.9.2.1 Methodology

The Demand Response Programs in both the Large and Small C&I sectors are managed as one program by the Companies. ADM conducts an impact evaluation of the combined program each year and evaluates impacts for all participants, large and small. The process evaluation for the combined DR programs is discussed in Section 3.10.2.

3.9.2.2 Results

Table 141 shows verified impacts by event and EDC, as well as overall PY10 impacts with 90% confidence intervals.

Table 141: C&I Demand Response Program – Small, Verified PY10 Impacts

Event Date	Verified MW and Precision @ 90% C.L.		
	Met-Ed	Penn Power	WPP
7/2/2018	6.0 ± 0.8	0.0 ± 0.0	1.1 ± 0.2
7/3/2018	6.7 ± 0.9	0.0 ± 0.0	1.1 ± 0.2
8/6/2018	6.3 ± 0.8	0.0 ± 0.0	1.2 ± 0.2
8/28/2018	4.9 ± 0.9	0.0 ± 0.0	1.2 ± 0.2
9/4/2018	3.8 ± 0.7	0.0 ± 0.0	1.2 ± 0.2
9/5/2018	2.6 ± 0.4	0.0 ± 0.0	1.1 ± 0.2
Total	**5.1 +/- 0.5**	**0.0 +/- 0.0**	**1.2 +/- 0.1**

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3.9.3 Process Evaluation

The Demand Response Programs in both the Large and Small C&I sectors are managed as one program by the Companies. Tetra Tech conducted a process evaluation of the combined program in PY9. The process evaluation is discussed in Section 3.10.3.

3.9.4 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 142, Table 143, and Table 144 for Met-Ed, Penn Power, and West Penn Power respectively. TRC benefits were calculated using gross verified impacts. PYTD financials are expressed in 2018 dollars and P3TD financials are expressed in the 2016 dollars. Additional discussion of TRC inputs and alternative TRC values for the C&I Demand Response programs are provided in Section 3.10.4.

Table 142: Summary of Finances for C&I Demand Response Program – Small – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	34		35		34		35	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-9		-10		-9		-10	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**26**		**26**		**26**		**26**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	4	0	8	0	4	0	8
6	Administration, Management, and Technical Assistance [3]	10	14	39	30	10	14	39	30
7	Marketing [4]	0	21	0	45	0	21	0	45
8	Program Delivery [5]	0	31	2	68	0	31	2	68
9	EDC Evaluation Costs	7		19		7		19	
10	SWE Audit Costs	3		10		3		10	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**90**		**221**		**90**		**221**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**116**		**227**		**116**		**227**	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	485		639		485		639	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**485**		**639**		**485**		**639**	
19	**TRC Benefit-Cost Ratio [8]**	**4.20**		**2.81**		**4.20**		**2.81**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 143: Summary of Finances for C&I Demand Response Program – Small – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	0		0		0		0	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**0**		**0**		**0**		**0**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	0	0	0	0	0	0	0
6	Administration, Management, and Technical Assistance [3]	3	0	15	1	3	0	15	1
7	Marketing [4]	0	0	0	1	0	0	0	1
8	Program Delivery [5]	0	0	1	2	0	0	1	2
9	EDC Evaluation Costs	2		6		2		6	
10	SWE Audit Costs	1		4		1		4	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**7**		**30**		**7**		**30**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**7**		**28**		**7**		**28**	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	0		15		0		15	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**0**		**15**		**0**		**15**	
19	**TRC Benefit-Cost Ratio [8]**	**0.00**		**0.54**		**0.00**		**0.54**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 144: Summary of Finances for C&I Demand Response Program – Small – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	9		11		9		11	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-2		-4		-2		-4	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**6**		**6**		**6**		**6**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	1	0	3	0	1	0	3
6	Administration, Management, and Technical Assistance [3]	13	2	48	11	13	2	48	11
7	Marketing [4]	0	3	0	17	0	3	0	17
8	Program Delivery [5]	1	5	2	26	1	5	2	26
9	EDC Evaluation Costs	9		24		9		24	
10	SWE Audit Costs	3		11		3		11	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**37**		**143**		**37**		**143**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**43**		**142**		**43**		**142**	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	110		311		110		311	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**110**		**311**		**110**		**311**	
19	**TRC Benefit-Cost Ratio [8]**	**2.55**		**2.19**		**2.55**		**2.19**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.9.5 Status of Recommendations

The Demand Response Programs in both the Large and Small C&I sectors are effectively managed as one program by the Companies. Findings and recommendations for both programs are discussed in Section 3.10.5.

3.10 C&I Demand Response Program - Large

The C&I Demand Response Program – Large (LDR Program) is a load curtailment program that is available to all Large C&I customers. The program for both the Large and Small C&I sectors is managed as one program by the companies, and is implemented by Enel X in Penn Power, and by both Enel X and CPower in Met-Ed and WPP. The program offers incentives for load reductions during event hours. Most customers reduce loads by rescheduling industrial processes to off-event hours or by changing operations during event hours.

Compliance targets for demand response programs were established at the system level, which means the load reductions measured at the customer meter must be grossed up to reflect transmission and distribution losses. The peak demand impacts presented in this section have been adjusted for line losses.

3.10.1 Participation and Reported Savings by Customer Segment

Table 145 presents the participation counts, reported demand savings, and incentive payments for the LDR Program in PY10 by EDC. Each separate facility is counted as one participant.

Table 145: C&I Demand Response Program – Large, Program Participation and Impacts

Parameter	Met-Ed Large C&I (Non-GNI)	Met-Ed GNI	Met-Ed Total	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	59	17	76	7	2	9	35	0	35
PYVTD MW/yr	35.96	6.80	42.76	43.72	0.29	44.01	134.27	0.04	134.30
PYTD Incentives ($1000)	116,283	21,985	138,268	448,094	2,962	451,057	1,407,151	389	1,407,540
Evaluation Approach	Apply weighted average of three lowest-RRMSE CBL algorithms, selected from 12 candidates.								

3.10.2 Gross Impact Evaluation

3.10.2.1 Methodology

Gross impact evaluation consisted of establishing various customer baseline loads (CBLs) for each program participant. The CBL algorithms were ranked in order of relative root mean square error (RRMSE) and the three CBLs with lowest RRMSEs were selected for each participant. A weighted average of the top three CBLs was used in creating the actual CBL for each participant, with the inverse squares of the RMSEs used as weights. The CBLs are described below.

Ten of Ten CBL

This CBL is the average hourly whole-facility demand profile from the last ten weekdays that are (i) not holidays, (ii) not pre-specified customer-specific shutdown days, (iii) not weekends[13], (iv) not Act 129 event-days, (v) not customer-specific PJM event-participation days.

Ten of Ten Individual CBL

This CBL is the average hourly whole-facility demand profile from the last ten weekdays of the matching type (e.g. Mondays, Tuesdays, etc.) that are (i) not holidays, (ii) not pre-specified customer-specific shutdown days, (iii) not weekends, (iv) not Act 129 event-days, (v) not customer-specific PJM event-participation days (vi) not customer – specific peak load shaving event days.

Six of Seven CBL

This CBL is the average hourly whole-facility demand profile from the highest load (as defined during event-hours) six of last seven weekdays that are (i) not holidays, (ii) not pre-specified customer-specific shutdown days, (iii) not weekends, (iv) not Act 129 event-days, (v) not customer-specific PJM event-participation days (vi) not customer – specific peak load shaving event days.

To be eligible for this CBL, customers must provide forward-looking weekly production schedules.

Six of Seven Individual CBL

This CBL is the average hourly whole-facility demand profile from the highest load (as defined during event-hours) six of the last seven weekdays of the matching type (e.g. Mondays, Tuesdays, etc.) that are (i) not holidays, (ii) not pre-specified customer-specific shutdown days, (iii) not weekends, (iv) not Act 129 event-days, (v) not customer-specific PJM event-participation days (vi) not customer – specific peak load shaving event days.

To be eligible for this CBL, customers must provide forward-looking weekly production schedules.

PJM Three Day Type CBL

This CBL is similar to the six of seven CBL listed above, but the basis day exclusion rules are to first select the five most recent qualifying weekdays, then, if any of the five are 75% lower than the average of the five, to replace them with the next available reference weekday, going back at most 45 days. Once there are five suitable reference weekdays, the highest four are selected to develop the CBL.

PJM Seven Day Type CBL

[13] This rule anticipates that all events will be called on non-holiday weekdays.

This CBL is similar to the Three-Day Type CBL described above, but also requires matching of individual day types.

Twenty of Twenty CBL

This CBL is similar to the Ten of Ten CBL described above, but adds first ten weekdays following the event that are (i) not holidays, (ii) not pre-specified customer-specific shutdown days, (iii) not weekends, (iv) not Act 129 event-days, (v) not customer-specific PJM event-participation days.

Twenty of Twenty Individual CBL

This CBL is similar to the Twenty of Twenty CBL described above, but uses weekdays of the matching type.

Weather Sensitive Adjustment

For each of the CBLs above, a weather-sensitive variant was constructed with the addition of a "Weather Sensitive Adjustment", which is a linear correction term with facility demand as the dependent variable and the dry-bulb temperature as the independent variable. The regressions were run for hours ending 15-18,using weekdays with average event-window temperatures above 75 °F, that were not holidays, event days, or facility shutdown days.

Measurement Precision and Confidence Intervals

Confidence intervals were calculated with the RRMSEs of the top three CBLs, with cross terms to account for correlations between the CBLs. Systematic uncertainty with respect to overall CBL selection methodology was estimated by comparing results with results from an alternate scenario where only the top CBL was selected for each participant.

3.10.2.2 Results

Table 146Table 141 shows verified impacts by event and EDC, as well as overall PY10 impacts with 90% confidence intervals.

Table 146: C&I Demand Response Program – Large, Verified PY10 Impacts

Event Date	Verified MW and Relative Precision @ 90% C.L.		
	Met-Ed	Penn Power	WPP
7/2/2018	51.9 ± 4.3	50.7 ± 20.1	145.2 ± 30.3
7/3/2018	51.1 ± 4.3	31.8 ± 18.5	132.5 ± 30.2
8/6/2018	39.2 ± 3.7	54.9 ± 21.9	152.6 ± 32.9
8/28/2018	44.2 ± 3.5	43.1 ± 18.2	127.0 ± 33.6
9/4/2018	35.1 ± 3.5	56.9 ± 21.9	122.9 ± 33.3
9/5/2018	35.1 ± 3.4	26.7 ± 12.6	125.6 ± 33.5
Total	**42.8 +/- 2.6**	**44.0 +/- 12.8**	**134.3 +/- 21.7**

3.10.3 Process Evaluation

Tetra Tech conducted a process evaluation of the Commercial and Industrial Demand Response Programs in PY9. This process evaluation examined researchable questions related to program design, marketing, program operations, and participant satisfaction.

The evaluation consisted of the following activities:

- Program documentation and tracking data review, including review and preliminary analysis of actual 2017 event data;
- Interviews with Company staff (completed in December 2017) and ICSP program providers;
- Participation in a CPower webinar targeted towards potential new customers, entitled "Maximize Revenues with the Commercial and Industrial Demand Response Program from FirstEnergy's Pennsylvania Utilities";
- Surveys with participating customers (n=25 completes).

Process evaluation activities were combined for the Large C&I, Small C&I programs given the combined program delivery. The Tetra Tech team used the program and implementation staff interviews to understand how the program targeted, enrolled, and communicated with program participants.

As a precursor to surveying customers, Tetra Tech identified the number unique program participants, as several participants had multiple facilities enrolled in the program. There were 60 unique participants in PY9, and all were contacted for the survey. The stratification design and response rates are shown in Table 147, and represents all C&I energy efficiency programs offered by each EDC.

Table 147: C&I Demand Response Program Process Evaluation Sample Design

Stratum (ICSP)	Population Size (Unique Participants)	Achieved Sample Size	Response Rate
All	60	25	42%

Key findings and recommendations are listed in Section 3.10.5.

3.10.4 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 148, Table 149, and Table 150 for Met-Ed, Penelec, and Penn Power respectively. TRC benefits were calculated using gross verified impacts. PYTD financials are expressed in 2018 dollars and P3TD financials are expressed in the 2016 dollars. Customer costs are estimated considering 75% of ICSP pricing consistent with the TRC order.

The Companies believe that the TRC values for the Demand Response Programs may be overstated due to data sources and calculation methodology associated with cost effectiveness reporting of DR programs for Act 129. There are several reasons for the apparent high TRC values. One reason is that startup costs have been incurred in previous years, and are not reflected in PY10. This by itself does not bias TRC results in any way, but TRC measurements in PY10-12 do not reflect startup costs incurred in the first two years of the Phase.

Using annual capacity prices instead of summer-only capacity prices, assuming 100% of the DR event savings equate to 100% avoided capacity, and including transmission and distribution avoided costs in the cost effectiveness determination of DR programs for Act 129 are several other reasons for the artificially high TRC values.

As in prior reports, the Companies present rational, alternative cost-effectiveness calculations that yield more realistic TRC ratios.

First, the TRC Order specifies, for Demand Response, the that *"All peak demand reduction values would be multiplied by the avoided cost of generation capacity ($/kW-year for the Annual Product Type) for the delivery year as set by PJM's Base Residual Auction."* The Companies abide by the TRC order, but note that in 2018, PJM clearing prices are available for multiple Capacity Products: a) Base DR/EE (Summer-Only) Resources; b) Base Generation Resources; and c) Annual Resources. The Summer-Only value is approximately 8% lower than other annual product values and the "most comparable" product to the Summer-Only Act 129 DR Program. The reported TRC for the Companies' DR programs would be similarly lower if the difference in valuation between year-round and summer-only resources were considered.

Second is that in 2017, 2018, and 2019, Act 129 DR events in PY10 occurred on three of five critical peak days, as defined by PJM. It is reasonable to prorate DR program benefits by a factor of 3/5, given that the DR program had no impact on two of five PJM critical peak days. This would reduce the average DR TRC by 40%.

Third, Avoided Transmission and Distribution (T&D) prices comprise 20% to 41% of total avoided costs associated with demand response in PY10, depending on customer sector. The Companies have previously recommended, and continue to recommend the exclusion of all avoided T&D costs from cost effectiveness tests for demand response because the Phase III Act 129 DR Program is solely targeting PJM's peak load periods for Capacity or Generation and does not provide the necessary benefits needed to avoid costs on the T&D systems. If T&D benefits were to be excluded, the average TRC for Large C&I DR programs offered by the three Companies in PY10 would decrease by 20%, while the TRC for residential and Small C&I customers would decrease by 41%.

The combination of these alternative calculations would reduce TRC by 56% to 67% for Large C&I and residential/Small C&I customers respectively. In addition, there is some evidence that larger customers manage loads or peak shave on high load days to reduce peak load share costs in subsequent years. While ADM has not performed an assessment of net-to-gross for the

program, this would further reduce TRC. The Companies formally report the higher TRC values following Commission directives for the DR programs, but continue to offer these alternative scenarios for consideration.

Table 148: Summary of Finances for C&I Demand Response Program – Large – Met-Ed

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	138		167		138		167	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-35		-63		-35		-63	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**104**		**104**		**104**		**104**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	48	1	92	1	48	1	92
6	Administration, Management, and Technical Assistance [3]	89	187	353	361	89	187	353	361
7	Marketing [4]	0	281	0	541	0	281	0	541
8	Program Delivery [5]	4	422	17	812	4	422	17	812
9	EDC Evaluation Costs	65		168		65		168	
10	SWE Audit Costs	23		87		23		87	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,119**		**2,433**		**1,119**		**2,433**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**1,223**		**2,330**		**1,223**		**2,330**	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	2,976		6,064		2,976		6,064	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**2,976**		**6,064**		**2,976**		**6,064**	
19	**TRC Benefit-Cost Ratio [8]**	**2.43**		**2.60**		**2.43**		**2.60**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 149: Summary of Finances for C&I Demand Response Program – Large – Penn Power

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	451		682		451		682	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-113		-344		-113		-344	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**338**		**338**		**338**		**338**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	0	12	0	25	0	12	0	25
6	Administration, Management, and Technical Assistance [3]	31	46	138	98	31	46	138	98
7	Marketing [4]	0	69	0	147	0	69	0	147
8	Program Delivery [5]	1	103	7	221	1	103	7	221
9	EDC Evaluation Costs	22		58		22		58	
10	SWE Audit Costs	8		31		8		31	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**294**		**724**		**294**		**724**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**632**		**1,126**		**632**		**1,126**	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	3,063		5,151		3,063		5,151	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**3,063**		**5,151**		**3,063**		**5,151**	
19	**TRC Benefit-Cost Ratio [8]**	**4.85**		**4.58**		**4.85**		**4.58**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

Table 150: Summary of Finances for C&I Demand Response Program – Large – WPP

Row #	Cost Category	Gross PYTD ($1,000)		Gross P3TD ($1,000)		Net PYTD ($1,000)		Net P3TD ($1,000)	
1	EDC Incentives to Participants [1]	1,408		1,981		1,408		1,981	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-352		-926		-352		-926	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**1,056**		**1,056**		**1,056**		**1,056**	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development [2]	1	51	1	103	1	51	1	103
6	Administration, Management, and Technical Assistance [3]	113	200	434	404	113	200	434	404
7	Marketing [4]	0	300	0	605	0	300	0	605
8	Program Delivery [5]	5	449	20	908	5	449	20	908
9	EDC Evaluation Costs	82		212		82		212	
10	SWE Audit Costs	26		100		26		100	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	**1,227**		**2,789**		**1,227**		**2,789**	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	**2,282**		**3,905**		**2,282**		**3,905**	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	9,346		14,515		9,346		14,515	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	**9,346**		**14,515**		**9,346**		**14,515**	
19	**TRC Benefit-Cost Ratio [8]**	**4.10**		**3.72**		**4.10**		**3.72**	

[1] Includes direct install equipment costs and costs for EE&C kits.
[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.
* Rows 1-11 are presented in nominal dollars

3.10.5 Status of Recommendations

There were no process evaluation activities for this program in PY10. Findings and recommendations from previous process evaluation efforts are available in the PY8 and PY9 annual reports.

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 PY10 are shown in Table 151, Table 152, Table 153, and Table 154 for Met-Ed, Penelec, Penn Power, and WPP. The columns in these tables Table 151 through Table 158 are adapted from the 'Direct Program Cost' categories in the Commission's EE&V Plan template[14] for Phase III. EDC Materials, Labor, and Administration includes costs associated with an EDC's own employees. ICSP Materials, Labor, and Administration includes 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 151 through Table 158 are based on EDC tracking of expenditures with no adjustments to account for inflation.[15]

Table 151: Met-Ed PY10 Program and Portfolio total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Appliance Turn-in	288	61	700	30	1,078
Energy Efficient Homes	3,885	226	2,168	219	6,498
Energy Efficient Products	2,348	117	828	143	3,437
Low Income Energy Efficiency	86	259	3,160	119	3,624
C&I Energy Solutions for Business - Small	1,171	143	761	215	2,290
C&I Energy Solutions for Business - Large	1,787	98	959	221	3,064
Governmental & Institutional Tariff	52	8	31	5	95
C&I Demand Response Program – Small	34	10	70	7	122
C&I Demand Response Program – Large	138	94	938	65	1,235
Common Portfolio Costs[1]				0	0
Portfolio Total				**1,024**	**21,444**
SWE Costs[2]	**N/A**	**N/A**	**N/A**	**N/A**	**256**
Total					**21,700**

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.

[14] http://www.puc.pa.gov/pcdocs/1372426.doc Section 10

[15] 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 152: Penelec PY10 Program and Portfolio total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Appliance Turn-in	255	64	634	32	985
Energy Efficient Homes	3,985	207	1,612	181	5,986
Energy Efficient Products	1,901	118	770	137	2,926
Low Income Energy Efficiency	103	309	3,047	123	3,582
C&I Energy Solutions for Business - Small	1,476	154	825	225	2,680
C&I Energy Solutions for Business - Large	2,083	88	1,077	193	3,441
Governmental & Institutional Tariff	40	11	57	7	115
Common Portfolio Costs[1]				0	0
Portfolio Total	**9,845**	**951**	**8,022**	**899**	**19,716**
SWE Costs[2]	**N/A**	**N/A**	**N/A**	**N/A**	**232**
Total					**19,948**

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 153: Penn Power PY10 Program and Portfolio total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Appliance Turn-in	90	19	249	7	366
Energy Efficient Homes	1,224	70	565	21	1,880
Energy Efficient Products	738	26	241	30	1,035
Low Income Energy Efficiency	33	110	774	41	957
C&I Energy Solutions for Business - Small	692	65	321	54	1,132
C&I Energy Solutions for Business - Large	376	35	193	42	646
Governmental & Institutional Tariff	0	5	9	2	16
C&I Demand Response Program – Small	0	4	0	2	6
C&I Demand Response Program – Large	451	33	230	22	736
Common Portfolio Costs[1]				0	0
Portfolio Total				**221**	**6,775**
SWE Costs[2]	**N/A**	**N/A**	**N/A**	**N/A**	**72**
Total					**6,847**

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 154: WPP PY10 Program and Portfolio total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Appliance Turn-in	316	61	765	30	1,172
Energy Efficient Homes	1,449	216	1,852	200	3,718
Energy Efficient Products	2,316	132	996	158	3,602
Low Income Energy Efficiency	83	268	2,813	124	3,288
C&I Energy Solutions for Business - Small	1,541	162	1,325	244	3,273
C&I Energy Solutions for Business - Large	1,193	79	659	178	2,110
Governmental & Institutional Tariff	164	11	59	6	240
C&I Demand Response Program – Small	9	13	12	9	43
C&I Demand Response Program – Large	1,408	119	999	82	2,608
Common Portfolio Costs[1]				0	0
Portfolio Total				**1,032**	**20,053**
SWE Costs[2]	**N/A**	**N/A**	**N/A**	**N/A**	**240**
Total					**20,293**

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 III are shown in Table 155, Table 156, Table 157, and Table 158 for Met-Ed, Penn Power, Penelec, and WPP.

Table 155: Met-Ed P3TD Program and Portfolio total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Appliance Turn-in	789	185	1,881	79	2,935
Energy Efficient Homes	9,812	617	7,044	428	17,902
Energy Efficient Products	5,472	164	2,386	322	8,344
Low Income Energy Efficiency	278	800	9,017	317	10,411
C&I Energy Solutions for Business - Small	3,367	376	2,352	456	6,551
C&I Energy Solutions for Business - Large	4,826	230	2,736	497	8,288
Governmental & Institutional Tariff	97	8	107	34	247
C&I Demand Response Program – Small	35	41	151	19	246
C&I Demand Response Program – Large	167	371	1,807	168	2,513
Common Portfolio Costs[1]				0	0
Portfolio Total				**2,321**	**57,437**
SWE Costs[2]	**N/A**	**N/A**	**N/A**	**N/A**	**960**
Total					**58,397**

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 156: Penelec P3TD Program and Portfolio total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Appliance Turn-in	687	197	1,724	86	2,694
Energy Efficient Homes	9,102	593	6,173	373	16,241
Energy Efficient Products	4,894	173	2,421	309	7,798
Low Income Energy Efficiency	268	960	8,776	347	10,351
C&I Energy Solutions for Business - Small	4,197	448	2,385	479	7,509
C&I Energy Solutions for Business - Large	5,025	252	2,716	439	8,432
Governmental & Institutional Tariff	140	29	204	53	426
Common Portfolio Costs[1]				0	0
Portfolio Total	**24,313**	**2,652**	**24,400**	**2,085**	**53,450**
SWE Costs[2]	**N/A**	**N/A**	**N/A**	**N/A**	**870**
Total					**54,320**

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 157: Penn Power P3TD Program and Portfolio total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Appliance Turn-in	241	50	678	20	990
Energy Efficient Homes	3,083	227	1,983	143	5,436
Energy Efficient Products	1,606	10	593	67	2,276
Low Income Energy Efficiency	106	334	2,553	112	3,105
C&I Energy Solutions for Business - Small	1,940	133	908	115	3,096
C&I Energy Solutions for Business - Large	1,053	81	560	95	1,789
Governmental & Institutional Tariff	110	7	82	12	211
C&I Demand Response Program – Small	0	16	4	6	26
C&I Demand Response Program – Large	682	145	491	58	1,375
Common Portfolio Costs[1]				0	0
Portfolio Total				**627**	**18,305**
SWE Costs[2]	**N/A**	**N/A**	**N/A**	**N/A**	**270**
Total					**18,575**

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 158: WPP P3TD Program and Portfolio total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Appliance Turn-in	884	191	2,146	79	3,300
Energy Efficient Homes	6,578	676	6,865	405	14,523
Energy Efficient Products	5,782	264	2,917	344	9,306
Low Income Energy Efficiency	242	819	8,465	338	9,864
C&I Energy Solutions for Business - Small	4,083	426	3,100	502	8,111
C&I Energy Solutions for Business - Large	3,503	197	2,201	402	6,302
Governmental & Institutional Tariff	920	22	498	45	1,485
C&I Demand Response Program – Small	11	51	57	24	142
C&I Demand Response Program – Large	1,981	456	2,020	212	4,670
Common Portfolio Costs[1]				0	0
Portfolio Total				**2,349**	**57,704**
SWE Costs[2]	**N/A**	**N/A**	**N/A**	**N/A**	**900**
Total					**58,604**

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 EDCs 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 2.4. For example, the low-income customer segments are subsets of the residential tariff(s) and therefore not listed separately. Table 159, Table 160, Table 161, and Table 162.

Table 159: Met-Ed EE&C Expenditures by Cost-Recovery Category[16] ($1,000)

Cost Recovery Sector	Rate Classes Included	PYTD $ Spending ($1,000)[1]	P3TD $ Spending ($1,000)[1]
Residential (incl Low Income)	Rate RS	$14,703	$40,215
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	$2,583	$6,972
Large C&I	Rate GS-Large, Rate GP and Rate TP	$4,314	$10,953
Street Lighting	Street Lighting Service, LED Street Lighting Service and Ornamental Street Lighting Service	$57	$130
Government & Non-Profit Tariff	Rate GS - Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate and Rate MS	$42	$127
Portfolio Total		$21,700	$58,397

Table 160: Penelec EE&C Expenditures by Cost-Recovery Category[17] ($1,000)

Cost Recovery Sector	Rate Classes Included	PYTD $ Spending ($1,000)[1]	P3TD $ Spending ($1,000)[1]
Residential (incl Low Income)	Rate RS	$13,548	$37,712
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	$2,817	$7,650
Large C&I	Rate GS-Large, Rate GP, and Rate LP	$3,464	$8,521
Street Lighting	Street Lighting Service, LED Street Lighting Service, and Ornamental Street Lighting Service	$33	$174
Government & Non-Profit Tariff	Rate GS – Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate and Rate H	$86	$263
Portfolio Total		$19,948	$54,320

[16] Includes SWE costs
[17] Includes SWE costs

Table 161: Penn Power EE&C Expenditures by Cost-Recovery Category[18] ($1,000)

Cost Recovery Sector	Rate Classes Included	PYTD $ Spending ($1,000)[1]	P3TD $ Spending ($1,000)[1]
Residential (incl Low Income)	Rate RS	$4,253	$11,983
Small C&I	Rate GS, GS Special Rider GSDS, Rate GM, Rate GS-Large and POL	$1,201	$3,183
Large C&I	Rate GP, and Rate GT	$1,373	$3,193
Street Lighting	Rate Schedules SV, SVD, SM and LED	$2	$164
Government & Non-Profit Tariff	Rate GS – Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate and Rate PNP	$17	$52
Portfolio Total		$6,847	$18,575

Table 162: WPP EE&C Expenditures by Cost-Recovery Category[19] ($1,000)

Cost Recovery Sector	Rate Classes Included	PYTD $ Spending ($1,000)[1]	P3TD $ Spending ($1,000)[1]
Residential (incl Low Income)	Rate 10	$11,837	$37,568
Small C&I	Rate GS 20, Rate GS 30	$3,488	$8,435
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	$4,723	$11,104
Street Lighting	Rate Schedules 51 through 58, 71, 72	$189	$1,299
Government & Non-Profit Tariff	Rate GS 20 – Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate	$57	$198
Portfolio Total		$20,293	$58,604

[18] Includes SWE costs
[19] Includes SWE costs

Appendix A Upstream Lighting Cross Sector Sales

The upstream lighting programs promote and discount efficient screw-based light bulbs at participating retail stores within the Companies' service territories. Historical M&V activities have established that a small percentage of the discounted lamps are installed in non-residential settings. This has several implications for evaluation, reporting, and program management:

1. The hours of use and coincidence factors used to calculate verified impacts must be adjusted to account for various installation settings.
2. The impacts for lamps installed in GNI facilities can be counted toward the Companies' GNI energy reduction compliance targets.
3. Program funds need to be moved between the residential and commercial sectors to ensure that there was no subsidization of commercial energy savings by the residential class.

The general approach to evaluating the impacts from cross sector sales is to conduct a random digit dial survey to determine the percentages of program lamps that are installed in various facility types. The PA TRM impact evaluation algorithms and parameters for nonresidential lighting are used to evaluate impacts for the percentage of lamps that are reported to be installed in nonresidential settings. This process is discussed in detail in Appendix I.

Note that the Companies EE&C plans also include distribution of efficient screw-based lamps through conservation kits in their residential and nonresidential sector programs. Based on historical customer surveys, a portion of lighting products distributed to small commercial customers are subsequently redistributed to employees, members, or parishioners for use in their homes. In such cases, the TRM residential lighting protocols are used to evaluate the energy and demand impacts associated with these "reverse-crossover" lamps. The Companies did not have active conservation kit programs in the commercial sector in Phase III, therefore adjustments of this kind are not needed for Phase III.

The Companies' EE&C plans and tracking and reporting systems attribute all costs and impacts of the upstream lighting initiative to the residential sector, specifically to the *Energy Efficient Products Program*. However, post-hoc adjustments to funding are made after M&V activities establish the cross-sector rate. Data in the tracking and reporting systems are not adjusted to account for cross-sector sales. Adjustments to overall impacts are conveyed by the program realization rate (this is one of the reasons for the high realization rate for this initiative). See Appendix M for impact evaluation details.

Survey results indicate that practically all of the efficient lamps that are installed in the nonresidential sector are installed in the small commercial and industrial class. Therefore, the funds transfer needed to avoid cross-subsidization is a net transfer from the ESB-Small Program to the EEP Program. Table 163 shows the overall incentive funding for the Upstream Lighting initiative, and allocates incentives according to the fraction of sales attributed to residential and non-residential sectors. The funding amounts in the last column are transferred from ESB-Small Program to the EEP Program.

Table 163: Upstream Lighting funding allocation between programs.

EDC	Total Upstream Lighting Incentives	Residential EEP Program (92.9%)	SFB-Small Program (7.1%)
Met-Ed	$ 1,367,662	$ 1,270,022	$ 97,640.39
Penelec	$ 1,200,958	$ 1,115,219	$ 85,738.99
Penn Power	$ 439,664	$ 408,276	$ 31,388.59
West Penn	$ 1,194,435	$ 1,109,162	$ 85,273.35

Appendix B Site Inspection Summary

Table 164: PY10 Site Visit Summary

EDC	Program	Inspection Firm	Number of Inspections Conducted	Number of Sites with Discrepancies from Reported Values	Summary of Common Discrepancies
Met-Ed	Energy Efficient Products Program - HVAC Rebates	Honeywell	124	0	n/a
Penelec		Honeywell	92	0	n/a
Penn Power		Honeywell	40	0	n/a
WPP		Honeywell	188	0	n/a
Met-Ed	Energy Efficient Products Program - New Construction	PSD	6	Discrepancies do not necessarily constitute a lack of verification for this program. Please refer to the gross realization rates as a measure of consistency between reported and verified values.	The most common are due to using REM/Rate defaults for furnace fan energy usage rating rather than looking them up by model #, and estimating the % of lamps that are efficient.
Met-Ed		ADM	16		
Penelec		PSD	5		
Penelec		ADM	2		
Penn Power		PSD	7		
Penn Power		ADM	19		
WPP		PSD	12		
WPP		ADM	11		
Met-Ed	Low Income Direct Install Programs	PSD, Action Housing, Pure Energy LLC	65	3	Measure count discrepancies involve aerators, furnace whistles, lamps, showerheads, and smart power strips.
Penelec			46	2	
Penn Power			51	1	
WPP			46	3	
Met-Ed	C/I Programs	ADM	74	Discrepancies do not necessarily constitute a lack of verification. Please refer to the gross realization rates as a measure of consistency between reported and verified values.	The main discrepancy is lamp fixture counts/types. Other measures are verified essentially 100% of the time.
Penelec	C/I Programs	ADM	73		
Penn Power	C/I Programs	ADM	59		
WPP	C/I Programs	ADM	73		
TOTAL			**1010**	**n/a**	

Appendix C Assignments of Measures to Gross Impact Initiatives

C.1 NONRESIDENTIAL EE PROGRAMS

Sampling for the nonresidential programs is performed on a project by project level. Each project can have multiple measures. If a project is sampled, all (or in rare cases where sampling may be involved, most) measures are sampled. As a first step, projects in the tracking and reporting system are assigned an evaluation initiative. Each entry in FirstEnergy's tracking and reporting system is assigned to one of seven initiatives: Appliance Recycling, Prescriptive, Lighting, Custom, Direct Install, Conservation Kits, Behavioral, or Null. The Null Initiative is defined solely to strip away items that are not associated with energy savings. These are generally line items to track special promotional bonus incentives, and may include Energy Audits that are not associated with energy savings (if measures are installed as a result of the audit, they appear as separate entries in the tracking system). In PY10, there were no measures associated with the Behavioral, or Conservation Kits Initiatives. These program components are a part of the Companies' EE&C plans, but were not implemented in PY10.
It is possible for projects to include multiple measures, and therefore a project may theoretically map to multiple initiatives. In practice, since rebate applications include equipment and measures that map to a single initiative as defined below, this did not occur in PY10. Measures assigned to the custom evaluation protocol are those that may potentially require custom treatment, but TRM algorithms may be applicable.

Table 165: Assignment of measures to initiatives for Nonresidential Programs

Measure	TRM Section	Initiative
Freezer Recycling - SCI	2.4.3	CI_Appliance_Recycling
Refrigerator Recycling - SCI	2.4.3	CI_Appliance_Recycling
Room Air Conditioner Recycling - SCI	2.2.5	CI_Appliance_Recycling
Dehumidifiers Recycling - Govt	IMP	CI_Appliance_Recycling
Freezer Recycling - Govt	2.4.3	CI_Appliance_Recycling
Refrigerator Recycling - Govt	2.4.3	CI_Appliance_Recycling
Room Air Conditioner Recycling - Govt	2.2.5	CI_Appliance_Recycling
Automatic Milker Takeoffs	4.1.1	CI_Prescriptive
Dairy Scroll Compressors	4.1.2	CI_Prescriptive
High Efficiency Ventilation Fans	4.1.3	CI_Prescriptive
High Volume LowSpeed Fans	4.1.5	CI_Prescriptive
Livestock Waterer	4.1.6	CI_Prescriptive
Heat Reclaimers	4.1.4	CI_Prescriptive
Low Pressure Irrigation System	4.1.8a	CI_Prescriptive
VFD on Dairy Vacuum Pumps	4.1.7	CI_Prescriptive
LED - Traffic Signals - Round - 12 Green	3.1.4	CI_Lighting
LED - Traffic Signals - Round - 8 Green	3.1.4	CI_Lighting
LED - Traffic Signals - Round - 12 Red	3.1.4	CI_Lighting
LED - Traffic Signals - Round - 8 Red	3.1.4	CI_Lighting
LED - Traffic Signals - Round - 12 Yellow	3.1.4	CI_Lighting
LED - Traffic Signals - Turn Signals - 12 Green	3.1.4	CI_Lighting
LED - Traffic Signals - Turn Signals - 8 Green	3.1.4	CI_Lighting
LED - Traffic Signals - Turn Signals - 12 Red	3.1.4	CI_Lighting

Measure	TRM Section	Initiative
LED - Traffic Signals - Turn Signals - 8 Red	3.1.4	CI_Lighting
LED - Traffic Signals - Turn Signals - 12 Yellow	3.1.4	CI_Lighting
LED - Traffic Signals - Turn Signals - 8 Yellow	3.1.4	CI_Lighting
LED - Traffic Signals - 12 Countdown Only	3.1.4	CI_Lighting
LED - Traffic Signals - 12 Hand Only	3.1.4	CI_Lighting
LED - Traffic Signals - 12 Pedestrian and Hand Overlay	3.1.4	CI_Lighting
LED - Traffic Signals - 12 Pedestrian Only	3.1.4	CI_Lighting
LED - Traffic Signals - 16 Hand with Countdown Side by Side	3.1.4	CI_Lighting
LED - Traffic Signals - 16 Pedestrian and Hand Overlay	3.1.4	CI_Lighting
LED - Traffic Signals - 16 Pedestrian and Hand Side by Side	3.1.4	CI_Lighting
LED - Traffic Signals - 16 Pedestrian and Hand with Countdown Overlay	3.1.4	CI_Lighting
LED - Traffic Signals - 9 Hand Only	3.1.4	CI_Lighting
LED - Traffic Signals - 9 Pedestrian Only	3.1.4	CI_Lighting
LED - Traffic Signals - Round - 8 Yellow	3.1.4	CI_Lighting
Street & Area Lighting (Tariff / Customer Owned)	3.1.1	CI_Lighting
Street & Area Lighting (Tariff / Utility Owned)	3.1.1	CI_Lighting
Anti Sweat Heater Controls	3.5.6	CI_Prescriptive
Ice Machines GT 1000 lbs/day	3.7.1	CI_Prescriptive
Ice Machines 501 to 1000 lbs/day	3.7.1	CI_Prescriptive
Ice Machine LT 500lbs/day	3.7.1	CI_Prescriptive
Combination Oven	IMP	CI_Prescriptive
Convection Ovens	IMP	CI_Prescriptive
Fryer	IMP	CI_Prescriptive
Griddles	IMP	CI_Prescriptive
Hot Food Holding Cabinet - Half Size	IMP	CI_Prescriptive
Hot Food Holding Cabinet - Three-Quarter Size	IMP	CI_Prescriptive
Hot Food Holding Cabinets - Full size	IMP	CI_Prescriptive
Commercial Reach In Refrigerators	3.5.1	CI_Prescriptive
Commercial Reach In Freezers	3.5.1	CI_Prescriptive
Refrigerated Case Covers	3.5.10	CI_Prescriptive
Steam cookers - 3 Pan	3.7.4	CI_Prescriptive
Steam cookers - 4 Pan	3.7.4	CI_Prescriptive
Steam cookers - 5 Pan	3.7.4	CI_Prescriptive
Steam cookers - 6 Pan	3.7.4	CI_Prescriptive
Strip Curtains	3.5.9	CI_Prescriptive
Vending Machine Controls	3.7.2	CI_Prescriptive
Vending Machines	3.7.5	CI_Prescriptive
Pre Rinse Spray Nozzles	3.4.2	CI_Prescriptive
Water Heater - Heat Pump	3.4.1	CI_Prescriptive
Water Heater - Solar	2.3.2	CI_Prescriptive
Clothes Dryer	2.4.5	CI_Prescriptive
Clothes Washers - Tier I	3.6.1	CI_Prescriptive
Clothes Washers - Tier II	3.6.1	CI_Prescriptive
Clothes Washers - Tier III	3.6.1	CI_Prescriptive
Room Air Conditioners	3.2.7	CI_Prescriptive
Freezers	2.4.2	CI_Prescriptive
Refrigerators - Tier I	2.4.1	CI_Prescriptive
Refrigerators - Tier II	2.4.1	CI_Prescriptive

Measure	TRM Section	Initiative
Refrigerators - Tier III	2.4.1	CI_Prescriptive
Computers	3.9.1a	CI_Prescriptive
Uninterruptable Power Supplies	IMP	CI_Prescriptive
Computer Monitors	3.9.1f	CI_Prescriptive
Heat Pump Clothes Dryer	IMP	CI_Prescriptive
Copiers	3.9.1c	CI_Prescriptive
Fax Machine	3.9.1b	CI_Prescriptive
Multifunction Devices	3.9.1e	CI_Prescriptive
Printers	3.9.1d	CI_Prescriptive
Direct Install - Non Lighting	Various TRM Sections	CI_Direct_Install
Direct Install - Lighting	Various TRM Sections	CI_Direct_Install
Post Audit - Lighting	Various TRM Sections	CI_Direct_Install
Post Audit - Non Lighting	Various TRM Sections	CI_Direct_Install
Combined Heat and Power	n/a	CI_Custom
Custom - Building Improvements	n/a	CI_Custom
Custom - Retro-commissioning - Large	n/a	CI_Custom
Custom - Process Improvement	n/a	CI_Custom
Custom - Compressed Air	n/a	CI_Custom
Custom - Data Centers	n/a	CI_Custom
Custom - HVAC & Chillers	n/a	CI_Custom
Custom - Motors - Three Phase	n/a	CI_Custom
Custom - Retro-commissioning Small	n/a	CI_Custom
Custom - Refrigeration	n/a	CI_Custom
Custom - VFDs < 10HP	n/a	CI_Custom
Custom - VFDs > 10 HP	n/a	CI_Custom
Facility Audits	Various TRM Sections	CI_Direct_Install
Electric Chillers - Air Cooled > 150 tons	3.2.2a	CI_Prescriptive
Electric Chillers - Air Cooled < 150 tons	3.2.2a	CI_Prescriptive
Electric Chillers - Water Cooled - Centrifugal < 150 tons	3.2.2b	CI_Prescriptive
Electric Chillers - Water Cooled - Centrifugal >= 600 tons	3.2.2b	CI_Prescriptive
Electric Chillers - Water Cooled - Centrifugal >= 150 tons and < 300 tons	3.2.2b	CI_Prescriptive
Electric Chillers - Water Cooled - Centrifugal >= 300 tons and < 600 tons	3.2.2b	CI_Prescriptive
Electric Chillers - Water Cooled - Reciprocating/Positive Disp >= 150 < 300 tons	3.2.2b	CI_Prescriptive
Electric Chillers - Water Cooled - Reciprocating/Positive Disp >= 300 ton	3.2.2b	CI_Prescriptive
Electric Chillers - Water Cooled - Reciprocating/Positive Displ >= 75 < 150 tons	3.2.2b	CI_Prescriptive
Electric Chillers - Water Cooled - Reciprocating/Positive Displacement < 75 tons	3.2.2b	CI_Prescriptive
Heat Pumps - Air Source < 65,000 Btu/h (5.4 tons) 16 SEER 9.0 HSPF	3.2.1d	CI_Prescriptive
Heat Pumps - Air Source < 65,000 Btu/h (5.4 tons) 18 SEER 10.0 HSPF	3.2.1d	CI_Prescriptive

Measure	TRM Section	Initiative
Heat Pumps - Air Source >= 135,000 (11.25 tons) and < 240,000 Btu/h (20 tons)	3.2.1d	CI_Prescriptive
Heat Pumps - Air Source >= 240,000 Btu/h (20 tons)	3.2.1d	CI_Prescriptive
Heat Pumps - Air Source >= 65,000 (5.4 tons) and < 135,000 Btu/h (11.25 tons)	3.2.1d	CI_Prescriptive
Heat Pumps - Ground Source < 135,000 Btu/h (11.25 tons)	3.2.3c	CI_Prescriptive
Heat Pumps - Ground Water Source < 135,000 Btu/h (11.25 tons)	3.2.3b	CI_Prescriptive
Heat Pumps - Single Zone Ductless Mini-Split	3.2.4b	CI_Prescriptive
Heat Pumps - Multi Zone Ductless Mini-Split	3.2.4b	CI_Prescriptive
Heat Pumps - Water Source < 17,000 Btu/h (1.42 tons)	3.2.3a	CI_Prescriptive
Heat Pumps - Water Source GTE 17,000 Btu/h (1.42 tons)	3.2.3a	CI_Prescriptive
Packaged Terminal Air Conditioner	3.2.1e	CI_Prescriptive
Packaged Terminal Heat Pump	3.2.1g	CI_Prescriptive
Packaged/Split AC - Air Cooled >= 135,000 (11.25) and < 240,000 Btu/h (20 tons)	3.2.1a	CI_Prescriptive
Packaged/Split AC - Air Cooled >= 240,000 (20) and < 760,000 Btu/h (63.33 tons)	3.2.1a	CI_Prescriptive
Packaged/Split AC - Air Cooled >= 65,000 (5.4) and < 135,000 Btu/h (11.25 tons)	3.2.1a	CI_Prescriptive
Packaged/Split AC - Air Cooled >= 760,000 Btu/h (63.33 tons)	3.2.1a	CI_Prescriptive
Packaged/Split AC - Evap Cooled GE 135,000 (11.25) and LT 240,000 Btu/h (20 tons)	3.2.1c	CI_Prescriptive
Packaged/Split AC - Evap Cooled GE 240,000 (20) and LT 760,000 Btu/h (63.33 tons)	3.2.1c	CI_Prescriptive
Packaged/Split AC - Evap Cooled GE 65,000 (5.4) and LT 125,000 Btuh (11.25 tons)	3.2.1c	CI_Prescriptive
Packaged/Split AC - Evaporatively Cooled LT 65,000 Btu/h (5.4 tons) 16 SEER	3.2.1c	CI_Prescriptive
Packaged/Split AC - Evaporatively Cooled LT 65,000 Btu/h (5.4 tons) 18 SEER	3.2.1c	CI_Prescriptive
Packaged/Split AC - Water Cooled GE 135,000 (11.25) and < 240,00 Btu/h (20 tons)	3.2.1b	CI_Prescriptive
Packaged/Split AC - Water Cooled GE 760,000 Btu/h (63.33 tons)	3.2.1b	CI_Prescriptive
Packaged/Split AC -Water Cooled >= 240,000 (20) and < 760,000 Btu/h (63.33 tons)	3.2.1b	CI_Prescriptive
Packaged/Split AC -Water Cooled >= 65,000 (5.4) and < 135,000 Btu/h (11.25 tons)	3.2.1b	CI_Prescriptive
Packaged/Split AC Units - Air Cooled LT 65,000 Btu/h (5.4 tons) 16 SEER	3.2.1a	CI_Prescriptive
Packaged/Split AC Units - Air Cooled LT 65,000 Btu/h (5.4 tons) 18 SEER	3.2.1a	CI_Prescriptive
Packaged/Split AC Units - Evaporatively Cooled GE 760,000 Btu/h (63.33 tons)	3.2.1c	CI_Prescriptive
Packaged/Split AC Units - Water Cooled < 65,000 Btu/h (5.4 tons) 16 SEER	3.2.1b	CI_Prescriptive
Packaged/Split AC Units - Water Cooled < 65,000	3.2.1b	CI_Prescriptive

Measure	TRM Section	Initiative
Btu/h (5.4 tons) 18 SEER		
CFL Fixtures	3.1.1	CI_Lighting
Lighting - Other	3.1.1	CI_Lighting
Lighting Controls	3.1.3	CI_Lighting
CFL Lamps Specialty	3.1.1	CI_Lighting
CFL Lamps	3.1.1	CI_Lighting
Linear Fluorescent T5	3.1.1	CI_Lighting
Linear Fluorescent T8	3.1.1	CI_Lighting
LED Channel Signage	3.1.6	CI_Lighting
Exit Sign	3.1.5	CI_Lighting
LED Fixtures External	3.1.1	CI_Lighting
LED Fixtures Internal	3.1.1	CI_Lighting
LED Lamps	3.1.1	CI_Lighting
LED Lamps (Post 2020)	3.1.1	CI_Lighting
LED Linear	3.1.1	CI_Lighting
LED Reach in Refrigerator / Freezer Lights	3.1.7	CI_Lighting
Street & Area Lighting (Customer Owned)	3.1.1	CI_Lighting
CFL Lamps (Post 2020)	3.1.1	CI_Lighting
LED 6-8W Standard Bulb	3.1.1	CI_Direct_Install
LED 9-13W Standard Bulb	3.1.1	CI_Direct_Install
LED Nightlights	3.1.1	CI_Direct_Install
Tier 1, Smart Power Strip 5 Outlets, one installed	2.5.3	CI_Direct_Install
Tier 2, Smart Power Strip	2.5.3	CI_Direct_Install
CFL 9-13 Watt	3.1.1	CI_Direct_Install

C.2 Residential Programs

For the gross impact evaluation effort, sampling initiatives were confined to distinct programs with the exception of the New Homes component of the Low Income Energy Efficiency Program, which was evaluated in the general residential New Homes Initiative. The table below lists (non-low-income) residential measures in the Companies' tracking and reporting system and assigns them to their respective evaluation initiatives. Note that some of the measures are denoted as disabled in the tracking system because they are not currently offered. We retain these measures for completeness – if the measures will again be offered in Act 129, they will fall in their corresponding sampling initiatives in the table. Note that the Home Energy Report measure is not listed in the table below, but the measure constitutes its own initiative.

Table 166: Assignment of measures to initiatives for Residential Programs

Measure	TRM Section	Initiative
100W equivalent CFL	2.1.1	Upstream Lighting
100W equivalent LED	2.1.1	Upstream Lighting
100W equivalent LED Specialty	2.1.1	Upstream Lighting
100W equivalent LEDee	2.1.1	Upstream Lighting
150W equivalent CFL	2.1.1	Upstream Lighting
150W equivalent LED	2.1.1	Upstream Lighting
150W equivalent LED Specialty	2.1.1	Upstream Lighting
150W equivalent LEDee	2.1.1	Upstream Lighting

Measure	TRM Section	Initiative
25-30W equivalent CFL	2.1.1	Upstream Lighting
25-30W equivalent LED	2.1.1	Upstream Lighting
25-30W equivalent LED Specialty	2.1.1	Upstream Lighting
25-30W equivalent LEDee	2.1.1	Upstream Lighting
40-45W equivalent CFL	2.1.1	Upstream Lighting
40-45W equivalent LED	2.1.1	Upstream Lighting
40-45W equivalent LED Specialty	2.1.1	Upstream Lighting
40-45W equivalent LEDee	2.1.1	Upstream Lighting
50-60W equivalent CFL	2.1.1	Upstream Lighting
50-60W equivalent LED	2.1.1	Upstream Lighting
50-60W equivalent LED Specialty	2.1.1	Upstream Lighting
50-60W equivalent LEDee	2.1.1	Upstream Lighting
65W equivalent CFL	2.1.1	Upstream Lighting
65W equivalent LED	2.1.1	Upstream Lighting
65W equivalent LED Specialty	2.1.1	Upstream Lighting
65W equivalent LEDee	2.1.1	Upstream Lighting
72-75W equivalent CFL	2.1.1	Upstream Lighting
72-75W equivalent LED	2.1.1	Upstream Lighting
72-75W equivalent LED Specialty	2.1.1	Upstream Lighting
New Construction - Multi Family Low Rise	2.6.3	New Homes
New Construction - Single Family Detached	2.6.3	New Homes
New Construction - Two-on-Two Condos	2.6.3	New Homes
New Construction -Townhouse and Duplexs	2.6.3	New Homes
New Manufactured Housing	2.6.3	New Homes
LI New Construction	2.6.3	New Homes
Dehumidifier Recycling	IMP	Res ATI
Freezer Recycling	2.4.3	Res ATI
Refrigerator Recycling	2.4.3	Res ATI
Room Air Conditioner Recycling	2.2.55	Res ATI
Low Flow Swivel Aerator	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits
LED 12w	Various TRM Sections	Res EE Kits
LED 9w	Various TRM Sections	Res EE Kits
LED nightlight	Various TRM Sections	Res EE Kits
Low Flow Shower Head 1.6 GPM	Various TRM Sections	Res EE Kits
13/20/25 - 3 way CFL	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits
LED 12w	Various TRM Sections	Res EE Kits
LED 9w	Various TRM Sections	Res EE Kits
LED nightlight	Various TRM Sections	Res EE Kits
13/20/25 - 3 way CFL	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
Low Flow Swivel Aerator	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits
LED 9w	Various TRM Sections	Res EE Kits
LED nightlight	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits

Measure	TRM Section	Initiative
LED 9w	Various TRM Sections	Res EE Kits
LED nightlight	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
72-75W equivalent LEDee	2.1.1	Upstream Lighting
Clothes Washer - Level 1	2.4.4	Res_Appliances
Clothes Dryer - (Elec w Moisture Sensor)	2.4.5	Res_Appliances
Dehumidifiers	2.4.8	Res_Appliances
Freezers	2.4.2	Res_Appliances
Refrigerators - Level 1	2.4.1	Res_Appliances
Clothes Dryer - (Elec Heat Pump)	2.4.5	Res_Appliances
Refrigerators - Level 2	2.4.1	Res_Appliances
Refrigerators - Level 3	2.4.1	Res_Appliances
Water Heater - Heat Pump	2.3.1	Res_Appliances
Water Heater - Solar	2.3.2	Res_Appliances
TVs	2.5.1	Upstream Electronics
Computers	2.5.2	Upstream Electronics
Imaging	2.5.2	Upstream Electronics
Monitors	2.5.2	Upstream Electronics
Central Air Conditioner - Level 2	2.2.1	Res HVAC
Central Air Conditioner - Level 3	2.2.1	Res HVAC
Ductless Mini-Split Heat Pump - Level 3	2.2.3	Res HVAC
Furnace Fans	2.2.1	Res HVAC
Heat Pump - Level 2	2.2.1	Res HVAC
Heat Pump - Level 3	2.2.1	Res HVAC
Heat Pump - Water & GeoT - ES Tier 3	2.2.1	Res HVAC
PTAC - Level 2 - Multi Family	2.2.10	Res HVAC
PTHP - Level 2 - Multi Family	2.2.10	Res HVAC
HVAC - Maintenance	2.2.1	Res HVAC
Programmable Thermostat - Direct Install	IMP	Res HVAC
Programmable Thermostat - Store Bought	IMP	Res HVAC
3-way CFL (12/23/33)	Various TRM Sections	Res EE Kits
11W LED	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
LED Nite Lite	Various TRM Sections	Res EE Kits
9W LED	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits
Kitchen Swivel Aerator	Various TRM Sections	Res EE Kits
Over 150W equivalent CFL	2.1.1	Upstream Lighting
Over 150W equivalent LED	2.1.1	Upstream Lighting
Over 150W equivalent LED Specialty	2.1.1	Upstream Lighting
Over 150W equivalent LED Specialty	2.1.1	Upstream Lighting
Over 150W equivalent LEDee	2.1.1	Upstream Lighting
Under 25W equivalent CFL	2.1.1	Upstream Lighting
Under 25W equivalent LED	2.1.1	Upstream Lighting
Under 25W equivalent LED Specialty	2.1.1	Upstream Lighting
Under 25W equivalent LEDee	2.1.1	Upstream Lighting
Attic Insulation	2.6.1	Res DI
Air Sealing	2.6.6	Res DI
Showerhead	2.3.9	Res DI

Measure	TRM Section	Initiative
Pipe Wrap	2.3.7	Res DI
CFL - 13W	2.1.1	Res DI
CFL - 18W	2.1.1	Res DI
CFL - 23W	2.1.1	Res DI
CFL - 9W	2.1.1	Res DI
LED - 9W	2.1.1	Res DI
Bath Aerator	2.3.8	Res DI
Kitchen Aerator	2.3.8	Res DI
CFL - 9W Specialty	2.1.1	Res DI
12/22/33 Watt 3-way CFL	2.1.1	Res DI
14W Globe CFL	2.1.1	Res DI
ENERGY STAR® Windows	2.6.2	Res DI
Wall Insulation	2.6.1	Res DI
Duct Sealing	2.2.6	Res DI
16W R30 Flood	2.1.1	Res DI
Furnace Whistle	2.2.7	Res DI
LED Night Light	2.1.4	Res DI
Smart Power Strips	2.5.3	Res DI
CFL - 19W	2.1.1	Res DI
CFL - 9W Floodlight	2.1.1	Res DI
CFL - 14W Floodlight	2.1.1	Res DI
CFL - 14W Candelabra	2.1.1	Res DI
CFL - 19W Globe	2.1.1	Res DI
CFL - 9W Candelabra	2.1.1	Res DI
CFL - 9W Globe	2.1.1	Res DI
LED -11W	2.1.1	Res DI
CFL - 23W Floodlight	2.1.1	Res DI
HandHeld Showerhead	2.3.9	Res DI
LED 11/12W	2.1.1	Res DI
LED 5W Candelabra	2.1.1	Res DI
LED 6W Globe	2.1.1	Res DI
LED 14/15	2.1.1	Res DI
LED 11W R30 Flood	2.1.1	Res DI

C.3 Residential Low-Income Program Direct Install

For the gross impact evaluation effort, sampling initiatives were confined to distinct programs with the exception of the New Homes component of the Low Income Energy Efficiency Program, which was evaluated in the general residential New Homes Initiative. The table below lists low-income residential measures in the Companies' tracking and reporting system and assigns them to their respective evaluation initiatives. Note that some of the measures are denoted as disabled in the tracking system because they are not currently offered. We retain these measures for completeness – if the measures will again be offered in Act 129, they will fall in their corresponding sampling initiatives in the table. The Home Energy Report measure is not listed in the table below, but the measure constitutes its own initiative.

Table 167 - Assignment of measures to initiatives for Low-Income Residential Programs

Measure	TRM Section	Initiative
CREATE INT. ATTIC HATCH > 2 SQ. FT.	2.6.6	LI Direct Install
CREATE EXT. ATTIC HATCH UP TO 2 SQ. FT.	2.6.6	LI Direct Install
CREATE EXT. ATTIC HATCH > 2 SQ. FT.	2.6.6	LI Direct Install
CREATE KNEE WALL ACCESS	2.6.6	LI Direct Install
INSULATE ATTIC ACCESS-PUSH UP	2.6.6	LI Direct Install
INSULATE ATTIC ACC/FOLD. STAIRS	2.6.6	LI Direct Install
INSUL. & WXSTRIP PULL-DOWN ATTIC-PRE-FAB UNIT	2.6.6	LI Direct Install
INSUL.& WXSTRIP HORIZONTAL/PUSH-UP ATTIC HTCH-PRE-FAB UNIT	2.6.6	LI Direct Install
INSULATE & WXSTRIP WHOLE ATTIC DOOR	2.6.6	LI Direct Install
INSUL. & WXSTRIP WHOLE ATTIC DOOR (STAIRWAY)-PRE-FAB UNIT	2.6.6	LI Direct Install
ATTIC RECESSED LIGHTING BOXING	2.6.6	LI Direct Install
INSULATE ATTIC KNEE WALL	2.6.1	LI Direct Install
INSULATE ATTIC KNEE WALL PRE-FAB	2.6.1	LI Direct Install
FRAME SETS-ENERGY GUARD. OR EQUIVALENT ATTIC BOX	2.6.6	LI Direct Install
ENERGY GUARDIAN ACCESSORY PACK	2.6.6	LI Direct Install
FLOOR-FACED BAT FBGL R-11 16" ON CENTER	2.6.1	LI Direct Install
FLOOR-FACD BAT FBGL R-19 16" ON CENTER	2.6.1	LI Direct Install
FLOOR-FACD BAT FBGL R-19 24" ON CENTER	2.6.1	LI Direct Install
FLR. UNCOD. SP- VAPOR BARRIER-CRAWLSPACE	2.6.6	LI Direct Install
BREATHABLE MATERIAL-TYPAR/TYVEK -MOISTURE CONTROL	2.6.6	LI Direct Install
PERIMETER INSULATION-FACD FBGL R-11	2.6.1	LI Direct Install
PERIMETER INSULATION-FACD FBGL R-19	2.6.1	LI Direct Install
GARAGE- RIGID BOARD	2.6.6	LI Direct Install
GARAGE-FACD BAT FBGL R-19	2.6.1	LI Direct Install
MISC REPAIRS-CHIMNEY, FLUE, ETC.	2.6.6	LI Direct Install
INT. REPAIRS-FLOOR/WALL/CEILING..	2.6.6	LI Direct Install
EXHAUST FANS	2.6.6	LI Direct Install
VENT AN EXISTING EXHAUST TO OUTSIDE	2.6.6	LI Direct Install
DRYER VENT REPLACEMENT	2.6.6	LI Direct Install
DRYER VENT REPAIR	2.6.6	LI Direct Install
HEAT SYST./FURN. REPR. & RETROFIT	2.2.1	LI Direct Install
DUCT SEALING & REPAIR	2.2.6	LI Direct Install
DUCT INSULATION LESS THAN 6" IN DIAMETER	2.2.6	LI Direct Install
DUCT INSULATION GREATER THAN 6" DIAMETER	2.2.6	LI Direct Install
DUCT INSULATION SQUARE DUCTS	2.2.6	LI Direct Install
FURN./HEAT. SYSTEM REPLACEMENT	2.2.1	LI Direct Install
BASEBOARD REPAIR/REPLACE	2.6.6	LI Direct Install
FURNACE MAINT./TUNE-UP	2.2.1	LI Direct Install
REPLACE FURNACE FILTER	2.2.1	LI Direct Install
HEAT PUMP FILTER CLEANING/REPLACEMENT	2.2.1	LI Direct Install
HEAT PUMP COIL CLEANING-COIL ACCESSIBLE	2.2.1	LI Direct Install
HEAT PUMP COIL CLEANING-COIL NOT ACCESSIBLE	2.2.1	LI Direct Install
INSTALL AIR COND/APPLIANCE TIMER	2.2.1	LI Direct Install
EFFICIENT LIGHTING FIXTURES/COMPACT FLUORESCENT	2.1.1	LI Direct Install
DIMMABLE COMPACT FLUORESCENT LIGHTS	2.1.1	LI Direct Install

THREE-WAY COMPACT FLUORESCENT LIGHTS	2.1.1	LI Direct Install
R-30 AND R-40 COMPACT FLUORESCENT LIGHTS	2.1.1	LI Direct Install
3W AND 7W COMPACT FLUORESCENT LIGHTS	2.1.1	LI Direct Install
LIGHT FIXTURE OR SPECIALTY BULB REPLACEMENT	2.1.1	LI Direct Install
REPLACE AIR CONDITIONING FILTER	2.2.1	LI Direct Install
WINDOW/WALL A/C FILTER CLEANING/REPLACEMENT	2.2.1	LI Direct Install
CENTRAL AIR CONDITIONING TUNE-UP	2.2.1	LI Direct Install
CENTRAL A/C COIL CLEAN-COIL NOT ACCESSIBLE	2.2.1	LI Direct Install
COOLING SYSTEM REPLACEMENT- CENTRAL A/C	2.2.1	LI Direct Install
THERMOSTAT (REG.) RECALB./RELOCT/REPLAC.	2.2.8	LI Direct Install
LINE VOLTAGE THERMOSTAT	2.2.8	LI Direct Install
INSTALL SETBACK THERMOSTAT	2.2.8	LI Direct Install
CHANGEOUT AIR CONDITIONER--5000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--8000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--10000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--12000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--14000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--18000 BTU	2.2.1	LI Direct Install
WINDOW FILM	2.6.6	LI Direct Install
GRAVITY FILM EXCHANGE (GFX)	2.6.6	LI Direct Install
5 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
7 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
9 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
15 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
20 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
12 CU FT FREEZER UPRIGHT	2.4.2	LI Direct Install
14 CU FT FREEZER UPRIGHT FROST-FREE	2.4.2	LI Direct Install
14 CU FT FREEZER UPRIGHT MANUAL	2.4.2	LI Direct Install
17 CU FT FREEZER UPRIGHT FROST-FREE	2.4.2	LI Direct Install
17 CU FT FREEZER UPRIGHT/MANUAL	2.4.2	LI Direct Install
15 CUBIC FT. TOP MOUNT REFRIGERATOR	2.4.1	LI Direct Install
15 CUBIC FT. TOP MOUNT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
18 CUBIC FT. TOP MOUNT REFRIGERATOR	2.4.1	LI Direct Install
18 CU FT TOP MOUNT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
21 CUBIC FT. TOP MOUNT REFRIGERATOR	2.4.1	LI Direct Install
21 CU FT. TOP MOUNT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
22 CU FT. SIDE/SIDE REFRIGERATOR (ICE)	2.4.1	LI Direct Install
22 CU FT TOP MOUNT REFRIGERATOR (NO ICE)	2.4.1	LI Direct Install
25 CU FT REFRIG SIDE/SIDE ICE	2.4.1	LI Direct Install
ADDITIONAL REFRIGERATOR/FREEZER REMOVAL	2.4.3	LI Direct Install
DRYER REPLACEMENT	2.4.5	LI Direct Install
TORCHERE LAMP	2.1.1	LI Direct Install
SMART STRIP POWER PLUG	2.5.3	LI Direct Install
FAUCET AERATOR-BATH	2.3.8	LI Direct Install
FAUCET AERATOR-KITCH	2.3.8	LI Direct Install
FAUCET AERATOR-WITH SWIVEL HEAD	2.3.8	LI Direct Install
ENERGY SAVING SHOWERHEAD W/O SHUTOFF	2.3.9	LI Direct Install
ENERGY SAVING SHOWERHEAD W/SHUTOFF	2.3.9	LI Direct Install
SHOWERHEAD - HANDHELD	2.3.9	LI Direct Install
WATER HEATER JACKET R-11	2.3.5	LI Direct Install
WATER HEATER JACKET TANK GREATER THAN 52 GALLONS	2.3.5	LI Direct Install
WATER HEATER INSULATION - LOW E OR EQUIVALENT	2.3.5	LI Direct Install

PIPE INSULATION - 3/4	2.3.7	LI Direct Install
PIPE INSULATION - 1/2"	2.3.7	LI Direct Install
TANK TEMPERATURE SETBACK	2.3.6	LI Direct Install
30 GAL ELEC HOT WATER TANK REMOVE/REPLACE	Null Measure	LI Direct Install
40 GAL ELEC. HOT WATER TANK REMOVE/REPLACE	2.3.1	LI Direct Install
52 GAL ELEC HOT WATER TANK REMOVE/REPLACE	2.3.1	LI Direct Install
80 GAL ELEC HOT WATER TANK REMOVE/REPLACE	2.3.1	LI Direct Install
INFILTRATION WORK INCLUDING BLOWER DOOR	2.6.6	LI Direct Install
RIGID BOARD HOLE REPAIR/AIR SEALING	2.6.6	LI Direct Install
TWO-PART FOAM PERIMETER INSULATION	2.6.6	LI Direct Install
FIBERGLASS PERIMETER INSULATION (R19)	2.6.1	LI Direct Install
RIGID BOARD PERIMETER INSULATION (1`)	2.6.6	LI Direct Install
DRYWALL PATCH W/TAPED JOINTS & TOP COAT	2.6.6	LI Direct Install
DRYWALL FULL SHEET W/TAPED JOINTS & TOP COAT	2.6.6	LI Direct Install
KITCHEN VENT COVER	2.6.6	LI Direct Install
INTERIOR ATTIC STAIR COVER	2.6.6	LI Direct Install
WHOLE HOUSE FAN COVER	2.6.6	LI Direct Install
INFILTRATION WORK EXCLUDING BLOWER DOOR	2.6.6	LI Direct Install
CAULK	2.6.6	LI Direct Install
CAULK - HIGH TEMPERATURE	2.6.6	LI Direct Install
AEROSOL FOAM SEALANT	2.6.6	LI Direct Install
AEROSOL FOAM SEALANT-HIGH TEMPERATURE	2.6.6	LI Direct Install
AIR TIGHT INSERT KIT OR EQUIVALENT FOR RECESSED LIGHTS	2.6.6	LI Direct Install
AIR CONDITIONER COVER-RIGID	2.6.6	LI Direct Install
AIR CONDITIONER COVER-SOFT	2.6.6	LI Direct Install
WINDOW QUILT	2.6.6	LI Direct Install
BLOWN SIDEWALL INSULATION - ASBESTOS	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION - WOOD / ASPHALT	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION - STUCCO/BRICK	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION - ALUMINUM SIDING	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION - VINYL SIDING	2.6.1	LI Direct Install
FIBERGLASS UNFINISHED WALL INSULATION (R13)	2.6.1	LI Direct Install
FIBERGLASS UNFINISHED WALL INSULATION-R19	2.6.1	LI Direct Install
WET SPRAY CELLULOSE INSULATION	2.6.1	LI Direct Install
EXT. DOOR - SWEEP	2.6.6	LI Direct Install
EXT. DOOR - WEATHER-STRIP	2.6.6	LI Direct Install
EXT. DOOR - FIX LOCK	2.6.6	LI Direct Install
EXT. DOOR - REPLACE LOCK	2.6.6	LI Direct Install
EXT. DOOR - REPAIR	2.6.6	LI Direct Install
EXT. DOOR - REPLACE	2.6.6	LI Direct Install
EXTERIOR DOOR - CONSTRUCT	2.6.6	LI Direct Install
EXT. DOOR - STORM DOOR	2.6.6	LI Direct Install
INT. DOOR - WEATHER-STRIP	2.6.6	LI Direct Install
EXT./INT. DOOR - INSULATE W/RIGID BD	2.6.6	LI Direct Install
WINDOW-REPL GLASS W/ GLAZE	2.6.6	LI Direct Install
WINDOW-REGLAZE ONLY	2.6.6	LI Direct Install
WINDOW-REPAIR/REPLACE SASH	2.6.6	LI Direct Install
WINDOW WEATHER-STRIP	2.6.6	LI Direct Install
WINDOW-REPLACE SASH LOCK	2.6.6	LI Direct Install
WINDOW-ADD PULLEY SEALS	2.6.6	LI Direct Install
REPLACEMENT WINDOW	2.6.6	LI Direct Install
INTERIOR STORM WINDOW W/CLIPS	2.6.6	LI Direct Install

INTERIOR STORM WINDOW W/O CLIPS	2.6.6	LI Direct Install
EXTERIOR STORM WINDOW/DOOR REPAIR	2.6.6	LI Direct Install
INSTALL EXTERIOR STORM DOOR/WINDOW	2.6.6	LI Direct Install
MOBILE HOME-INSTALL DOOR/STORM COMBO	2.6.6	LI Direct Install
MOBILE HOME-REPL. EXT PRIME DOOR	2.6.6	LI Direct Install
MOBILE HOME--INTERIOR STORM WINDOWS	2.6.6	LI Direct Install
MOBILE HOME--REPLACE PRIME WINDOWS	2.6.6	LI Direct Install
MOBILE HOME-SKIRTING	2.6.6	LI Direct Install
REFLECTIVE ROOF COAT	2.6.6	LI Direct Install
MOB. HOME-CEILING INSULATION - CELLULOSE	2.6.1	LI Direct Install
MOB. HOME-CEILING INSULATION - FIBERGLASS	2.6.1	LI Direct Install
MOB. HOME- FLOOR INSULATION (BELLY) CELLULOSE	2.6.1	LI Direct Install
MOBILE HOME FLOOR INSULATION--FIBERGLASS	2.6.1	LI Direct Install
TYPAR/TYVEK BELLY BOARD MOBILE HOME REPAIR	2.6.6	LI Direct Install
PLYWOOD OR RIGID BOARD BELLY BOARD MOBILE HOME REPAIR	2.6.6	LI Direct Install
CLEAN/SEAL/SECURE MOBILE HOME ELECTRIC HEAT REG. RISER	2.6.6	LI Direct Install
MOBILE HOME ROOF PATCH	2.6.6	LI Direct Install
R11 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R13 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R-19 ATTIC-NON FACD BATT FBGLS	2.6.1	LI Direct Install
R25 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R30 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R38 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R19 PINK PLUS	2.6.1	LI Direct Install
BLOWN CELLULOSE UNFLOORED ATTIC INSULATION R19 OR LESS	2.6.1	LI Direct Install
BLOWN CELLULOSE UNFLOORED ATTIC INSULATION R20 OR GREATER	2.6.1	LI Direct Install
BLOWN CELLULOSE FLOORED (DENSE PACKED) ATTIC INSULATION R19 OR LESS	2.6.1	LI Direct Install
BLOWN CELLULOSE FLOORED (DENSE PACKED) ATTIC INSULATION R20 OR GREATER	2.6.1	LI Direct Install
PREP OR FOLLOW-UP TO AIR SEAL OR INSULATING	2.6.6	LI Direct Install
BOXING/DAMMING OF ATTIC HATCHES	2.6.6	LI Direct Install
BOXING/DAMMING OF CHIMNEYS	2.6.6	LI Direct Install
BOXING/DAMMING OF STORAGE AREAS	2.6.6	LI Direct Install
BOXING/DAMMING OF SOFFIT VENTS	2.6.6	LI Direct Install
BOXING/DAMMING FIXTURES-SEALED-END DUCT	2.6.6	LI Direct Install
BOXING/DAMMING FIXTURES (PRE-FAB 16" DAM)	2.6.6	LI Direct Install
BOXING/DAMMING FIXTURES (PRE-FAB 24" DAM)	2.6.6	LI Direct Install
CREATE INT. ATTIC HATCH UP TO 2 SQ.FT	2.6.6	LI Direct Install
CF1 9-13 watt CFL	2.1.1	LI Direct Install
CF2 14-16 watt CFL	2.1.1	LI Direct Install
CF3 17-20 watt CFL	2.1.1	LI Direct Install
CF4 21-25 watt CFL	2.1.1	LI Direct Install
SP 1 Smart Power Strip 6-9 outlets	2.5.3	LI Direct Install
SP 2 Smart Power Strip 10+ outlets	2.5.3	LI Direct Install
FLOOD/RECESSED CFL - 10-13 WATTS	2.1.1	LI Direct Install
FLOOD/RECESSED CFL - 14-16 WATTS	2.1.1	LI Direct Install
FLOOD/RECESSED CFL - 17-20 WATTS	2.1.1	LI Direct Install
FLOOD/RECESSED CFL - 21-25 WATTS	2.1.1	LI Direct Install
SPEC CFL - 2-9 WATTS	2.1.1	LI Direct Install

SPEC CFL - 10-13 WATTS	2.1.1	LI Direct Install
SPEC CFL - 14-16 WATTS	2.1.1	LI Direct Install
SPEC CFL - 17-20 WATTS	2.1.1	LI Direct Install
SPEC CFL - 21-25 WATTS	2.1.1	LI Direct Install
Furnace Whistle	2.2.7	LI Direct Install
LED Night Light	2.1.4	LI Direct Install
12 CU FT FREEZER UPRIGHT/MANUAL	2.4.2	LI Direct Install
13 CU FT FREEZER UPRIGHT MANUAL	2.4.2	LI Direct Install
14 CU FT FREEZER CHEST/FROSTFREE	2.4.2	LI Direct Install
15 CU FT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
16 CU FT FREEZER UPRIGHT/FROSTFREE	2.4.2	LI Direct Install
16 CU FT FREEZER UPRIGHT/MANUAL	2.4.2	LI Direct Install
16 CU FT REFRIGERATOR	2.4.1	LI Direct Install
16 CU FT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
17 CU FT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
17 CUBIC FT. REFRIGERATOR	2.4.1	LI Direct Install
21 CU FT FREEZER UPRIGHT FROST FREE	2.4.2	LI Direct Install
22 CU FT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
23 CU FT SIDE/SIDE REFRIGERATOR(ICE)	2.4.1	LI Direct Install
7 CU FT UPRIGHT FREEZER	2.4.2	LI Direct Install
A/C WINDOW UNIT - NO PRIOR UNIT	2.2.4	LI Direct Install
AIR CONDITIONER WINDOW/WALL GASKET	2.6.6	LI Direct Install
ATTIC BATT FBGLS R-38	2.6.1	LI Direct Install
ATTIC-BLN INSL R-10	2.6.1	LI Direct Install
ATTIC-BLN INSL R-19	2.6.1	LI Direct Install
ATTIC-BLN INSL R-20	2.6.1	LI Direct Install
ATTIC-BLN INSL R-25	2.6.1	LI Direct Install
ATTIC-BLN INSL R-27	2.6.1	LI Direct Install
ATTIC-BLN INSL R-30	2.6.1	LI Direct Install
ATTIC-BLN INSL R-38	2.6.1	LI Direct Install
ATTIC-BLN INSL R-8	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION-BIBS	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION-PLASTER/DRYW.	2.6.1	LI Direct Install
BOXING/DAMMING ATTIC HATCH - FIBERGLASS	2.6.6	LI Direct Install
CLEAN/SEAL/SECURE MOBILE HOME REG. RISER	2.6.6	LI Direct Install
DEHUMIDIFIER REPLACEMENT	2.4.8	LI Direct Install
DENSE PACK CANTILEVER	2.6.1	LI Direct Install
DISPOSAL AND INSTALLTION OF NEW AIR COND	2.2.1	LI Direct Install
ENERGY SAVING SHOWERHEAD	2.3.9	LI Direct Install
FLOOR-FACED BAT FBGL R-11 24 CTR	2.6.1	LI Direct Install
FLR. UNCOD. SP-FACD FBGL R11 16	2.6.1	LI Direct Install
GARAGE RIGID BOARD - 2 INCH	2.6.6	LI Direct Install
HEAT EXCHANGER REPLACEMENT	2.2.1	LI Direct Install
HEAT REFLECTOR	2.6.6	LI Direct Install
INSTALL CEILING FAN	2.4.10	LI Direct Install
INSTALL WHOLE HOUSE FAN	2.2.9	LI Direct Install
MOB. HOME-REPLACE FLOOR REG. 8X10	2.6.6	LI Direct Install
RIGID BOARD INSULATION 2 INCH	2.6.6	LI Direct Install
SPRAY FOAM-THERMAL/IGNITION BARRIER REQ	2.6.6	LI Direct Install
WATER HEATER T-STAT. - TEST/REPLACE	2.3.6	LI Direct Install
CHANGEOUT AIR CONDITIONER-15000 BTU	2.2.4	LI Direct Install
78A - Dimmable CFL	2.1.1	LI Direct Install
78F - Specialty CFL - Flood/Recessed	2.1.1	LI Direct Install

HPW-A - Install Heat Pump Water Heater 2.0 EF	2.3.1	LI Direct Install
HPW-B - Install Heat Pump Water Heater 2.3 EF	2.3.1	LI Direct Install
22 cu. Ft. SxS fridge (no ice)	2.4.1	LI Direct Install
25 cu. Ft. freezer chest/manual	2.4.2	LI Direct Install
Install heat pump water heater 2.0 EF	2.3.1	LI Direct Install
Install heat pump water heater 2.3 EF	2.3.1	LI Direct Install
Mobile home replace floor reg 4x10	2.6.6	LI Direct Install
Mobile home replace floor reg 4x12	2.6.6	LI Direct Install
Mobile home replace floor reg. 4x8	2.6.6	LI Direct Install
Safety test - atmospheric draft	2.6.6	LI Direct Install
25 cu ft refrigerator (side by side)	2.4.1	LI Direct Install
30 Gallon - .93 EF	Null Measure	LI Direct Install
30 Gallon - .94 EF	Null Measure	LI Direct Install
30 Gallon - .95 EF	Null Measure	LI Direct Install
40 Gallon - .93 EF	Null Measure	LI Direct Install
40 Gallon - .94 EF	Null Measure	LI Direct Install
40 Gallon - .95 EF	Null Measure	LI Direct Install
50 Gallon - .93 EF	Null Measure	LI Direct Install
50 Gallon - .94 EF	Null Measure	LI Direct Install
50 Gallon - .95 EF	Null Measure	LI Direct Install
80 Gallon - .93 EF	Null Measure	LI Direct Install
80 Gallon - .94 EF	Null Measure	LI Direct Install
80 Gallon - .95 EF	Null Measure	LI Direct Install
FW1 - Met-Ed	2.2.7	LI Direct Install
FW2 - Penelec	2.2.7	LI Direct Install
FW3 - Penn Power	2.2.7	LI Direct Install
FW4 - West Penn Power	2.2.7	LI Direct Install
Met-Ed - B2A	2.2.8	LI Direct Install
Penelec - B2B	2.2.8	LI Direct Install
Penn Power - B2C	2.2.8	LI Direct Install
West Penn Power - B2D	2.2.8	LI Direct Install
Removal of Additional Freezer	2.4.3	LI Direct Install
Energy Saving Showerhead with Shut Off	2.3.9	LI Direct Install
Faucet Aerator - Bath	2.3.8	LI Direct Install
Faucet Aerator - Kitchen	2.3.8	LI Direct Install
Faucet Aerator with Swivel Head	2.3.8	LI Direct Install
Pipe Ins. 1/2 inch from EHWH	2.3.7	LI Direct Install
Pipe Ins. 3/4 inch from EHWH	2.3.7	LI Direct Install
PIPE INSULATION - 3/4"	2.3.7	LI Direct Install
50 Gal .93EF Elec HWH Replace	Null Measure	LI Direct Install
50 Gal .94EF Elec HWH Replace	Null Measure	LI Direct Install
50 Gal .95EF Elec HWH Replace	Null Measure	LI Direct Install
50 Gal Elec. Hot Water Tank Remove/Replace	2.3.1	LI Direct Install
50 Gal Elec. Hot Water Tank Remove/Replace	Null Measure	LI Direct Install
Attic-BLN INSL R14	2.6.1	LI Direct Install
Attic-BLN INSL R33	2.6.1	LI Direct Install
Attic-BLN INSL R44	2.6.1	LI Direct Install
Ductless Mini-Split Heat Pump	2.2.3	LI Direct Install
LED - 13-14 WATT Flood	2.1.1	LI Direct Install
LED - 17 WATT Flood	2.1.1	LI Direct Install
LED - 2.3 WATT Globe	2.1.1	LI Direct Install
LED - 3.5 WATT Medium Base Torpedo	2.1.1	LI Direct Install
LED - 3.7-4.8 WATT Candelabra	2.1.1	LI Direct Install

LED - 6-8 WATT Standard Bulb	2.1.1	LI Direct Install
LED - 8 WATT Flood	2.1.1	LI Direct Install
LED - 9-13 WATT Standard Bulb	2.1.1	LI Direct Install
Ground Cover	2.6.6	LI Direct Install
Heat Pump Clean and Tune	2.2.1	LI Direct Install
LI Dehumidifier Recycling	IMP	LI ATI
LI Freezer Recycling	2.4.3	LI ATI
LI Refrigerator Recycling	2.4.3	LI ATI
LI Room Air Conditioner Recycling	2.2.5	LI ATI
Low Flow Swivel Aerator	Various TRM Sections	LI Kits
Furnace Whistle	Various TRM Sections	LI Kits
LED 12w	Various TRM Sections	LI Kits
LED 6.5w	Various TRM Sections	LI Kits
LED 9w	Various TRM Sections	LI Kits
LED nightlight	Various TRM Sections	LI Kits
Low Flow Shower Head 1.6 GPM	Various TRM Sections	LI Kits
13/20/25 - 3 way CFL	Various TRM Sections	LI Kits
23w CFL	Various TRM Sections	LI Kits
LI Clothes Washers	2.4.4	LI Appliances
LI Clothes Dryer	2.4.5	LI Appliances
LI Dehumidifiers	2.4.8	LI Appliances
LI Freezers	2.4.2	LI Appliances
LI Refrigerators	2.4.1	LI Appliances
3-way CFL (12/23/33)	Various TRM Sections	LI Kits
11W LED	Various TRM Sections	LI Kits
LED Nite Lite	Various TRM Sections	LI Kits
9W LED	Various TRM Sections	LI Kits
Kitchen Swivel Aerator	Various TRM Sections	LI Kits
6W LED	Various TRM Sections	LI Kits
SILL BOX INSUL PRE CUT PRODUCT	2.6.6	LI Direct Install
LE9 - Retrofit Kit - 13-14 Watt Flood	2.1.1	LI Direct Install

Appendix D Evaluation Detail – Residential Appliance Turn-In Initiative

D.1 Gross Impact Evaluation

Gross impact evaluation for the Appliance Turn-In (ATI) Initiative involved 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.

D.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical for all four EDCs. A TRM-based calculation was performed for each entry in the tracking and reporting system. The parameter values from the TRM (or for dehumidifiers, IMP) algorithms were taken from project-specific data from the tracking and reporting system when applicable, from TRM defaults, or from customer verification surveys. For refrigerators and freezers, measure attributes that participants would readily recall were determined from participant surveys, and the average parameter values were applied to all measures. Apart from measure verification, these attributes include the part-use factor, the location in the home where the appliance was used, and for refrigerators, whether the appliance was a primary or secondary unit. Technical attributes of the appliances, such as the age, capacity, and configuration, as collected by ARCA, were taken from program tracking and reporting data. TRM or IMP default parameters were used for room air conditioners (RACs) and dehumidifiers. Table 168 lists the data sources for gross impact calculation algorithms.

Table 168: 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	TRM Default
RAC	EER	TRM Default
RAC	RAC EFLH	TRM - Zip Code Lookup
RAC	CF	TRM Default
Dehumidifier	Capacity	IMP Default
Dehumidifier	Region (to determine kWh)	TRM - Zip Code Lookup
All Measures	Verification Rate	Participant Surveys

Both telephone and online surveys were conducted in PY8, and the two modes yielded compatible results. Since PY9, the online survey mode was used for the general ATI program, and the telephone survey mode was largely reserved for Low-Income ATI participants.

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. Although verification rates determined through surveys were approximately 100%, the realization rates are generally lower than 100% because the part-use factors are lower than the TRM default values, and the calculated unit energy consumptions were lower than what would expect from application of default parameters in the TRM.

D.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 169, Table 170, Table 171, and Table 172. The population sizes and sample sizes represent individual appliances rather than individual customers.

Table 169: ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	4,273	566	Survey (online)
Freezers	1,056	169	
Dehumidifiers	283	48	
RACs	531	96	
Program Total	**6,143**	**879**	

Table 170: ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	3,752	491	Survey (online)
Freezers	1,003	140	
Dehumidifiers	305	54	
RACs	384	71	
Program Total	**5,444**	**756**	

Table 171: ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	1,365	190	Survey (online)
Freezers	371	56	
Dehumidifiers	120	25	
RACs	91	14	
Program Total	**1,947**	**285**	

Table 172: ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	4,768	608	Survey (online)
Freezers	1,227	173	
Dehumidifiers	330	49	
RACs	348	55	
Program Total	**6,673**	**885**	

D.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 173, Table 174, Table 175, and Table 176 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 173: ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	4,033	100.5%	0.5	3.0%
Freezers	877	75.9%	0.5	5.5%
Dehumidifiers	71	225.6%	0.5	10.4%
RACs	61	125.1%	0.5	7.3%
Program Total	**5,041**	**98.3%**	**0.5**	**2.6%**

Table 174: ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	3,976	94.7%	0.5	3.2%
Freezers	844	83.9%	0.5	6.1%
Dehumidifiers	76	212.1%	0.5	9.8%
RACs	44	94.7%	0.5	8.5%
Program Total	**4,940**	**94.7%**	**0.5**	**2.6%**

Table 175: ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	1,475	92.8%	0.5	5.2%
Freezers	322	78.0%	0.5	9.6%
Dehumidifiers	30	177.2%	0.5	14.4%
RACs	10	100.4%	0.5	19.2%
Program Total	**1,837**	**91.6%**	**0.5**	**4.1%**

Table 176: ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	4,888	101.6%	0.5	2.9%
Freezers	1,058	82.1%	0.5	5.5%
Dehumidifiers	83	199.5%	0.5	10.3%
RACs	40	96.0%	0.5	9.7%
Program Total	**6,068**	**99.5%**	**0.5**	**2.5%**

D.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 177, Table 178, Table 179, and Table 180 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 177: ATI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.45	100.5%	0.5	3.0%
Freezers	0.10	75.9%	0.5	5.5%
Dehumidifiers	0.03	115.5%	0.5	10.4%
RACs	0.14	101.1%	0.5	7.3%
Program Total	**0.72**	**97.9%**	**0.5**	**2.5%**

Table 178: ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.44	94.7%	0.5	3.2%
Freezers	0.09	83.9%	0.5	6.1%
Dehumidifiers	0.03	126.6%	0.5	9.8%
RACs	0.10	94.7%	0.5	8.5%
Program Total	**0.67**	**94.6%**	**0.5**	**2.5%**

Table 179: ATI Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.17	92.8%	0.5	5.2%
Freezers	0.04	78.0%	0.5	9.6%
Dehumidifiers	0.01	102.2%	0.5	14.4%
RACs	0.02	100.0%	0.5	19.2%
Program Total	**0.24**	**91.7%**	**0.5**	**4.1%**

Table 180: ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.55	101.6%	0.5	2.9%
Freezers	0.12	82.1%	0.5	5.5%
Dehumidifiers	0.03	113.9%	0.5	10.3%
RACs	0.09	93.1%	0.5	9.7%
Program Total	**0.79**	**98.2%**	**0.5**	**2.5%**

D.2 NET IMPACT EVALUATION

D.2.1 Net Impact Evaluation Methodology

The net-to-gross evaluation for the Appliance Turn-in program followed the participant self-report methodology outlined in the PA Evaluation Framework. Net-to-gross was estimated for the program for each FirstEnergy EDC.

The participant self-report methodology was implemented following the common approach outlined in Appendix B of the 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 Turn-in 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.

Overall NTG ratios for the Appliance Turn-in program are higher than identified during Phase II evaluation, in part because of the addition of the question clarifying the timing of the participant's plans to remove their old unit in the absence of the program.

D.2.2 Sampling

The sample designs for the four EDCs are shown in Table 181, Table 182, Table 183, and Table 184 for Met-Ed, Penelec, Penn Power, and WPP respectively. The focus of the NTG surveys was on refrigerators and freezers because these two measures accounted for 98% of reported savings.

Table 181: ATI Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All	6,143	815	20.0%
Program Total	**6,143**	**815**	**20.0%**

Table 182: ATI Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Refrigerators	5,444	693	20.0%
Program Total	**5,444**	**693**	**20.0%**

Table 183: ATI Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Refrigerators	1,947	271	21.0%
Program Total	**1,947**	**271**	**21.0%**

Table 184: ATI Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Refrigerators	6,673	850	21.0%
Program Total	**6,673**	**850**	**21.0%**

D.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 185, Table 186, Table 187, and Table 188 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 185: ATI Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	4,956	55.0%	0.0%	45.0%	3.8%
Program Total	**4,956**	**55.0%**	**0.0%**	**45.0%**	**3.8%**

Table 186: ATI Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Refrigerators	4,677	53.0%	0.0%	47.0%	4.1%
Program Total	**4,677**	**53.0%**	**0.0%**	**47.0%**	**4.1%**

Table 187 ATI Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Refrigerators	1,683	49.0%	0.0%	51.0%	6.6%
Program Total	**1,683**	**49.0%**	**0.0%**	**51.0%**	**6.6%**

Table 188 ATI Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Refrigerators	6,038	52.0%	0.0%	48.0%	3.7%
Program Total	**6,038**	**52.0%**	**0.0%**	**48.0%**	**3.7%**

Appendix E Evaluation Detail – EE Kits Initiative

E.1 Gross Impact Evaluation

The Energy Efficiency Kits (EE Kits) initiative has three sub-components. The first two subcomponents, EE Kits and Online Audit Kits are administered by PowerDirect. Both components involve delivery of conservation kits to program participants, but the Online Audit component requires that customers participate in an online home energy audit, while the main program component, EE Kits, distributes kits to customers that submit an online or telephonic request for conservation kits. The third subcomponent, the School Education program, is administered by AM Conservation Group (AMCG), and distributes conservation kits to students at participating schools. The program 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, Online Audit Kits, and EE Kits). In the EE Kit and Online Audit Kit subprograms, two separate types of energy conservation kits were sent to customers depending on their hot water fuel source. The kits provided to customers with electric water heating included LED lamps, CFLs, LED night lights, energy saving aerators, a furnace whistle, and an energy saving showerhead. The kits provided to customers with non-electric water heating consists of LED lamps, CFLs, LED night lights, and a furnace whistle. School kits included LED lamps, LED night lights, an energy saving faucet aerator, and a furnace whistle.

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 2016 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 LEDs or CFLs 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 to 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. As with the Low-Income kits and the Schools kits, the average kit receipt rates and measure-level in service rates are closely correlated across all four FirstEnergy PA EDCs. EDC-specific variations are explicable primarily due to statistical variation in survey responses, which may account for a ±10% uncertainty in final verified impacts at the EDC-level. Due to this, average statewide in-service rates are used for all four FirstEnergy EDCs. This reduces the likelihood that one particular EDC will receive an unusually high or low realization rate due solely to statistical fluctuations, and is generally consistent with the PA TRM's treatment of in-service rates, which are uniform across the state. The statistical precision for this program component is based on the EDC-specific number of customers that completed survey responses.

The ISRs for kit components are expected to be dynamic quantities. Previous evaluations have shown that the ISR for residential lighting approaches 100%, but over a period of several years. This is in part the reason behind relating the ISR to the kit receipt rate, rather than to ISRs reported by customers, as survey ISRs represent a snapshot in time. While it is expected that the ISR for lighting may gradually increase as lamps installed in a home burn out and are replaced by lamps in the kit, the ISRs for other kit items may be relatively stable since the number of potential replacement scenarios are limited (e.g. a home may have dozens of general service lamps, but only one furnace filter, kitchen aerator, or showerhead). In Figure 27, we plot the ISR vs. survey lag (defined as the time between kit receipt and verification surveys, and taken from our PY8 evaluation effort[20]) for various kit components. In this figure, the ISR for lamps is estimated through general questions (installed some, none, or all of the supplied lamps), while other ISRs are constructed according to the methods described above. The figure suggests that ISRs for lighting do tend to grow with time, while ISRs for other items are relatively static after a brief ramp-up period.

[20] This comparison was conducted in PY8 to help guide our analysis approach relative to survey lag and recall effects. The analysis was not repeated in PY9.

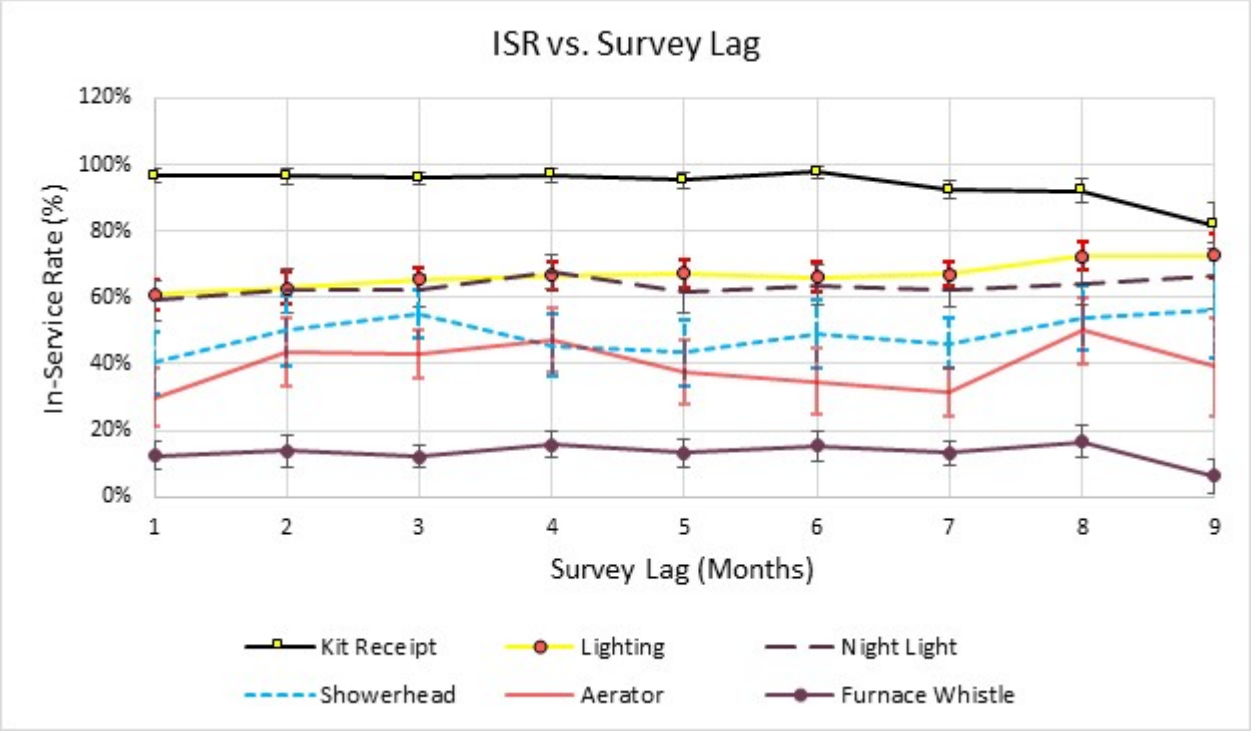

Figure 27: ISR vs. Survey Lag for Kit Components

Both telephone and online surveys were conducted in PY8. The two modes yielded compatible results, so each survey response for a given stratum was given equal weight. Due to the compatibility of results observed since PY8, the costlier telephone survey mode was reserved primarily to reach customers for which we do not have email contact information, and to reach quotas in certain sampling strata without having to send out new batches of online survey invites. We intend to continue to depend primarily on the online surveys, as they allow for efficient data acquisition and large sample sizes.

The gross realization rates for energy savings were driven primarily by in-service rates for the kit components. The realization rates were generally higher than 100% because impact values reported for the 9W LEDs were developed with the assumption of a 29W baseline. However, the 9W LEDs supplied by PowerDirect supplied 800 lumens and mapped to a 43W baseline. The in-service rates as determined by surveys were comparable to those used in planning assumptions.

E.1.2 Sampling

The low-income kits are treated as a separate initiative, and are discussed in Appendix O. Each kit type was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 189, Table 190, Table 191, and Table 192.

Table 189: EE Kits Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	33,041	1,753	Survey (phone + online)
EE Kits - Standard	30,162	1,499	
Online Kits - Electric	2,122	184	
Online Kits - Standard	1,438	129	
School Education kits	1,851	90	
Program Total	**68,614**	**3,655**	

Table 190: EE Kits Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	35,615	1,760	Survey (phone + online)
EE Kits - Standard	35,917	1,863	
Online Kits - Electric	1,317	106	
Online Kits - Standard	1,155	86	
School Education kits	2,000	83	
Program Total	**76,004**	**3,898**	

Table 191: EE Kits Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	7,099	657	Survey (phone + online)
EE Kits - Standard	8,058	643	
Online Kits - Electric	447	39	
Online Kits - Standard	467	42	
School Education kits	437	44	
Program Total	**16,508**	**1,425**	

Table 192: EE Kits Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	4,005	386	Survey (phone + online)
EE Kits - Standard	2,586	295	
Online Kits - Electric	3,687	407	
Online Kits - Standard	2,606	333	
School Education kits	3,585	133	
Program Total	**16,469**	**1,554**	

E.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 193, Table 194, Table 195, and Table 196 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 193: EE Kits 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	13,171	118.557%	0.5	1.7%
EE Kits - Standard	8,522	119.671%	0.5	1.8%
Online Kits - Electric	354	107.2%	0.5	5.1%
Online Kits - Standard	185	125.0%	0.5	6.0%
School Education kits	649	109.6%	0.5	7.4%
Program Total	**22,882**	**118.6%**	**0.5**	**1.2%**

Table 194: EE Kits Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	15,016	120.4%	0.5	1.7%
EE Kits - Standard	10,998	120.4%	0.5	1.6%
Online Kits - Electric	232	109.5%	0.5	6.7%
Online Kits - Standard	159	130.9%	0.5	7.5%
School Education kits	755	96.5%	0.5	7.7%
Program Total	**27,160**	**119.7%**	**0.5**	**1.2%**

Table 195: EE Kits 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	2,986	118.0%	0.5	2.7%
EE Kits - Standard	2,452	122.8%	0.5	2.7%
Online Kits - Electric	79	105.1%	0.5	11.0%
Online Kits - Standard	65	136.0%	0.5	10.6%
School Education kits	164	102.3%	0.5	10.3%
Program Total	**5,745**	**119.6%**	**0.5**	**1.8%**

Table 196: EE Kits Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	1,660	119.3%	0.5	3.5%
EE Kits - Standard	772	124.7%	0.5	3.9%
Online Kits - Electric	641	116.9%	0.5	3.4%
Online Kits - Standard	354	129.0%	0.5	3.7%
School Education kits	1,323	105.4%	0.5	6.1%
Program Total	**4,750**	**116.7%**	**0.5**	**2.2%**

E.1.4 Results for Demand

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

Table 197: EE Kits 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	1.43	122.2%	0.5	2%
EE Kits - Standard	0.96	127.0%	0.5	2%
Online Kits - Electric	0.04	115.0%	0.5	5%
Online Kits - Standard	0.02	136.5%	0.5	6%
School Education kits	0.08	113.0%	0.5	7%
Program Total	**2.53**	**123.8%**	**0.5**	**1.2%**

Table 198: EE Kits Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	1.48	122.8%	0.5	2%
EE Kits - Standard	1.08	128.7%	0.5	2%
Online Kits - Electric	0.02	111.3%	0.5	7%
Online Kits - Standard	0.02	158.5%	0.5	7%
School Education kits	0.08	101.0%	0.5	8%
Program Total	**2.67**	**124.6%**	**0.5**	**1.2%**

Table 199: EE Kits Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.32	123.8%	0.5	3%
EE Kits - Standard	0.27	135.3%	0.5	3%
Online Kits - Electric	0.01	111.2%	0.5	11%
Online Kits - Standard	0.01	157.4%	0.5	11%
School Education kits	0.02	106.7%	0.5	10%
Program Total	**0.63**	**128.5%**	**0.5**	**1.8%**

Table 200: EE Kits Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.19	120.6%	0.5	3%
EE Kits - Standard	0.09	134.0%	0.5	4%
Online Kits - Electric	0.08	124.1%	0.5	3%
Online Kits - Standard	0.04	143.2%	0.5	4%
School Education kits	0.16	112.6%	0.5	6%
Program Total	**0.57**	**122.7%**	**0.5**	**2.2%**

E.2 NET IMPACT EVALUATION

E.2.1 Net Impact Evaluation Methodology

The net-to-gross evaluation for the Energy Efficiency Kits 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. Kits contribute a significant portion of FirstEnergy's residential portfolio savings and several sub-programs operate with this delivery method. The evaluation sampled and analyzed kits as a high-impact measure (HIM) based on the definition in the evaluation framework. There are three distinct sub-programs that distribute kits. Opt-In Kits is the largest of the three sub-programs, and uses an opt-in participation model with simple participation and eligibility criteria. Online Audit Kits are similar to those in the Opt-In component, but the program also involves participation in an online home energy audit. School Kits are distributed to teachers and students' families at participating schools. Net Impact analysis was conducted for all three kit types in PY8 (with some crossover into PY9). In PY10, Tetra Tech conduced net impact analysis for Online Audit Kits. To calculate overall net-to-gross ratios for the kits program, the PY10 and PY8 results were weighted together in proportion to PY10 gross verified MWh for Online Kits and for the remaining kits, respectively. Free ridership scores in PY10 were 27% as averaged over the four EDCs, or approximately 7% higher than those in PY8. Spillover was found to be quite higher in the PY10 analysis – averaging 19% among the four EDCs, compared to a program weighted 2.5% in PY8. However, this is partly a function of the sub-program: Spillover was estimated at 10% for Online Audit participants in PY8, while the other two sub-programs had spillover rates near 2-3 percent.

E.2.2 Sampling

The sample designs for the four EDCs are shown Table 201. Note that the survey effort crossed program years, with one effort targeting PY8 and PY9 participants, and the more recent Online Audit Kit survey targeting PY10 customers. PY10 population counts are listed in the table below, though the counts are similar to those of PY8 and PY9. The achieved sample size is reported for the PY8 and PY10 survey efforts separately, and also as normalized to a typical program year to facilitate calculation of survey precisions. For example, if an EDC had a sample size of 150 in the overall PY8/PY9 survey, and a sample size of 100 for the PY10 Online Audit Kits survey, and if Online Audit Kits comprise 2% of the gross verified impacts in PY10, then the achieved sample size is calculated as 98% x 150 + 2% x 100 = 149.

Table 201: EE Kits Initiative Net-to-Gross Sampling

EDC	Population Size	Achieved Sample Size (PY8/9)	Achieved Sample Size (PY10 Online Audits Only)	Achieved Sample Size (Normalized)	Response Rate
Met-Ed	68,614	172	97	170	13.9%
Penelec	76,004	171	71	170	13.9%
Penn Power	16,508	181	72	178	14.9%
WPP	16,469	193	90	171	14.3%

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 202.Results below are weighted for the PY8 and PY10 survey efforts as described above for survey counts.

Table 202: EE Kits Initiative Net-to-Gross Results

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	27,137	21.2%	3.1%	82.0%	5.5%
Penelec	32,521	20.1%	3.2%	83.1%	5.5%
Penn Power	6,873	20.2%	2.2%	82.0%	5.4%
WPP	5,545	20.7%	9.6%	89.0%	5.5%

Appendix F Home Energy Reports Impact Evaluation Detail

F.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.

F.1.1 Data Preparation and Analysis Procedure

F.1.1.1 Data Gathering

Monthly billing data dating back to 12 months prior to each experimental cohort's treatment start date through May 2017 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.

F.1.1.2 Data Preparation

Much of FirstEnergy's service territories currently rely on traditional meter reads, which require a technician to record a customer's metered usage. Due to environmental and resource restrictions, it is not feasible for actual meter data to be obtained on a monthly basis. In order to accommodate these restrictions, FirstEnergy generates an estimated metered read based on load shapes and customer's historical usage. The customer's subsequent metered bill then features an adjustment factor to accommodate for any differences between the estimated read and the actual read.

As part of the data preparation process, ADM corrected for estimated reads and adjusted actual reads by using a "true-up" process. For each metered read and all estimated reads immediately preceding it, ADM totaled the billed usage and number of days spanning those bills. The total billed usage for that cumulative period was then divided by the total number of days to generate an average usage per day value. This average usage per day value was then multiplied by the number of days in each individual bill in order to generate a corrected usage value. Because

the number of estimated reads per actual read is inconsistent, the number of estimated reads prior to the first actual read in the provided dataset could not be assumed. Therefore, the first metered read and all estimated reads preceding it were excluded from the dataset. Similarly, estimated reads that did not have a corresponding actual read (generally towards the tail end of provided billing data) were also excluded from analysis. Equation 1 and Table 203 provide the algorithm and inputs for calculating the adjusted usage for billing data after the first metered read and all prior estimated reads have been excluded.

$$Adjusted\ usage = \sum_{i}^{n} Billed\ usage \times \frac{Billing\ days_m}{\sum_{i}^{n} Billing\ days}$$

Equation 1: Adjusted usage calculation for billing usage true-up.

Table 203: Definition of inputs for adjusted usage calculation.

Variable	Definition
i	First estimated bill in a sequence of estimated bills leading to a metered bill.
n	A metered bill providing an adjustment factor for preceding estimated bills.
m	The billing month of interest.
Billed usage	The total kWh billed in a monthly bill.
Billing days	The total number of days in a monthly bill's billing period.

Billing periods for customers do not fall on consistent dates between participants. For example, one customer's June bill may run from May 16th to June 17th while another's may run from May 20th to June 20th. Furthermore, the billing periods do not correspond to calendar months. In order to make the monthly billing data consistent between participants, ADM calendarized the data. Calendarization is the process of correcting monthly billing data to match calendar dates. For example, if 15 days in a billing period belonged to June and 15 days belonged to July, 50% of the billed usage would be attributed to June and 50% attributed to July. The proportionated usage and number of days that fall under a given calendar month are then summed to generate a calendarized usage value and a number of billed days for that month.

Equation 2 and Table 204 provide the algorithm for calculating the monthly usage for a given calendar month.

$$Monthly\ usage_m = \sum_{i}^{n} \left(Adjusted\ usage_i \times \frac{Month\ days_i}{Billing\ days_i} \right)$$

Equation 2: Monthly usage calculation.

Table 204: Definition of inputs for monthly usage calculation.

Variable	Definition
i	First bill containing the month of interest.
n	Last bill containing the month of interest.
m	Month of interest.
Monthly usage	The calendarized monthly usage for a given month.
Month days	The number of days belonging to the month of interest in a given billing period.
Billing days	The total number of days in a given billing period

In addition to calculating the monthly usage, the number of billed days per month was also calculated by summing together the number of billed days in a corresponding month. Equation 3 provides the algorithm for calculating the number of days billed in a given month.

$$Billed\ days_m = \sum_{i}^{n} Month\ days_i$$

Equation 3: Billed days calculation.

After calendarization was completed, an average daily usage value was calculated by dividing the monthly usage by the number of billed days in a month. Customer months that had less than one billed day or exceed the total number of days in that calendar month for that year were excluded from analysis—months that meet these criteria have overlapping bills and are unreliable for analysis. Months that were present after a customer's move out date were also be excluded from analysis. Customer months in which average daily usage exceeded 300 kWh or was less than -300 kW were considered outliers and were excluded from analysis. Partial-month data for the most recent available billing period was be removed from the data set. Furthermore, only the billing data from the past 12 months prior to the wave enrollment start date were used for analysis.

F.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 4: Formula specifying the lagged seasonal regression model.

The variables above are defined in Table 205 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 represents the daily kWh savings attributable to the treatment effect for that month per home.

Table 205: 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.
$\mathrm{treatment}_{imy}$	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.

F.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 III 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 5 10 below.

Table 206: 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%

F.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 5 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 5: kWh savings calculation.

The variables in the above equation are defined in Table 207 below.

Table 207: 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 208: Dual participation correction results by EDC and participation wave.

Wave	Treat	Control	Delta	Wave	Treat	Control	Delta
ME-1	29,931	28,892	1,038	PN-1	29,931	28,892	1,038
ME-1-LI	4,701	4,848	-146	PN-1-LI	4,701	4,848	-146
ME-2	13,624	12,611	1,014	PN-2	13,624	12,611	1,014
ME-2-LI	749	768	-19	PN-2-LI	749	768	-19
ME-3	2,309	2,156	153	PN-3	2,309	2,156	153
WP-1	21,187	19,928	1,260	PN-3-LI	21,187	19,928	1,260
WP-1-LI	2,542	2,501	41	PP-1	2,542	2,501	41
WP-2	2,465	2,389	75	PP-1-LI	2,465	2,389	75
WP-2-LI	852	841	11	PP-2	852	841	11
WP-3	2,459	2,071	388	PP-2-LI	2,459	2,071	388

F.1.1.6 Gross Demand Savings Calculation

ADM developed a model for predicting gross demand savings using the monthly gross energy savings calculated above and 8,760 load profiles for three residential end uses (heat pumps, interior lighting, and flat).

Step 1: Normalize kWh Usage

ADM normalized the kWh savings value predicted by the impact evaluation regression model into a percent savings value by dividing each month's savings by the total annual savings as follows:

$$\%\ savings_{my} = {kWh\ savings_{my}}\Big/{kWh\ savings_{y}}$$

Equation 6: Monthly savings normalization calculation.

Step 2: Calculate Monthly Load Factors for Component Variables

The model assumes a linear relationship between the end uses of interest and the percent savings calculated above. Because load shape information is available for multiple residential end uses at an 8,760 resolution, ADM can estimate the relationship between end use load shapes and percent savings in order to estimate total demand savings. In order to make sure that the model is interpretable, hourly load factors must be aggregated to a monthly resolution, providing a monthly load shape with 12 data points. To calculate monthly load shapes, ADM will take the sum of all hourly loads in a given month for each end use of interest.

Step 3: Multivariate Regression

In order to determine the relationship between the percent savings and the residential end uses, ADM used a multivariate regression approach. Because the model was used to assign weights to each end use, ADM held the intercept constant at 0 to ensure that the model produced percent weights for each end use. The following equation provides the model specification:

$$\%\, savings_{my} = \beta_1 end\ use_{heat\ pump} + \beta_2 end\ use_{interior\ lighting} + \beta_3 end\ use_{flat}$$

Equation 7: End use weight regression model.

The regression coefficients for the above regression equation represent the relationship of each of the component variables to percent savings. Because both independent and dependent variables are calculated in units of months, the numerator of the regression weights are time invariant and can be used to estimate the percent contribution across any unit of time.

Step 4: Demand Savings Calculation

After obtaining the percent weight of each of the three end uses, the 8,760 end use load profiles are then scaled by applying the percent weight to the normalized end use load profile. The total normalized whole house load can then be assumed to be the sum of the weighted load of the three end uses at a given hour. Averaging this value for all hours of the peak demand window will provide an average peak demand whole building load. Multiplying this value by the total annual kWh savings will then predict the kW savings for the program year.

As with gross energy savings, ADM anticipates that some participants in the treatment group will also participate in other FirstEnergy programs. Because the peak demand savings is predicted from the dual participation adjusted monthly savings, an additional adjustment does not be made.

F.1.2 Program Participation Levels

Table 209 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. The first wave started in July 2012, the second wave in January 2014, and the third wave in December 2014.

Table 209 – PY10 Participation Bill Counts by Month and Cohort.

Wave	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17
ME-1	71,084	70,937	70,761	70,538	70,226	73,065	72,710	72,367	72,055	71,772	71,502	71,289
ME-1-LI	9,458	9,416	9,364	9,307	9,230	9,897	9,818	9,732	9,662	9,605	9,538	9,498
ME-2	46,385	46,224	46,072	45,892	45,613	47,908	47,665	47,363	47,155	46,933	46,690	46,535
ME-2-LI	1,974	1,961	1,948	1,927	1,902	2,105	2,080	2,057	2,041	2,021	1,993	1,983
ME-3	10,338	10,290	10,229	10,177	10,089	10,881	10,773	10,672	10,583	10,510	10,444	10,386
PN-1	46,411	46,315	46,226	46,099	45,939	47,482	47,297	47,090	46,933	46,785	46,638	46,521
PN-1-LI	6,013	5,989	5,967	5,938	5,880	6,253	6,209	6,155	6,117	6,086	6,058	6,039
PN-2	60,094	59,909	59,713	59,505	59,184	61,986	61,697	61,353	61,030	60,749	60,482	60,289
PN-2-LI	1,466	1,460	1,454	1,442	1,424	1,570	1,546	1,522	1,506	1,496	1,484	1,474
PN-3	25,516	25,422	25,335	25,195	25,027	26,619	26,423	26,239	26,087	25,906	25,732	25,629
PN-3-LI	7,826	7,783	7,732	7,651	7,557	8,372	8,274	8,168	8,096	8,003	7,926	7,885
PP-1	16,527	16,492	16,455	16,405	16,322	16,978	16,897	16,814	16,745	16,674	16,616	16,568
PP-1-LI	1,937	1,930	1,922	1,912	1,888	2,024	2,009	1,996	1,984	1,969	1,956	1,950
PP-2	6,697	6,681	6,663	6,639	6,601	6,905	6,867	6,828	6,795	6,767	6,740	6,721
PP-2-LI	757	754	748	743	734	788	779	776	773	766	764	758
WP-1	110,025	109,802	109,519	109,205	108,793	112,611	112,180	111,681	111,251	110,883	110,555	110,267
WP-1-LI	10,205	10,170	10,126	10,055	9,937	10,727	10,627	10,537	10,438	10,368	10,302	10,258
WP-2	16,930	16,893	16,838	16,783	16,707	17,440	17,351	17,261	17,171	17,106	17,032	16,974
WP-2-LI	3,600	3,578	3,549	3,518	3,465	3,847	3,808	3,764	3,724	3,676	3,641	3,617
WP-3	25,737	25,650	25,532	25,410	25,270	26,714	26,527	26,353	26,195	26,050	25,925	25,823

F.1.3 Adjustment for 2012 Low Income vs. Standard Residential Savings

During the initial wave of participants in 2012, separate Low Income and standard residential groups were not established as part of program implementation. As part of the Phase III implementation, Low Income treatment and control participants were identified and treated as a separate cohort from their standard residential counterparts. In accordance with Phase III efficiency goals, a number of treatment group homes were dropped from the standard residential cohorts while fewer to no homes were dropped from the corresponding Low Income group.

Equivalence testing done in PY8, as part of our evaluation plan development showed initial imbalances between treatment and control groups for some of the Low Income cohorts when looking at annual pre-treatment energy usage. Simultaneously, unlike the standard residential cohorts, the Low Income cohorts showed high levels of volatility in predicting program year savings. This volatility could be due to the imbalance in treatment vs. control groups, high level of variability in billing data due to breaking of the randomized control trial in creating the Low Income group, or overall smaller cohort sizes for the Low Income groups.

To compensate for this volatility, the program year savings for the 2012 Low Income and standard residential cohorts were corrected by taking the sum of the Low Income group savings and its corresponding standard residential cohort. For each EDC, the summed savings was then proportioned back to the Low Income group and the standard residential group by taking the proportion of pre-treatment annual energy consumption belonging to each group (i.e., the proportion of pre-treatment annual energy usage for all Low Income treatment customers over the sum of the annual energy usage for all Low Income and standard residential treatment customers). This adjustment took place after calculating cohort-level savings as modeled

through the lagged seasonal model regression but prior to dual participation adjustment. Demand savings, similarly, were modeled after all adjustments to energy savings took place and therefore do not require additional adjustments.

F.1.4 Results

The reported and verified energy savings are shown in Table 210 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 211 shows the reported and verified demand reduction for each EDC and initiative.

Table 210: Verified Energy Savings and Absolute Precisions by EDC and Wave

Operating Company	Experimental Cohort	PYRTD (MWh)	PYVTD (MWh)	Relative Savings (%)	Absolute Precision at 95% CL
Met Ed	ME-1	16,552	16,811	1.69%	0.15%
Met Ed	ME-2	8,645	8,780	1.36%	0.25%
Met Ed	ME-3	3,488	3,543	2.46%	0.57%
Met Ed	**Total for EEH Program**	**28,685**	**29,134**	**1.68%**	**0.14%**
Met Ed	ME-1-LI	2,006	2,746	1.99%	0.55%
Met Ed	ME-2-LI	741	1,014	3.04%	0.91%
Met Ed	**Total for LI Program**	**2,747**	**3,760**	**2.28%**	**0.49%**
Penelec	PN-1	8,087	7,199	1.23%	0.19%
Penelec	PN-2	6,352	5,654	1.02%	0.26%
Penelec	PN-3	1,331	1,185	0.62%	0.35%
Penelec	**Total for EEH Program**	**15,769**	**14,038**	**1.10%**	**0.15%**
Penelec	PN-1-LI	1,173	1,253	1.64%	0.56%
Penelec	PN-2-LI	264	282	1.40%	1.04%
Penelec	PN-3-LI	323	345	0.55%	0.59%
Penelec	**Total for LI Program**	**1,760**	**1,881**	**1.40%**	**0.45%**
Penn Power	PP-1	3,375	3,690	1.82%	0.26%
Penn Power	PP-2	2,478	2,708	2.30%	0.36%
Penn Power	**Total for EEH Program**	**5,853**	**6,398**	**2.03%**	**0.21%**
Penn Power	PP-1-LI	605	486	2.03%	0.87%
Penn Power	PP-2-LI	148	119	0.88%	1.10%
Penn Power	**Total for LI Program**	**753**	**605**	**1.81%**	**0.76%**
WPP	WP-1	17,090	13,775	0.82%	0.28%
WPP	WP-2	5,962	4,805	1.55%	0.34%
WPP	WP-3	3,052	2,460	0.69%	0.34%
WPP	**Total for EEH Program**	**26,103**	**21,040**	**0.97%**	**0.23%**
WPP	WP-1-LI	1,784	1,578	0.97%	1.14%
WPP	WP-2-LI	624	552	1.11%	0.76%
WPP	**Total for LI Program**	**2,408**	**2,130**	**1.01%**	**0.89%**

Table 211: Demand reported and verified demand reductions for the HER Initiative

Operating Company	Initiative	PYRTD MW/yr	PYVTD MW/yr	Demand Realization Rate
Met Ed	Non-LI	4.52	3.28	73%
Met Ed	LI	0.43	0.42	97%
Penelec	Non-LI	2.38	1.57	66%
Penelec	LI	0.27	0.21	80%
Penn Power	Non-LI	0.76	0.72	95%
Penn Power	LI	0.10	0.07	71%
WPP	Non-LI	4.59	2.35	51%
WPP	LI	0.42	0.24	55%

Appendix G Evaluation Detail – Residential Direct Install Initiative

The Residential Direct Install Initiative is comprised of the Home Energy Assessment program implemented by GoodCents. 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 a comprehensive residential energy audits performed by GoodCents along with energy efficiency measures directly installed in the customer's 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.

The initial audit cost the customer $350. The customer can receive $200 worth of energy savings products installed during the day of the audit. Customer can apply for a rebate of $250 after the initial audit. The implementer and the customer also discuss major measure installation possibilities. A major measure typically requires a significant investment from the customer. Customer, which installed major measures, can receive an additional $100 for saving more than 2,000 kWh and $150 for saving more than 3,000 kWh.

G.1 Gross Impact Evaluation

G.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Res DI Initiative utilized a stratified sampling plan. The stratums are stratified by total ex-ante savings at the site. High, medium, and low savings stratums were used.

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 three stratums. Many of the projects in the highest-saving strata included major measures, while most projects in the lower saving stratums consisted of light bulbs, showerheads, aerators, and LED night lights.

Evaluation activities for each measure type is described below.

G.1.1.1 Major 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 CFM50post and CFM50pre values found in the project rebate forms.

G.1.1.2 Low-Cost Measures

A sample of customers projects were used to determine measure level in-service rates. Furthermore, a document review when applicable was used to verify water heating. Low-cost measures include light bulbs, showerheads, night lights, smart power strips, aerators, and pipe wrap insulation.

For lighting measures, efficient wattage ranges and bulb type are stated in equipment name column of the customer tracking data. The hours of use are assumed to be 3 hours because the bulb installation location is not known. TRM defaults were used for other portions of the calculation.

Gross impacts for aerators and showerheads are calculated according to the PA TRM. If the water heater type fuel type is known, and verified with a document review, then a factor of 100% is applied for homes with electric water heating, 0% for home that have non-electric water heating, and the TRM default 43% in cases where water heater fuel type is not determinable.

The default savings values were used for the smart strip plug outlets. All smart strips were assumed tier-1 smart strips unspecified use 5-plug power strips.

Table 212 lists the data sources for gross impact calculation algorithms.

Table 212: Data Sources for the ATI Initiative Gross Impact Evaluation

Measure	TRM Parameter	Value	Units	Data Source
All Measures	ISR	Varies	percent	inspection reports
Lighting	Wbase	Varies	W	TRM defaults using lamp spec sheets or PY9 upstream lighting program
Lighting	Wee	Varies	W	spec sheets or PY9 upstream lighting program
Lighting, LED Night Lights	HOU	Varies	hours	TRM default
Lighting, Attic Insulation	CF	Varies	fraction	TRM default
Lighting	IEkWh	Varies	percent	based on EDC
Lighting	IEkW	Varies	percent	based on EDC
LED Night Light	Wnl	0.5	W	TRM default
LED Night Light	Wbase	7	W	TRM default
Attic Insulation	Rbase	Varies	°F·ft^2·h/Btu	Project audit forms, phone converstations with contractor
Attic Insulation	Ree	Varies	°F·ft^2·h/Btu	Project audit forms or phone converstations with contractor
Wall Insulation	Rbase	Varies	°F·ft^2·h/Btu	TRM defaults
Wall Insulation	Ree	Varies	°F·ft^2·h/Btu	TRM defaults
Attic Insulation, Wall Insulation	HDD, CDD	Varies	Varies	TRM - Zip Code Lookup
Attic Insulation, Wall Insulation	Area	Varies	ft^2	Project audit forms
Attic Insulation, Wall Insulation	EER, SEER, HSPF, COP, GSHPDF, GSER	Varies	number	TRM default
Attic Insulation, Wall Insulation	DUA	0.75	fraction	TRM default
Attic Insulation	AHF	1.056	fraction	TRM default
Air Sealing	CFM50base	Varies	cfm	Project audit forms
Air Sealing	CFM50ee	Varies	cfm	Project audit forms
Air Sealing	UEScitysystem	Varies	text	TRM - Zip Code Lookup
Air Sealing	UDScitysystem	Varies	text	TRM - Zip Code Lookup
Air Sealing, Windows, Attic Insulation, Wall Insulation	Equipment Type	Varies	text	Verification table from GoodCents database, customer tracking data, project audit forms
Pipe Insulation, Aerators, Showerheads	Water heater type	Varies	text	Verification table from GoodCents database
Pipe Insulation	unit energy savings	9.43	kWh/ft	TRM default
Pipe Insulation	unit peak demand reduction	0.000759	kW/ft	TRM default
Smart Power Strip	# of plug	unspecified use	number	assumption
Smart Power Strip	Entertainment Center	unspecified use	text	assumption
Aerators, Showerhead	Housing Type	Varies	text	asumed single family
Aerators, Showerhead	Flow Rate (gpm)	1.5	gpm	TRM default

G.1.2 Sampling

The sampling strategy for gross impact evaluation is summarized in Table 213, Table 214, Table 215, and Table 216 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 213: Res DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
1	875	23	17	Desk Review
2	712	58	4	
3	n/a	80	6	
Program Total		**161**	**27**	

Table 214: Res DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
1	855	62	0	Desk Review
2	730	81	13	
3	n/a	104	10	
Program Total		**247**	**23**	

Table 215: Res DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
1	807	33	1	Desk Review
2	708	29	3	
3	n/a	49	7	
Program Total		**111**	**11**	

Table 216: Res DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
1	1,000	30	22	Desk Review
2	714	45	11	
3	n/a	82	6	
Program Total		**157**	**39**	

G.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 217, Table 218, Table 219, and Table 220 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 217: 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	875	52	104.5%	0.5	9%
2	712	46	92.3%	0.4	28%
3	n/a	47	91.4%	0.4	23%
Program Total		**146**	**96.3%**	**n/a**	**11.5%**

Table 218: 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	855	64	98.2%	0.5	0%
2	730	64	101.9%	0.4	15%
3	n/a	64	101.9%	0.4	17%
Program Total		**192**	**100.7%**	**n/a**	**7.6%**

Table 219: 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	807	30	102.5%	0.5	71%
2	708	22	101.7%	0.4	31%
3	n/a	30	103.5%	0.4	20%
Program Total		**83**	**102.7%**	**n/a**	**28.3%**

Table 220: 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	1,000	53	94.2%	0.5	8%
2	714	38	97.2%	0.4	15%
3	n/a	54	100.8%	0.4	23%
Program Total		**145**	**97.5%**	**n/a**	**10.0%**

G.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 221, Table 222, Table 223, and Table 224 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 221: 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	875	0.00	88.0%	0.5	9%
2	712	0.01	90.9%	0.4	28%
3	n/a	0.01	90.9%	0.4	23%
Program Total		**0.01**	**90.2%**	**n/a**	**13.6%**

Table 222: 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	855	0.01	89.6%	0.5	0%
2	730	0.01	91.1%	0.4	15%
3	n/a	0.01	91.2%	0.4	17%
Program Total		**0.02**	**90.6%**	**n/a**	**7.6%**

Table 223: 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	807	0.00	100.0%	0.5	70%
2	708	0.00	99.8%	0.4	31%
3	n/a	0.00	100.9%	0.4	20%
Program Total		**0.01**	**100.3%**	**n/a**	**27.9%**

Table 224: 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	1,000	0.00	96.5%	0.5	8%
2	714	0.00	103.6%	0.4	15%
3	n/a	0.01	107.3%	0.4	23%
Program Total		**0.01**	**103.2%**	**n/a**	**11.2%**

G.2 Net Impact Evaluation

G.2.1 Net Impact Evaluation Methodology

The net-to-gross evaluation for the Res DI initiative 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. The sample of participants was selected from both PY9 and PY10, since the small participation counts made it difficult to reach sample quotas by drawing from participants from just one program year. The population sizes (combined for PY9 and PY10), achieved sample sizes, and response rates are shown in Table 225 below.

Table 225: Res DI Initiative Net-to-Gross Sampling

EDC	Population Size	Achieved Sample Size	Response Rate
Met-Ed	277	75	27.0%
Penelec	383	113	30.0%
Penn Power	170	70	41.0%
WPP	298	73	25.0%

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 226. Overall, the program had 18% free ridership and 19% spillover, resulting in an NTG of 101% (ranging from 95% to 104% among the four PA Companies). The top five measures contributing to spillover savings were air sealing, attic insulation, wall insulation, LEDs purchased from non-participating upstream lighting stores, and pipe wrap.

Table 226: Res DI Initiative Net-to-Gross Results by EDC

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	140	19.0%	14.0%	95.0%	7.1%
Penelec	193	16.0%	19.0%	103.0%	5.7%
Penn Power	85	19.0%	20.0%	100.0%	6.6%
WPP	141	20.0%	24.0%	104.0%	7.3%

Appendix H – 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 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.

H.1 Gross Impact Evaluation

H.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Residential New Construction (Res NC) Initiative involved reviewing the software models submitted with each sampled project, performing on-site 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. Models were also modified to zero out the savings calculated for lighting improvements, appliances, and water heaters. Modified models were then run against the reference home to obtain ex post energy savings and demand reductions for weather sensitive measures. Ex post savings for lighting, appliances, and water heaters were obtained from corresponding TRM algorithms. Additional algorithm parameters required by the TRM but not required by software inputs were obtained through the on-site verification efforts.

H.1.1.1 On-Site Inspections

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

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

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

Visual inspection includes the following:

- Building Characteristics
  - Orientation (N, NE, E, SE, etc.)
  - Housing type (SF detached, Townhouse inside unit, Townhouse end unit, etc.)
  - Number of floors on or above grade
  - Conditioned sq. ft.
  - Number of bedrooms
  - Window type, size and orientation
  - Ceiling heights
- Envelope
  - Foundation type (slab, conditioned basement, unconditioned basement, etc.)
  - Wall and ceiling insulation R-values

    - Slab and framed floor insulation
    - Rim/band joist insulation
    - Number of exterior doors
- HVAC
    - Make and model
    - SEER, capacity, and HSPF
    - For gas furnaces, electric auxiliary energy usage (EAE) as obtained from the AHRI database
    - Programmable 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

H.1.1.2 Engineering Model Reviews

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

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

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

H.1.1.3 TRM Impact Evaluation

The PA TRM requires that impacts from lighting and appliances are evaluated with relevant TRM protocols rather than within engineering simulation models. The REM/Rate models submitted by participating HERS raters reflect that building as-found, and therefore include the impacts of efficient lighting and appliances. ADM recalculates energy and demand impacts for

sampled projects by altering the REM/Rate models to remove any impacts associated with lighting and appliances, and then adds back the associated impacts as calculated with TRM protocols.

H.1.2 Sampling

Sampling for the New Homes initiative requires close coordination with the implementation team. Projects are typically sampled prior to rebate approval. As such, the sampling is not strictly a simple random sample drawn from the tracking and reporting system. Rather, ADM samples randomly from projects that were part of PSD's quality assurance sample, and supplements with randomly selecting homes that are eligible for QA/QC visits (but before the rebates are approved and the homes are sold). The only exception is Penelec, where ADM reviewed a census of the homes that were inspected by PSD. Our sampling approach is essentially unaltered since Phase I, and allows us to leverage data gathered during QA/QC inspections, much like the process used for the low-income program evaluation. Furthermore, but sampling "ahead" of the tracking and reporting system, we are able to observe homes in near-final stages of construction, so that it is generally easier to verify building envelope characteristics. The sampling strategy for gross impact evaluation is summarized in Table 224, Table 228, Table 229, and Table 230 for Met-Ed, Penelec, Penn Power, and WPP respectively. We use an error ratio of 0.5 for calculating achieved precision levels. This error ratio is derived from evaluated sample points from all four EDCs. Our 15% relative precision targets were met for all EDCs, including Penelec. As with previous years, the program in the Penelec service territory was only a fraction of the size of the program in other service territories.

Table 227: RES NC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	400	37	Model Review / On-Site
Program Total	**400**	**37**	

Table 228: RES NC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	58	17	Model Review / On-Site
Program Total	**58**	**17**	

Table 229: RES NC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	481	31	Model Review / On-Site
Program Total	**481**	**31**	

Table 230: RES NC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	782	27	Model Review / On-Site
Program Total	**782**	**27**	

H.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 231, Table 232, Table 233, and Table 234 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 231: RES NC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
All	1,275	74.0%	0.5	11%
Program Total	**1,275**	**74.0%**	**0.5**	**11%**

Table 232: RES NC Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
All	228	72.2%	0.5	15%
Program Total	**228**	**72.2%**	**0.5**	**15%**

Table 233: RES NC Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
All	1,205	68.3%	0.5	13%
Program Total	**1,205**	**68.3%**	**0.5**	**13%**

Table 234: Res DI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
All	2,470	83.9%	0.5	14%
Program Total	**2,470**	**83.9%**	**0.5**	**14%**

H.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 235, Table 236, Table 237, and Table 238 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 235: RES NC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
All	0.48	81.4%	0.5	11%
Program Total	**0.48**	**81.4%**	**0.5**	**11%**

Table 236: RES NC Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
All	0.08	92.2%	0.5	15%
Program Total	**0.08**	**92.2%**	**0.5**	**15%**

Table 237: RES NC Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
All	0.48	71.0%	0.5	13%
Program Total	**0.48**	**71.0%**	**0.5**	**13%**

Table 238: RES NC Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
All	0.90	75.7%	0.5	14%
Program Total	**0.90**	**75.7%**	**0.5**	**14%**

H.2 Net Impact Evaluation

H.2.1 Net Impact Evaluation Methodology

For the New Homes program, Tetra Tech performed retrospective net-to-gross (NTG) analysis by tailoring the common approach defined in the Pennsylvania Act 129 Phase III Statewide Evaluation Framework to the New Homes program design. A series of free-ridership and spillover questions included in the participant interviews ask program participants 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 ten builders were interviewed from the 42 total builders that participate in the program, across the four PA Companies. The top five builders were selected with certainty, and five of the smaller builders were randomly selected. Builder responses resulted in a free ridership rate of 27 percent for PY10. The net-to-gross

research did not identify any participant spillover. Most commonly, builders reported that they submitted all homes that they built to the FirstEnergy program. Any homes that were not submitted to the program were reported as either not meeting program requirements (resulting in no savings) or the builder reported the program did not influence the efficiency of the homes they built outside the program. Due to the homogeneity of the program approach across the four PA Companies, and the relatively small number of builders, the same NTG ratio (73%) is applied to all four Companies' programs.

Appendix I Evaluation Detail – Residential Upstream Lighting Initiative

I.1 Gross Impact Evaluation

The Upstream Lighting initiative provides point of sale incentives on energy efficient lighting products at participating retailers. The program also provides for the promotion of energy efficient lighting at retailers, including product placement, signage, and staff training. Contact information for downstream participants is not collected, as this is an upstream program. The number of participants is reported as the number of packs of lamps. The average pack size is approximately three, the lamps to participants ratio is approximately three.

I.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Upstream Lighting Initiative involved a database review to reconcile invoices with tracking and reporting data and to calculate lamp-specific impacts according to the 2016 PA TRM, and a general population telephone survey to determine cross-sector sales. The impact evaluation process is described below.

I.1.1.1 Review of Sales Invoices and Determination of ISR

ADM conducted a review and obtained invoices for the lamps sold by participating retailers. These invoices are matched to the tracking and reporting (tracking and reporting) system to confirm proper counts and characteristics of the lamps and packages. The information regarding lamp types and quantities in the tracking and reporting system was found to be consistent with the reviewed invoices. Given this finding, the default 92% ISR is applied in the impact calculations. In the event that discrepancies are found between invoiced and tracked quantities.

I.1.1.2 Determination of Baseline and Efficient Lamp Watts

ADM developed an ex-ante wattage equivalency map for use by the ICSP. The wattage equivalency was not make/model specific, but was rather designed to facilitate accurate if somewhat conservative, reporting of energy and demand impacts.

To calculate verified impacts, ADM developed a make/model specific wattage equivalency map. For each unique stock keeping unit (SKU) description, ADM determined the lamp type as one of the following:

- General Service
- Reflector (with subcategories having different lumen to baseline wattage mappings)
- Globe
- Decorative
- 3-Way

For each category, the baseline wattage was determined according to the TRM as a function of the efficient lamp's lumen output. With the baseline and efficient watts determined, the impacts for all lamps are determined through TRM algorithms.

I.1.1.1 Treatment of Non ENERY STAR® LED Lamps

In PY8, approximately 21% of rebated LED lamps were not ENERGY STAR® ® qualified at the start of PY8. However, approximately 43% of those LED models have since qualified for ENERGY STAR® ®. The non-qualifying lamps have similar light output and color rendition, but often have shorter measure lives (at the beginning of PY8, the ENERGY STAR® ® lifetime requirement was 25,000 hours, but the requirement has since been relaxed to 15,000 hours). The non-qualifying "value" LEDs had considerable price advantages last year, and were offered as a transitional measure given the changes in ENERGY STAR® ® standards. The price advantage is now minimal, however, and the Companies stopped rebating non-qualifying LEDs at the end of PY8.

I.1.1.2 Determination of Cross Sector Sales

Since upstream program tracking data do not contain customer information, a general population survey was conducted in PY10 to update estimates of the fraction of lamps that are installed in various nonresidential settings. The online survey targeted 1,000 residential customers combined over the four FirstEnergy PA EDCs. A total of 1,001 surveys were completed. The survey instrument included initial questions to positively identify program participants, and then asked how many lamps they purchased and where the lamps were installed.

The weight for each sector is taken to be the number of lamp that are likely to be program-rebated lamps installed in the sector (residential or commercial) by the respondent, divided by the total number of program-rebated lamps installed by all respondents. If customers reported that they installed lamps in both residences and businesses, a follow up question asked for the proportion of lamps installed in each location.

The instrument included seven facility types that have previously been identified as likely places of lamp installation, along with an open-ended response for other facility types. The responses were then mapped to TRM building types for determination of GNI status according to the assignment scheme shown in Table 239. If a precise determination of business type is not possible after a review all responses in the "Other" category (last line of Table 239), the GNI status is set to non-GNI.

Table 239: Mapping of cross sector sales survey responses to TRM building types and GNI status.

Nonresidential Facility Type	TRM Building Type	GNI
Office	Office	No
Retail store	Retail	No
Health care facility	Health	Yes
Hotel / motel / lodging	Lodging	No
Restaurant	Restaurant	No
School	Education	Yes
Place of worship	Institutional	Yes
Other	Determined from response	

Out of 1,001 completed survey responses, 6,082 efficient lamps were reported to be purchased and installed in the last 12 months. However, inspection of the stores where the lamps were stated to be purchased revealed that only 3,698 of these lamps were likely to be purchased at stores that participate in the FirstEnergy Companies' Upstream Lighting programs. A significant portion of non-program lamps were determined to be purchased at electrical supply stores and online retailers.

After filtering out non-program lamps, a total of 19 customers reported installing a total of 264 lamps in businesses. The fraction of efficient lamps that are installed in non-residential settings is 264/3,698=7.1%. Of the 264 lamps, total of 100 were determined to be installed in GNI facilities, so that the GNI cross sector rate is 100/3,698=0.65%. The cross-sector rate is within the range of past efforts (the rate has been measured four times since PY4: 4.9%, 5.8%, 8.3%, and now 7.1%).

I.1.1.3 Determination of Hours of Use and Coincidence Factor

The daily hours of use and peak coincidence factor for lamps installed in the residential sector are taken as the corresponding values for efficient lamps as installed in the overall household in the 2016 PA TRM. Nonresidential hours of use and coincidence factors are derived from the associated Guidance Memo issued by SWE on May 7, 2019. ADM applied default values rather than building-specific values because only 19 of 1,001 respondents reported installing lamps in nonresidential settings, and this number is likely too small to warrant overriding default values.

I.1.1.4 Determination of HVAC Interactive Effects

Residential HVAC interactive effects factors are determined separately for each EDC in a two-step process. As a first step, we use data from the 2014 Act 129 Residential Baseline Study to estimate the fraction of lamps that are installed in conditioned space. The fraction of lamps in conditioned space is the ratio of the number of eligible interior sockets to the total number of eligible sockets for each EDC. This fraction is presented in Table 240.

Table 240: Determination of the fraction of lamps in conditioned space by EDC.

EDC	Number of Interior Lamps	Number of Exterior Lamps	Interior lamps as a % of total lamps
Met-Ed	45	6	88%
Penelec	35	4	90%
Penn Power	49	5	91%
West Penn	49	6	89%

As a second step the residential interactive factors from the PA TRM are adjusted through multiplication by the percentages in the last column of Table 240. The adjusted interactive effects are shown in Table 241.

Nonresidential HVAC interactive effects are derived from the Cross Sector Sales Guidance Memo issued by SWE on May 7, 2019.

Table 241: Original and adjusted energy and demand interactive effects by EDC.

EDC	IE_kWh	ADJ_IE_kW	IE_kW	ADJ_IE_kW
Met-Ed	-8%	-7%	13%	11%
Penelec	1%	1%	10%	9%
Penn Power	0%	0%	20%	18%
WPP	-2%	-2%	30%	27%

Table 242 lists the data sources for gross impact calculation algorithms.

Table 242: Data Sources for the ATI Initiative Gross Impact Evaluation

Evaluation Parameter	Data Source	Value
Verification of Quantity	Invoice to SSRS comparison	Varies
Baseline Watts	Lookup based on lumens, type	Varies
Watts	Lookup from EnergyStar DB and online searches	Varies
Lumens	Lookup from EnergyStar DB and online searches	Varies
Lamp Type	Lookup from EnergyStar DB and online searches	Varies
Residential Daily Hour of Use	TRM Table 2-5 HOU for Efficient Lamps in Household	3
Residential Coincidence Factor	TRM Table 2-5 CF for Efficient Lamps in Household	0.106
Residential IF_kWh	TRM Table 2-6, per EDC, for lamps installed indoors	Varies
Residential IF_kW	TRM Table 2-6, per EDC, for lamps installed indoors	Varies
Residential % Installed Indoors	2014 Baseline Study Figure 5-12 and Table 5-50	Varies
Percent Nonresidential	Cross Sector Sales Survey*	7.14%
Percent GNI	Cross Sector Sales Survey*	2.70%
Nonresidential Hour of Use	Cross Sector Sales Survey* and TRM Table 3-5	1,821
Nonresidential CF	Cross Sector Sales Survey* and TRM Table 3-5	0.32
GNI Hours of Use	Cross Sector Sales Survey* and TRM Table 3-5	2,222
GNI CF	Cross Sector Sales Survey* and TRM Table 3-5	0.31
Nonesidential IF_kWh	TRM Table 2-6, per EDC, for lamps installed indoors	0
Nonesidential IF_kW	TRM Table 2-6, per EDC, for lamps installed indoors	0.192
*Cross sector sales survey results are applied to all four EDCs		

I.1.2 Sampling

Of the three gross impact evaluation activities conducted for this initiative, only the invoice review component involved sampling. The sampling was conducted on a simple random basis. The relative precision on the cross-sector rate is estimated to be 60%, but this translates to approximately 6% at the initiative level. The sample design for this initiative is summarized in Table 243 below.

Table 243: Gross Impact Sample Design for the Upstream Lighting Initiative

EDC	Population Size	Achieved Sample Size	Evaluation Activity
Met-Ed	391,882	Census	Database Review
		49	Invoice Review
		233	X-Sector Sales Survey
Met-Ed Total	**391,882**	**282**	
Penelec	352,700	Census	Database Review
		51	Invoice Review
		276	X-Sector Sales Survey
Penelec Total	**352,700**	**327**	
Penn Power	114,596	Census	Database Review
		49	Invoice Review
		255	X-Sector Sales Survey
Penn Power Total	**114,596**	**304**	
WPP	321,468	Census	Database Review
		51	Invoice Review
		237	X-Sector Sales Survey
WPP Total	**321,468**	**288**	

I.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 244.

Table 244: Upstream Lighting Initiative Energy Gross Realization Rates

EDC	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Met-Ed	25,330	141.0%	0.5	10.3%
Penelec	26,436	137.1%	0.5	10.1%
Penn Power	10,877	138.9%	0.5	10.3%
WPP	27,127	139.0%	0.5	10.1%

I.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 245.

Table 245: Upstream Lighting Initiative Demand Gross Realization

EDC	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Met-Ed	3.01	151.1%	0.5	10.3%
Penelec	2.79	151.4%	0.5	10.1%
Penn Power	1.26	149.6%	0.5	10.3%
WPP	3.48	145.7%	0.5	10.1%

I.2 NET IMPACT EVALUATION

I.2.1 Net Impact Evaluation Methodology

Upstream lighting net-to-gross was based on both customer and retailer survey responses. As part of the general population survey, customers who reported purchasing program-eligible bulbs from a participating retailer were asked a series of questions to assess free-ridership. Sixteen percent of customers who purchased LEDs were aware of a discount on the product they purchased. Similar to PY8, customer awareness was higher in Penelec and Penn Power territories; however, awareness in all four territories increased by three to five percent.

Regardless of awareness of a specific discount, we asked all customers what they would have done in the absence of the incentive. For customers who were not previously aware of the discount, we introduced these questions by saying they "would have received a discount of up to $5 per bulb" at participating retailers. We modeled these questions after the common approach to free-ridership outlined in the PA Evaluation Framework, including questions to gauge customer intention and program influence. The results suggest that some customers would have modified their purchase if the discount had not been available: 25 percent would have purchased fewer bulbs ("some but not all"), 7 percent would not have purchased any bulbs for at least one year, and 6 percent would have purchased less efficient lighting. Just less than fifty percent of customers would have made the same purchase without the discount. Twenty-five percent of customers rated at least one aspect of the program at least a four on a one to five scale, where one was "not at all influential" and five was "extremely influential." The overall free-ridership estimates from the general population survey ranged from 71 to 75 percent by EDC.

The retailer survey included several metrics to gauge the effectiveness of the program on the sales of program-eligible bulbs. The primary metric used to estimate net-to-gross from this effort was sales lift, or a series of questions that ask retailers to estimate how their sales of program-eligible bulbs would have been affected if the program incentive was not available.[21] The analysis calculated a mean sales lift per retail chain per EDC, and then these were weighted by the gross savings attributable to that retail chain for that EDC. Tracking data does not maintain sufficient detail to weight by each retail location's savings.

The program's overall net-to-gross results based on PY10 evaluation are simply an average of the general population and retailer sales lift results. Both of these estimates are more robust than the results from PY8 since both analyses include considerably more data points.

I.2.2 Sampling

Both retailers and participants were contacted for net impact evaluation purposes. The sample designs for the four EDCs are shown in Table 246.

[21] Retailer survey questions N6-N9.

Table 246: Upstream Lighting Initiative Net-to-Gross Sampling

EDC	Stratum	Population Size	Achieved Sample Size	Response Rate
Met-Ed	Retailers	62	32	52%
	Customers	391,882	233	19%
Met-Ed Total		n/a	n/a	n/a
Penelec	Retailers	116	67	58%
	Customers	352,700	276	22%
Penele Total		n/a	n/a	n/a
Penn Power	Retailers	24	13	54%
	Customers	114,596	255	21%
Penn Power Total		n/a	n/a	n/a
WPP	Retailers	73	28	38%
	Customers	321,468	237	19%
WPP Total		n/a	n/a	n/a

I.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 247.

Table 247: Upstream Lighting Initiative Net-to-Gross Results

EDC	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	35,707	71.0%	0.0%	29.0%	10.0%
Penelec	36,254	69.0%	0.0%	31.0%	7.2%
Penn Power	15,112	74.0%	0.0%	26.0%	14.2%
WPP	37,709	77.0%	0.0%	23.0%	11.7%

Appendix J Evaluation Detail – Residential Upstream Electronics Initiative

J.1 Gross Impact Evaluation

The Upstream Electronic initiative provides retailers incentives for the promotion of energy efficient computers, monitors, televisions, and imaging equipment. Each rebated item is counted as one participant for reporting purposes.

J.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Upstream Electronics Initiative involved a database review to reconcile invoices with tracking and reporting data and to calculate lamp-specific impacts according to the 2016 PA TRM. The impact evaluation process is described below.

J.1.1.1 Review of Sales Invoices and Determination of Product Eligibility

ADM conducted a review and obtained invoices for the computers, monitors, televisions, and imaging equipment sold by participating retailers. These invoices are matched to the tracking and reporting (T&R) system to confirm proper counts and characteristics of rebated items. The information regarding item types and quantities in the T&R system was found to be consistent with the reviewed invoices. In the event that discrepancies are found between invoiced and tracked quantities, a verification rate is generated by dividing the invoiced quantity by the tracked quantity and applied to calculated energy and demand savings.

J.1.1.2 Determination of ENERGY STAR® Status

To calculate verified impacts, ADM developed a make/model specific equipment map. For each unique stock keeping unit (SKU) description, ADM categorized the equipment type as one of the following:

- Computer
- Monitor
- Television
- Imaging Equipment

Imaging equipment was further sub-divided based on imaging equipment technology (multifunction device, printer, or scanner) and ink-type (inkjet, laser, or thermal transfer/impact). ADM utilized ENERGY STAR® databases for the program year to determine equipment eligibility. Impacts for all equipment are determined using deemed savings tables from the TRM.

J.1.2 Sampling

Of the two gross impact evaluation activities conducted for this initiative, only the invoice review component involved sampling. The sampling was conducted on a simple random basis. The sample design for this initiative is summarized in Table 248 below.

Table 248: Upstream Electronics Initiative Sample Design

EDC	Population Size	Achieved Sample Size	Evaluation Activity
Met-Ed	10,037	Census	Database Review
		Census	Invoice Review
Met-Ed Total	**10,037**	**10037**	
Penelec	4,783	Census	Database Review
		Census	Invoice Review
Penelec Total	**4,783**	**4783**	
Penn Power	3,545	Census	Database Review
		Census	Invoice Review
Penn Power Total	**3,545**	**3545**	
WPP	14,545	Census	Database Review
		Census	Invoice Review
WPP Total	**14,545**	**14,545**	

J.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 249, Table 250, Table 251, and Table 252 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 249: Upstream Electronics Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
TV	288	111.3%	0.5	0.0%
Imaging	34	149.4%	0.5	0.0%
Computer	20	100.0%	0.5	0.0%
Monitor	32	99.7%	0.5	0.0%
Program Total	**373**	**113.2%**	**0.5**	**0.0%**

Table 250: Upstream Electronics Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
TV	140	107.1%	0.5	0.0%
Imaging	16	202.2%	0.5	0.0%
Computer	15	100.0%	0.5	0.0%
Monitor	13	100.0%	0.5	0.0%
Program Total	**184**	**114.1%**	**0.5**	**0.0%**

Table 251: Upstream Electronics Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
TV	92	110.0%	0.5	0.0%
Imaging	13	166.0%	0.5	0.0%
Computer	7	100.0%	0.5	0.0%
Monitor	15	99.8%	0.5	0.0%
Program Total	**126**	**114.0%**	**0.5**	**0.0%**

Table 252: Upstream Electronics Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
TV	430	111.3%	0.5	0.0%
Imaging	44	172.0%	0.5	0.0%
Computer	32	100.4%	0.5	0.0%
Monitor	46	99.9%	0.5	0.0%
Program Total	**552**	**114.6%**	**0.5**	**0.0%**

J.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 253, Table 254, Table 255, and Table 256 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 253: Upstream Electronics Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
TV	0.03	118.9%	0.5	0.0%
Imaging	0.01	98.6%	0.5	0.0%
Computer	0.00	100.6%	0.5	0.0%
Monitor	0.00	105.9%	0.5	0.0%
Program Total	**0.04**	**112.7%**	**0.5**	**0.0%**

Table 254: Upstream Electronics Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
TV	0.01	114.4%	0.5	0.0%
Imaging	0.00	133.6%	0.5	0.0%
Computer	0.00	100.6%	0.5	0.0%
Monitor	0.00	106.2%	0.5	0.0%
Program Total	**0.02**	**115.4%**	**0.5**	**0.0%**

Table 255: Upstream Electronics Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
TV	0.01	117.5%	0.5	0.0%
Imaging	0.00	109.6%	0.5	0.0%
Computer	0.00	100.5%	0.5	0.0%
Monitor	0.00	105.9%	0.5	0.0%
Program Total	**0.01**	**113.2%**	**0.5**	**0.0%**

Table 256: Upstream Electronics Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
TV	0.04	118.9%	0.5	0.0%
Imaging	0.01	113.6%	0.5	0.0%
Computer	0.00	100.9%	0.5	0.0%
Monitor	0.01	106.1%	0.5	0.0%
Program Total	**0.06**	**115.4%**	**0.5**	**0.0%**

J.2 Net Impact Evaluation

J.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted a net impact evaluation for the upstream electronics program in PY10. Due to the small size of the program, the general population survey cannot net enough participants for a meaningful participant survey (the program component accounts for about 1% of the energy savings for its parent program, Energy Efficient Products). The program has 11 participating retailers between all four PA Companies. Of those 11 retailers, five responded to the net impact evaluation survey, but only three were able to fully complete the survey, making for a response rate of 27%. Retailers reported that the incentive did not affect their sales of ENERGY STAR equipment and that the program influenced their sales through marketing

signage and sales staff education. The average net-to-gross ratio from the three respondents, 58%, was applied for calculation of portfolio-level net verified impacts and for net-level TRC calculations for each EDC.

Appendix K 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 programmable thermostat, or replace an existing furnace fan with a new high-efficiency one. Enhanced rebates are provided for CEE tier 2 and tier 3 HVAC systems.

Participants are defined as each separate measure rebated. Thus, the rebate application, rather than the customer is the sampling unit for gross impact evaluation.

K.1 Gross Impact Evaluation

K.1.1 Gross Impact Evaluation Methodology

Each component of gross impact evaluation is described below.

Mini-Splits

Ductless mini-splits (ACs and heat pumps) were also looked up on AHRI similar to the other HVAC system types, 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 TRM default value was used for CF. The baseline system type was determined from participant surveys. Several response fields were taken into account 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 or ducted mini-split (both have SEERbase = 14 and HSPFbase = 8.2). Baseline efficiencies were taken from TRM table 2-21 according to the type of baseline system.

Thermostats

Programmable thermostats were classified by the features they possess according to the IMP: conventional programmable, basic smart, or advanced smart. The corresponding features are: programmable schedule, remote access, and occupancy sensing. These features were looked up on manufacturer websites and compiled into a database. For each sampled thermostat measure, the IMP classification was looked up in the database based on its features. The IMP classification was used to determine the Energy Saving Factors (ESFcool and ESFheat) used in the IMP algorithm. The baseline thermostat was determined based on the rebate application. In cases where the existing thermostat was broken or non-existing, a manual baseline was assumed.

Furnace Fans

High-efficiency furnace fan energy savings relied on the deemed values in the TRM. ADM used the results of participant surveys to determine the verification rate.

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.

PTACs and PTHPs

As there were only a handful of PTACs and PTHPs reported across all four EDCs, ADM elected to pass these measures through the evaluation process with no activity.

Table 257 lists the data sources for gross impact calculation algorithms.

Table 257: 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 # (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
Programmable Thermostats	Install Type	Application Review
Programmable Thermostats	Thermostat Type	Application Review
Programmable Thermostats	Heating System Type	Application Review
Programmable Thermostats	Cooling System Type	Application Review
Programmable Thermostats	Baseline Thermostat Type	Application Review

K.1.1.1 Determination of Verification Rate

ADM performed 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 HVAC measures. The verification rates are used to inform measure-level realization rates.

K.1.1.2 Invoice and Application Review

ADM obtained invoices and applications from Honeywell. 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. 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, straightforward manual correction of the make or model numbers results in positive identification of the involved equipment in the supporting databases.

K.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 were taken from TRM table 2-12 based on the reported zip code or zip code obtained through participant surveys if the reported zip code was overridden by the respondent. The TRM default value was used for CF. Baseline efficiencies were taken as TRM defaults assuming a replace on burnout scenario rather than early retirement[22].

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 were determined through zip code lookups as provided in the T&R data or with zip codes from survey data if overridden by respondents. The TRM default value for CF was used. 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 3-36. In these cases, the replace on burnout scenario assumes kWh_{pump} and kW_{pump} for the baseline ASHP are zero.

[22] 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.

Mini-Splits

Ductless mini-splits (ACs and heat pumps) were also looked up on AHRI similar to the other HVAC system types, 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 TRM default value was used for CF. The baseline system type was determined from participant surveys. Several response fields were taken into account 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 or *ducted* mini-split (both have $SEER_{base}$ = 14 and $HSPF_{base}$ = 8.2). Baseline efficiencies were taken from TRM table 2-21 according to the type of baseline system.

Thermostats

Programmable thermostats were classified by the features they possess according to the IMP: conventional programmable, basic smart, or advanced smart. The corresponding features are: programmable schedule, remote access, and occupancy sensing. These features were looked up on manufacturer websites and compiled into a database. For each sampled thermostat measure, the IMP classification was looked up in the database based on its features. The IMP classification was used to determine the Energy Saving Factors (ESF_{cool} and ESF_{heat}) used in the IMP algorithm. The baseline thermostat was determined based on the rebate application. In cases where the existing thermostat was broken or non-existing, a manual baseline was assumed.

Furnace Fans

High-efficiency furnace fan energy savings relied on the deemed values in the TRM. ADM used the results of participant surveys to determine the verification rate.

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.

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.

K.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 258, Table 259, Table 260, and Table 261.

Table 258: Res HVAC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	396	39	22
Mini-Split HP	350	42	34
GSHP	72	13	14
CAC	194	23	21
Furnace Fan	615	28	23
Thermostat	996	117	42
HVAC Tune-Up	153	40	22
PTAC	0	0	0
PTHP	0	0	0
Program Total	**2,776**	**302**	**178**

Table 259: Res HVAC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	147	20	21
Mini-Split HP	602	81	65
GSHP	28	5	11
CAC	18	4	10
Furnace Fan	397	22	30
Thermostat	688	92	64
HVAC Tune-Up	388	56	21
PTAC	0	0	0
PTHP	0	0	0
Program Total	**2,268**	**280**	**222**

Table 260: Res HVAC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	116	20	25
Mini-Split HP	61	7	5
GSHP	13	2	8
CAC	11	1	7
Furnace Fan	440	35	34
Thermostat	398	37	50
HVAC Tune-Up	125	14	17
PTAC	0	0	0
PTHP	0	0	0
Program Total	**1,164**	**116**	**146**

Table 261: Res HVAC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	482	67	24
Mini-Split HP	417	30	24
GSHP	48	6	18
CAC	82	6	17
Furnace Fan	1,083	79	28
Thermostat	1,397	138	60
HVAC Tune-Up	824	98	31
PTAC	0	0	0
PTHP	2	0	0
Program Total	**4,333**	**424**	**202**

K.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 262, Table 263, Table 264, and Table 265 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 262: Res HVAC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	296	113.3%	0.5	14.9%
Mini-Split HP	292	215.0%	0.5	11.7%
GSHP	114	199.9%	0.5	17.3%
CAC	44	128.3%	0.5	14.8%
Furnace Fan	274	100.0%	0.5	14.7%
Thermostat	60	404.5%	0.5	10.9%
HVAC Tune-Up	26	125.6%	0.5	14.2%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	**1,106**	**162.4%**	**0.5**	**6.07%**

Table 263: Res HVAC Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	124	133.9%	0.5	14.5%
Mini-Split HP	501	269.1%	0.5	8.4%
GSHP	45	193.1%	0.5	16.9%
CAC	4	111.1%	0.5	15.2%
Furnace Fan	177	100.0%	0.5	12.6%
Thermostat	41	350.3%	0.5	8.6%
HVAC Tune-Up	67	74.1%	0.5	15.3%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	**959**	**206.2%**	**0.5**	**6.08%**

Table 264: Res HVAC Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	93	104.4%	0.5	12.8%
Mini-Split HP	51	210.1%	0.5	30.9%
GSHP	21	201.0%	0.5	15.8%
CAC	3	134.8%	0.5	16.4%
Furnace Fan	196	100.0%	0.5	11.9%
Thermostat	24	428.2%	0.5	9.5%
HVAC Tune-Up	22	132.2%	0.5	16.2%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	**409**	**140.9%**	**0.5**	**7.65%**

Table 265: Res HVAC Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	388	117.4%	0.5	14.3%
Mini-Split HP	347	406.4%	0.5	14.3%
GSHP	76	189.8%	0.5	13.4%
CAC	19	114.0%	0.5	15.5%
Furnace Fan	483	100.0%	0.5	13.4%
Thermostat	84	383.5%	0.5	9.1%
HVAC Tune-Up	142	112.6%	0.5	12.7%
PTAC		100.0%	0.5	0.0%
PTHP	1	100.0%	0.5	100.0%
Program Total	**1,540**	**194.7%**	**0.5**	**7.51%**

K.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 266, Table 267, Table 268, and Table 269 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 266: Res HVAC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	0.08	176.0%	0.5	14.9%
Mini-Split HP	0.12	84.2%	0.5	11.7%
GSHP	0.02	404.9%	0.5	17.3%
CAC	0.03	230.5%	0.5	14.8%
Furnace Fan	0.06	100.0%	0.5	14.7%
Thermostat	0.00	100.0%	0.5	10.9%
HVAC Tune-Up	0.02	102.2%	0.5	14.2%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	6.1%
Program Total	**0.33**	**141.9%**	**0.5**	**6.51%**

Table 267: Res HVAC Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	0.03	224.9%	0.5	14.5%
Mini-Split HP	0.20	75.7%	0.5	8.4%
GSHP	0.01	386.3%	0.5	16.9%
CAC	0.00	248.1%	0.5	15.2%
Furnace Fan	0.04	100.0%	0.5	12.6%
Thermostat	0.00	100.0%	0.5	8.6%
HVAC Tune-Up	0.04	108.2%	0.5	15.3%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	6.1%
Program Total	**0.33**	**104.5%**	**0.5**	**5.54%**

Table 268: Res HVAC Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	0.02	167.2%	0.5	12.8%
Mini-Split HP	0.02	154.1%	0.5	30.9%
GSHP	0.00	394.0%	0.5	15.8%
CAC	0.00	258.8%	0.5	16.4%
Furnace Fan	0.05	100.0%	0.5	11.9%
Thermostat	0.00	100.0%	0.5	9.5%
HVAC Tune-Up	0.01	108.1%	0.5	16.2%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	7.6%
Program Total	**0.11**	**137.2%**	**0.5**	**8.42%**

Table 269: Res HVAC Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	0.09	191.3%	0.5	14.3%
Mini-Split HP	0.14	81.1%	0.5	14.3%
GSHP	0.01	400.5%	0.5	13.4%
CAC	0.02	217.3%	0.5	15.5%
Furnace Fan	0.11	100.0%	0.5	13.4%
Thermostat	0.00	100.0%	0.5	9.1%
HVAC Tune-Up	0.09	98.2%	0.5	12.7%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	7.5%
Program Total	**0.47**	**123.5%**	**0.5**	**6.38%**

K.2 NET IMPACT EVALUATION

K.2.1 Net Impact Evaluation Methodology

The net-to-gross evaluation for the downstream HVAC measures, conducted in PY8, 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 slightly lower than those determined in the Phase II evaluation, as customers reported higher levels of free ridership.

K.2.2 Sampling

Tetra Tech sampled randomly from all participants on record in the Companies' tracking and reporting systems in early PY8Q4. The sample designs for the four EDCs are shown in Table 270, Table 271, Table 272, and Table 273 for Met-Ed, Penelec, Penn Power, and WPP respectively (note the population sizes correspond to the current program year, which are similar to PY8 counts, but the achieved sample sizes and response rates are from the PY8 NTG effort).

Table 270: Res HVAC Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,776	74	26.0%
Program Total	**2,776**	**74**	**26.0%**

Table 271: Res HVAC Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,268	72	26.0%
Program Total	**2,268**	**72**	**26.0%**

Table 272: Res HVAC Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,164	46	29.0%
Program Total	**1,164**	**46**	**29.0%**

Table 273: Res HVAC Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	4,333	74	26.0%
Program Total	**4,333**	**74**	**26.0%**

K.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 274, Table 275, Table 276, and Table 277 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 274: Res HVAC Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	1,796	55.0%	0.0%	45.0%	12.6%
Program Total	**1,796**	**55.0%**	**0.0%**	**45.0%**	**12.6%**

Table 275: Res HVAC Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	1,977	49.0%	1.0%	52.0%	12.7%
Program Total	**1,977**	**49.0%**	**1.0%**	**52.0%**	**12.7%**

Table 276 Res HVAC Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	576	47.0%	3.0%	56.0%	15.6%
Program Total	**576**	**47.0%**	**3.0%**	**56.0%**	**15.6%**

Table 277 Res HVAC Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	2,999	52.0%	1.0%	49.0%	12.6%
Program Total	**2,999**	**52.0%**	**1.0%**	**49.0%**	**12.6%**

Appendix L Evaluation Detail – Residential Appliances and LI Residential Appliances Initiatives

Residential Appliances and LI Appliances are two separate initiatives in ADM's PY8 evaluation plan. While the program process is the same between the two, the measures and rebate levels differ. Refrigerators, Freezers, Clothes Washers, Clothes Dryers, and Dehumidifiers are rebated under both initiatives, but under the LI Appliance initiative, the rebates are increased by $25. Income eligibility is attested to by the customer on the rebate application by providing "Number of Household Residents" and "Gross Household Income". Heat Pump Water Heaters are rebated under the Residential Appliances initiative, but not under the LI Appliances initiative. Enhanced rebates are available to the Residential Appliance initiative participants for purchasing a CEE Tier 2 or Tier 3 Refrigerator.

In PY10, Midstream Appliance rebates were introduced. Only Heat Pump Water Heaters and Dehumidifiers are rebated. Dehumidifier rebate levels are the same as downstream, but Heat Pump Water Heater rebates are fixed at $500. Rebates are paid to retailers for point-of-sale discounts on the purchase price. Residential customers do not file rebate applications, instead retailers invoice for rebates with point-of-sale data files as supporting documentation.

Midstream Appliance measures are included in the Residential Appliances initiative by default. A channel is available, however, for residential customers to call in and apply for an additional rebate by attesting to meeting income eligibility requirements. These measures, which are naturally all Dehumidifiers in PY10, are included in the LI Residential Appliances initiative.

Participants are defined as each separate appliance rebated. Additional rebates provided to LI customers are not included in participation counts. Thus, the rebate application, rather than the customer is the sampling unit for gross impact evaluation.

Gross impact evaluation activities are identical for the two initiatives. Separate survey samples were maintained in PY8 to assess whether demographic differences would affect the realization rates for the measures. No significant differences were found, however. The PY8 report discussed the possibility of combining the two groups into the same initiative. We have opted to maintain separate samples for the Res LI appliance rebates. Although it is not required to evaluate this Initiative each year, we opt to maintain a small sample each year to retain the ability to provide timely feedback if evaluation issues arise.

L.1 Gross Impact Evaluation

L.1.1 Gross Impact Evaluation Methodology

Each component of gross impact is described below.

L.1.1.1 Verification Surveys

For downstream measures, 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.

Midstream appliances were not sampled for customer verification surveys. Instead, verification rates were developed using the supporting documentation for each retailer invoice. The ratio of invoiced quantities to reported quantities was calculated for each measure. In PY10, Verification Rates were 100% for all measures across all four EDCs for Midstream Appliance measures.

L.1.1.2 Invoice and Application Review

For downstream appliances, ADM obtained invoices and applications from the Honeywell. 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, straightforward manual correction of the make or model numbers results in positive identification of the involved equipment in the supporting databases.

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.

L.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. 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. Both downstream and midstream measure impacts were calculated in this way.

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 following provide additional details into the calculation review procedure.

Table 278 lists the data sources for gross impact calculation algorithms.

Table 278: Data Sources for the Res Appliances Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
Downstream	Verification Rate	Participant Surveys
Midstream	Verification Rate	Retailer Invoices
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	IMEF_ee	Energy Star Database
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	CEF_ee	Energy Star Database
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	Product Class	Energy Star Database
Refrigerator	Adjusted Volume	Energy Star Database
Freezer	Product Class	Energy Star Database
Freezer	Adjusted Volume	Energy Star Database
Dehumidifier	HOU / CF	TRM Default
Dehumidifier	L/kWh_base / L/kWh_ee	TRM - Capacity Lookup
HPWH	EF_base	TRM - Capacity Lookup
HPWH	EF_ee	Energy Star Database
HPWH	F_derate	TRM Default
HPWH	HW	TRM Default
HPWH	T_hot / T_cold	TRM Default

The gross realization rates for energy savings were driven primarily by the reported energy savings in the tracking and reporting system. In general, the reported energy and demand impacts are calculated with conservative assumptions of market-average efficiencies and capacities.

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 279, Table 280, Table 281, and Table 282.

Table 279: Res Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Heat Pump Water Heater	107	26	15
Heat Pump Water Heater - Midstream	323	0	323
Clothes Washer	1,438	229	42
Dehumidifier	1,025	191	25
Dehumidifier - Midstream	9,110	0	9,110
Refrigerator	1,328	215	28
Clothes Dryer	735	94	31
Freezer	200	46	23
Program Total	**14,266**	**801**	**9,597**

Table 280: Res Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Heat Pump Water Heater	32	7	11
Heat Pump Water Heater - Midstream	198	0	198
Clothes Washer	893	157	40
Dehumidifier	1,761	319	27
Dehumidifier - Midstream	6,840	0	6,840
Refrigerator	1,071	171	28
Clothes Dryer	382	57	26
Freezer	224	51	23
Program Total	**11,401**	**762**	**7,193**

Table 281: Res Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Heat Pump Water Heater	9	2	3
Heat Pump Water Heater - Midstream	74	0	74
Clothes Washer	427	74	41
Dehumidifier	345	66	22
Dehumidifier - Midstream	2,707	0	2,707
Refrigerator	352	56	27
Clothes Dryer	194	25	30
Freezer	72	24	20
Program Total	**4,180**	**247**	**2,924**

Table 282: Res Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Heat Pump Water Heater	63	15	17
Heat Pump Water Heater - Midstream	292	0	292
Clothes Washer	1,516	266	39
Dehumidifier	1,957	371	22
Dehumidifier - Midstream	8,994	0	8,994
Refrigerator	1,423	250	29
Clothes Dryer	739	124	33
Freezer	275	61	23
Program Total	**15,259**	**1,087**	**9,449**

The sample designs for the Res LI Appliance Initiative are shown in Table 283, Table 284, Table 285, and Table 286.

Table 283: Res LI Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Clothes Washer	88	18	28
Dehumidifier	29	9	11
Refrigerator	54	13	18
Clothes Dryer	35	9	14
Freezer	2	2	1
Program Total	**208**	**51**	**72**

Table 284: Res LI Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Clothes Washer	93	23	22
Dehumidifier	116	43	19
Refrigerator	98	25	19
Clothes Dryer	48	11	19
Freezer	11	6	7
Program Total	**366**	**108**	**86**

Table 285: Res LI Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Clothes Washer	30	12	15
Dehumidifier	21	7	13
Refrigerator	22	3	10
Clothes Dryer	11	2	6
Freezer	3	2	2
Program Total	**87**	**26**	**46**

Table 286: Res LI Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Clothes Washer	75	17	23
Dehumidifier	72	28	21
Refrigerator	70	19	17
Clothes Dryer	45	15	15
Freezer	10	6	6
Program Total	**272**	**85**	**82**

L.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 287, Table 288, Table 289, and Table 290 for Met-Ed, Penelec, Penn Power, and WPP respectively. In general, gross realization rates were far above 100% for both energy and demand. The primary reason for the high realization rates are generally conservative ex ante values for clothes washers (93 kWh per unit) and heat pump water heaters (1,389 kWh per unit).

Table 287: Res Appliances Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	149	128.5%	0.5	17.2%
Heat Pump Water Heater - Midstream	449	148.7%	0.5	0.0%
Clothes Washer	134	154.8%	0.5	10.9%
Dehumidifier	142	93.4%	0.5	14.2%
Dehumidifier - Midstream	1,266	143.4%	0.5	0.0%
Refrigerator	88	91.8%	0.5	13.5%
Clothes Dryer	18	111.2%	0.5	12.7%
Freezer	5	202.0%	0.5	14.1%
Program Total	**2,251**	**138.8%**	**0.5**	**1.5%**

Table 288: Res Appliances Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	44	148.2%	0.5	17.6%
Heat Pump Water Heater - Midstream	275	148.0%	0.5	0.0%
Clothes Washer	83	158.1%	0.5	11.1%
Dehumidifier	245	95.1%	0.5	13.7%
Dehumidifier - Midstream	951	142.8%	0.5	0.0%
Refrigerator	72	94.5%	0.5	13.4%
Clothes Dryer	10	112.1%	0.5	13.6%
Freezer	5	204.4%	0.5	14.2%
Program Total	**1,685**	**135.6%**	**0.5**	**1.7%**

Table 289: Res Appliances Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	13	149.9%	0.5	33.9%
Heat Pump Water Heater - Midstream	103	148.7%	0.5	0.0%
Clothes Washer	40	151.5%	0.5	10.7%
Dehumidifier	48	95.7%	0.5	14.9%
Dehumidifier - Midstream	376	143.6%	0.5	0.0%
Refrigerator	24	100.0%	0.5	13.3%
Clothes Dryer	5	120.3%	0.5	12.1%
Freezer	2	196.7%	0.5	13.7%
Program Total	**609**	**139.6%**	**0.5**	**1.4%**

Table 290: Res Appliances Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	88	139.6%	0.5	14.9%
Heat Pump Water Heater - Midstream	406	148.5%	0.5	0.0%
Clothes Washer	141	155.9%	0.5	11.4%
Dehumidifier	272	103.8%	0.5	15.3%
Dehumidifier - Midstream	1,250	143.3%	0.5	0.0%
Refrigerator	95	95.8%	0.5	13.2%
Clothes Dryer	19	110.4%	0.5	12.3%
Freezer	6	201.9%	0.5	14.4%
Program Total	**2,276**	**138.1%**	**0.5**	**1.7%**

The gross realization rates for energy and relative precisions for the Res LI Appliances Initiative are shown in Table 291, Table 292, Table 293, and Table 294 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 291: Res LI Appliances Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	9	137.3%	0.5	11.3%
Dehumidifier	4	102.6%	0.5	17.1%
Refrigerator	4	106.8%	0.5	13.9%
Clothes Dryer	1	111.7%	0.5	14.9%
Freezer	0	208.7%	0.5	50.9%
Program Total	**17**	**121.6%**	**0.5**	**7.7%**

Table 292: Res LI Appliances Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	9	142.0%	0.5	13.4%
Dehumidifier	16	114.1%	0.5	15.1%
Refrigerator	6	109.9%	0.5	14.8%
Clothes Dryer	1	112.3%	0.5	12.8%
Freezer	0	194.8%	0.5	16.4%
Program Total	**33**	**121.5%**	**0.5**	**8.6%**

Table 293: Res LI Appliances Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	3	134.5%	0.5	13.1%
Dehumidifier	3	97.4%	0.5	12.5%
Refrigerator	1	97.2%	0.5	16.8%
Clothes Dryer	0	93.9%	0.5	19.8%
Freezer	0	220.5%	0.5	29.4%
Program Total	**8**	**112.5%**	**0.5**	**7.8%**

Table 294: Res LI Appliances Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	7	145.4%	0.5	12.5%
Dehumidifier	10	103.3%	0.5	13.2%
Refrigerator	5	95.3%	0.5	15.2%
Clothes Dryer	1	111.3%	0.5	15.2%
Freezer	0	212.4%	0.5	18.6%
Program Total	**23**	**116.4%**	**0.5**	**7.5%**

L.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 295, Table 296, Table 297, and Table 298 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 295: Res Appliances Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	0.01	148.1%	0.5	17.2%
Heat Pump Water Heater - Midstream	0.03	174.2%	0.5	0.0%
Clothes Washer	0.01	154.4%	0.5	10.9%
Dehumidifier	0.04	92.0%	0.5	14.2%
Dehumidifier - Midstream	0.32	141.4%	0.5	0.0%
Refrigerator	0.01	83.5%	0.5	13.5%
Clothes Dryer	0.00	98.3%	0.5	12.7%
Freezer	0.00	173.3%	0.5	14.1%
Program Total	**0.43**	**138.4%**	**0.5**	**1.0%**

Table 296: Res Appliances Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	0.00	170.8%	0.5	17.6%
Heat Pump Water Heater - Midstream	0.02	173.7%	0.5	0.0%
Clothes Washer	0.01	157.7%	0.5	11.1%
Dehumidifier	0.06	93.7%	0.5	13.7%
Dehumidifier - Midstream	0.24	141.0%	0.5	0.0%
Refrigerator	0.01	86.0%	0.5	13.4%
Clothes Dryer	0.00	99.1%	0.5	13.6%
Freezer	0.00	175.3%	0.5	14.2%
Program Total	**0.34**	**133.4%**	**0.5**	**1.8%**

Table 297: Res Appliances Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	0.00	172.7%	0.5	33.9%
Heat Pump Water Heater - Midstream	0.01	171.4%	0.5	0.0%
Clothes Washer	0.00	151.1%	0.5	10.7%
Dehumidifier	0.01	94.4%	0.5	14.9%
Dehumidifier - Midstream	0.10	141.1%	0.5	0.0%
Refrigerator	0.00	91.0%	0.5	13.3%
Clothes Dryer	0.00	106.4%	0.5	12.1%
Freezer	0.00	168.7%	0.5	13.7%
Program Total	**0.12**	**137.4%**	**0.5**	**1.1%**

Table 298: Res Appliances Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	0.01	160.8%	0.5	14.9%
Heat Pump Water Heater - Midstream	0.03	171.4%	0.5	0.0%
Clothes Washer	0.02	155.4%	0.5	11.4%
Dehumidifier	0.07	102.3%	0.5	15.3%
Dehumidifier - Midstream	0.32	141.3%	0.5	0.0%
Refrigerator	0.01	87.2%	0.5	13.2%
Clothes Dryer	0.00	97.6%	0.5	12.3%
Freezer	0.00	173.3%	0.5	14.4%
Program Total	**0.45**	**136.2%**	**0.5**	**1.8%**

The gross realization rates for demand and relative precisions for the Res LI Appliances Initiative are shown in Table 295, Table 296, Table 297, and Table 298 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 299: Res LI Appliances Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	0.00	129.8%	0.5	11.3%
Dehumidifier	0.00	101.1%	0.5	17.1%
Refrigerator	0.00	97.1%	0.5	13.9%
Clothes Dryer	0.00	102.9%	0.5	14.9%
Freezer	0.00	179.0%	0.5	50.9%
Program Total	**0.00**	**111.5%**	**0.5**	**8.1%**

Table 300: Res LI Appliances Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	0.00	134.3%	0.5	13.4%
Dehumidifier	0.00	112.4%	0.5	15.1%
Refrigerator	0.00	99.9%	0.5	14.8%
Clothes Dryer	0.00	103.4%	0.5	12.8%
Freezer	0.00	167.1%	0.5	16.4%
Program Total	**0.01**	**114.4%**	**0.5**	**10.3%**

Table 301: Res LI Appliances Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	0.00	127.2%	0.5	13.1%
Dehumidifier	0.00	96.0%	0.5	12.5%
Refrigerator	0.00	88.3%	0.5	16.8%
Clothes Dryer	0.00	86.5%	0.5	19.8%
Freezer	0.00	189.1%	0.5	29.4%
Program Total	**0.00**	**103.1%**	**0.5**	**8.0%**

Table 302: Res LI Appliances Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	0.00	137.5%	0.5	12.5%
Dehumidifier	0.00	101.8%	0.5	13.2%
Refrigerator	0.00	86.7%	0.5	15.2%
Clothes Dryer	0.00	102.5%	0.5	15.2%
Freezer	0.00	182.2%	0.5	18.6%
Program Total	**0.00**	**107.5%**	**0.5**	**8.4%**

L.2 NET IMPACT EVALUATION

L.2.1 Net Impact Evaluation Methodology

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 slightly lower than those found in the Phase II evaluation, as customers reported lower amounts of spillover. A net impact evaluation was not conducted for the Low-Income Appliances Initiative. An NTG ratio of 100% is used for reporting of net impacts and for cost effectiveness testing for the Low-Income Appliances Initiative.

L.2.2 Sampling

Tetra Tech sampled randomly from all participants on record in the Companies' tracking and reporting systems in early PY8Q4. The sample designs for the four EDCs are shown in Table 303, Table 304, Table 305, and Table 306 for Met-Ed, Penelec, Penn Power, and WPP. Note that the tables show PY10 population counts but PY8 achieved sample sizes, but the participant counts are comparable between the two program years, and both are large compared to the sample sizes.

Table 303: Res Appliances Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	14,266	76	27.0%
Program Total	**14,266**	**76**	**27.0%**

Table 304: Res Appliances Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	11,401	72	26.0%
Program Total	**11,401**	**72**	**26.0%**

Table 305: Res Appliances Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	4,180	71	25.0%
Program Total	**4,180**	**71**	**25.0%**

Table 306: Res Appliances Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	15,259	72	26.0%
Program Total	**15,259**	**72**	**26.0%**

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 307, Table 308, Table 309, and Table 310 for Met-Ed, Penelec, Penn Power, and WPP. In PY8, the free ridership rates tended to be approximately 10% higher than those obtained from the previous NTG study in PY6.

Table 307: Res Appliances Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	3,126	52.0%	4.0%	52.0%	12.4%
Program Total	**3,126**	**52.0%**	**4.0%**	**52.0%**	**12.4%**

Table 308: Res Appliances Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	2,284	53.0%	1.0%	48.0%	12.7%
Program Total	**2,284**	**53.0%**	**1.0%**	**48.0%**	**12.7%**

Table 309 Res Appliances Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	851	56.0%	3.0%	47.0%	12.8%
Program Total	**851**	**56.0%**	**3.0%**	**47.0%**	**12.8%**

Table 310 Res Appliances Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	3,143	50.0%	0.0%	50.0%	12.7%
Program Total	**3,143**	**50.0%**	**0.0%**	**50.0%**	**12.7%**

Appendix M Evaluation Detail – Low Income Residential Appliance Turn-In Initiative

M.1 Gross Impact Evaluation

Gross impact evaluation for the Low Income Appliance Turn-In (LI ATI) 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.

M.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical for all four EDCs. A TRM-based calculation was performed for each entry in the tracking and reporting system. The parameter values from the TRM (or for dehumidifiers, IMP) algorithms were taken from project-specific data from the tracking and reporting system when applicable, from TRM defaults, or from customer verification surveys. For refrigerators and freezers, measure attributes that participants would readily recall were determined from participant surveys, and the average parameter values were applied to all measures. Apart from measure verification, these attributes include the part-use factor, the location in the home where the appliance was used, and for refrigerators, whether the appliance was a primary or secondary unit. Technical attributes of the appliances, such as the age, capacity, and configuration, as collected by ARCA, were taken from program tracking and reporting data. TRM or IMP default parameters were used tor room air conditioners (RACs) and dehumidifiers. Table 311 lists the data sources for gross impact calculation algorithms.

Table 311: 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	TRM Default
RAC	EER	TRM Default
RAC	RAC EFLH	TRM - Zip Code Lookup
RAC	CF	TRM Default
Dehumidifier	Capacity	IMP Default
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. Although verification rates determined through surveys were approximately 100%, the realization rates are generally lower than 100% because the part-use factors are lower than the TRM default values, and the calculated unit energy consumptions were lower than what would expect from application of default parameters in the TRM.

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 312, Table 313, Table 314, and Table 315. 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.

Table 312: LI ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	774	167	Survey (phone + online)
Freezers	157	44	
Dehumidifiers	37	10	
RACs	120	33	
Program Total	**1,088**	**254**	

Table 313: LI ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	884	154	Survey (phone + online)
Freezers	169	47	
Dehumidifiers	56	13	
RACs	124	24	
Program Total	**1,233**	**238**	

Table 314: LI ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	263	53	Survey (phone + online)
Freezers	51	13	
Dehumidifiers	19	4	
RACs	28	6	
Program Total	**361**	**76**	

Table 315: LI ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	676	124	Survey (phone + online)
Freezers	152	26	
Dehumidifiers	28	6	
RACs	76	11	
Program Total	**932**	**167**	

M.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 316, Table 317, Table 318, and Table 319 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 316: LI ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	731	110.5%	0.5	5.6%
Freezers	130	78.0%	0.5	10.9%
Dehumidifiers	9	294.6%	0.5	22.8%
RACs	14	117.3%	0.5	12.5%
Program Total	**884**	**107.7%**	**0.5**	**5.3%**

Table 317: LI ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	937	94.1%	0.5	5.8%
Freezers	142	78.4%	0.5	10.5%
Dehumidifiers	14	212.0%	0.5	20.0%
RACs	14	96.4%	0.5	14.7%
Program Total	**1,107**	**93.6%**	**0.5**	**4.8%**

Table 318: LI ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	284	84.8%	0.5	9.9%
Freezers	44	81.3%	0.5	20.0%
Dehumidifiers	5	278.0%	0.5	36.0%
RACs	3	71.6%	0.5	29.4%
Program Total	**336**	**86.9%**	**0.5**	**7.5%**

Table 319: LI ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	693	94.0%	0.5	6.5%
Freezers	131	82.0%	0.5	14.1%
Dehumidifiers	7	170.1%	0.5	29.4%
RACs	9	94.1%	0.5	21.7%
Program Total	**840**	**92.8%**	**0.5**	**5.4%**

M.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 320, Table 321, Table 322, and Table 323 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 320: LI 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	110.5%	0.5	5.6%
Freezers	0.01	78.0%	0.5	10.9%
Dehumidifiers	0.00	143.3%	0.5	22.8%
RACs	0.03	97.1%	0.5	12.5%
Program Total	**0.13**	**104.6%**	**0.5**	**5.0%**

Table 321: LI ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.10	94.1%	0.5	5.8%
Freezers	0.02	78.4%	0.5	10.5%
Dehumidifiers	0.01	127.2%	0.5	20.0%
RACs	0.03	95.8%	0.5	14.7%
Program Total	**0.16**	**94.1%**	**0.5**	**4.8%**

Table 322: LI ATI Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.03	84.8%	0.5	9.9%
Freezers	0.00	81.3%	0.5	20.0%
Dehumidifiers	0.00	159.7%	0.5	36.0%
RACs	0.01	71.4%	0.5	29.4%
Program Total	**0.05**	**85.4%**	**0.5**	**7.3%**

Table 323: LI ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.08	94.0%	0.5	6.5%
Freezers	0.01	82.0%	0.5	14.1%
Dehumidifiers	0.00	99.3%	0.5	29.4%
RACs	0.02	91.7%	0.5	21.7%
Program Total	**0.11**	**92.2%**	**0.5**	**5.6%**

M.2 Net Impact Evaluation

M.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 N – 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 2018 Federal Poverty Guideline.

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 customer's income.

N.1 Gross Impact Evaluation

N.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the LI DI Initiative involved using TRM calculations for measures installed throughout the program. Unique measure calculations were performed in accordance with the 2016 PA TRM for each measure type. The impact evaluation process is described below.

N.1.1.1 Determination of In-Service Rates

In-service rates are calculated by using QA/QC forms created by a third-party inspector. Inspectors verified measure installations during a site visit after the project was completed. The verified installed quantities were compared to reported quantities to develop the in-service rates.

In PY8, ADM performed ride along site visits with three different QA/QC contractors to ensure that the contractors were performing the QA/QC visit properly. It was found that the QA/QC contractors were indeed looking for the right measures and measure quantities. ADM verified the same quantity of measures as the QA/QC contractors. ADM continues to rely on QA/QC contractors' inspections to determine in-service rates for measures.

In-service rates were used in all savings calculations except air sealing and attic insulation measures.

N.1.1.2 TRM Calculations

For lighting measures, the efficient wattage ranges and bulb type are stated in equipment name columns of the customer tracking data. ADM used data from the upstream lighting program to determine average baseline watts and average energy efficient watts for each unique equipment name. The hours of use are assumed to be the TRM default of 3 hours because the bulb installation location is not known. 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 the equipment name and equipment description fields in the customer tracking data. If the name and description fields contradicted each other, the description field was used because the description column is more accurate and detailed. The implementer stated that the newly installed appliances are required to have the same size and configuration as the replaced appliance. Portions of the recycling part of the savings calculation come from the appliance turn-in program, other portions come from the determined category number. All appliances were assumed to be primary use. The default part use factors were used in the calculation.

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 percentage of residences with a clothes washer stated in the 2014 SWE PA residential baseline study is used in the water heater temperature setback measure calculation. 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. The PA 2016 TRM does not have a measure for electric resistance water heaters, therefore this type of measure saves zero energy.

Billing analysis was used to verify 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 EFLHcool were found using the zip code lookup table to the projects reference city.

Residential air sealing measures used CFM50post and CFM50pre 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. All smart strips were assumed to be tier 1 smart strips. 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.

Room air conditioner measures were evaluated using section 2.2.4 of the 2016 PA TRM. The capacity of the RAC is given the measures equipment name. All RACs were assumed to have louvered sides. The CEERbase and CEERee were found using the louvered sided assumption. The hours of use for room air conditioners were found using the zip code lookup table in the TRM.

Duct sealing measures were not evaluated because no supporting documentation was given to support the saving calculations. This did not adversely affect the program realization rates because there were very few duct sealing jobs[23].

N.1.1.3 Billing Based Verification of Electric Space Heat

The customer tracking data often times misreported the heating and cooling equipment type for a given address which received attic insulation. To verify the heating and cooling equipment type, a billing analysis was performed on a sample of homes which received attic insulation measures. It was found that in many situations an address tracked as non-electric heat had an inoperable non-electric central furnace as the primary heat source and therefore uses electric resistance heaters to heat the residence. The billing analysis uses monthly billing data, actual weather data, house size, and energy intensity (btu/sqft for heating and tons/sqft for cooling) assumptions to predict the heating and cooling type. Once the heating and cooling equipment types are confirmed, insulation savings calculations were made. Attic insulation savings realization rates were developed and applied to the attic insulation measure population.

N.1.2 Sampling

The sampling strategy for gross impact evaluation is summarized in Table 324, Table 325, Table 326, and Table 327 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 324: LI DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,680	196	22	TRM Analysis + On-Site Verification
Medium Savings	970	450	16	
Low Savings	0	1,236	24	
Program Total		**1,882**	**62**	

Table 325: LI DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,300	430	24	TRM Analysis + On-Site Verification
Medium Savings	790	728	21	
Low Savings	0	1,854	23	
Program Total		**3,012**	**68**	

[23] There are other measures with sparse implementation that are also not credited savings. One example is the installation of a clothes line. Although it is expected that this measure can reduce energy usage associated with clothes drying, it is difficult to quantify impacts to the level of certainty that would warrant a TRM addition or interim measure protocol.

Table 326: LI DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,280	103	12	TRM Analysis + On-Site Verification
Medium Savings	740	220	18	
Low Savings	0	645	18	
Program Total		**968**	**48**	

Table 327: LI DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,625	247	22	TRM Analysis + On-Site Verification
Medium Savings	1,060	445	17	
Low Savings	0	1,135	30	
Program Total		**1,827**	**69**	

N.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 328, Table 329, Table 330, and Table 331 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 328: LI 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	1,680	463	117.2%	0.5	14%
Medium Savings	970	577	99.9%	0.5	18%
Low Savings	0	514	94.8%	0.5	15%
Program Total		**1,555**	**103.4%**	**0.5**	**9.1%**

Table 329: 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	1,300	792	93.6%	0.5	14%
Medium Savings	790	730	96.3%	0.5	15%
Low Savings	0	722	96.0%	0.5	15%
Program Total		**2,244**	**95.3%**	**0.5**	**8.6%**

Table 330: 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	1,280	192	95.4%	0.5	20%
Medium Savings	740	215	99.5%	0.5	16%
Low Savings	0	224	95.8%	0.5	17%
Program Total		**631**	**96.9%**	**0.5**	**10.1%**

Table 331: 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.
High Savings	1,625	590	96.1%	0.5	15%
Medium Savings	1,060	577	100.6%	0.5	17%
Low Savings	0	575	96.1%	0.5	13%
Program Total		**1,742**	**97.6%**	**0.5**	**8.7%**

N.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 332, Table 333, Table 334, and Table 335 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 332: 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	1,680	0.04	140.6%	0.5	14%
Medium Savings	970	0.06	104.4%	0.5	18%
Low Savings	0	0.06	100.5%	0.5	15%
Program Total		**0.16**	**112.3%**	**0.5**	**9.2%**

Table 333: 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	1,300	0.07	97.6%	0.5	14%
Medium Savings	790	0.07	98.5%	0.5	15%
Low Savings	0	0.07	97.2%	0.5	15%
Program Total		**0.21**	**97.8%**	**0.5**	**8.6%**

Table 334: 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	1,280	0.02	97.8%	0.5	20%
Medium Savings	740	0.02	100.8%	0.5	16%
Low Savings	0	0.02	99.7%	0.5	17%
Program Total		**0.07**	**99.5%**	**0.5**	**10.0%**

Table 335: 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	1,625	0.06	98.0%	0.5	15%
Medium Savings	1,060	0.06	101.9%	0.5	17%
Low Savings	0	0.06	97.3%	0.5	13%
Program Total		**0.19**	**99.0%**	**0.5**	**8.7%**

N.2 Net Impact Evaluation

N.2.1 Net Impact Evaluation Methodology

An independent net impact evaluation was not conducted for this initiative.

Appendix O Evaluation Detail – LI EE Kits Initiative

O.1 Gross Impact Evaluation

The Low Income EE Kits initiative has two sub-components. Low-income EE Kits, administered by PowerDirect, and the Low-Income School Education program, 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 from PowerDirect targets customers that are income qualified in the Companies' customer information systems databases. The Low-Income Schools program targets schools in low-income areas.

O.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical to the process described for EE Kits in Appendix E. As with other residential surveys for gross impact evaluation, ADM prioritized online surveys and used telephone surveys to achieve sample quotas in cases where a few phone calls could avoid the launch of a new wave of online surveys.

O.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 336, Table 337, Table 338, and Table 339.

Table 336: LI EE Kits Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	5,807	184	Survey (phone + online)
LI EE Kits - Standard	9,563	200	
LI School Education Kits	970	19	
Program Total	**16,340**	**403**	

Table 337: LI EE Kits Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	5,638	149	Survey (phone + online)
LI EE Kits - Standard	9,307	193	
LI School Education Kits	0	0	
Program Total	**14,945**	**342**	

Table 338: LI EE Kits Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	1,558	106	Survey (phone + online)
LI EE Kits - Standard	2,603	145	
LI School Education Kits	209	10	
Program Total	**4,370**	**261**	

Table 339: LI EE Kits Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	4,629	170	Survey (phone + online)
LI EE Kits - Standard	7,469	203	
LI School Education Kits	738	53	
Program Total	**12,836**	**426**	

O.1.3 Determination of Low-Income Eligibility

The low-income EE Kits program component targets customers that are designated as income-qualified customers. The two programs, however, have different methods of identifying low-income customers. The Low Income EE Kits are delivered to customers that are known to be low-income qualified in the Companies' customer information systems databases. Customers may be identified as low-income due to past or present participation in income-qualified programs offered by the Companies. Such programs include the Act 129 WARM programs, the Low Income Home Energy Assistance Program, and Pennsylvania Customer Assistance Program. The School Education program component focuses on students in participating school within the Companies' service territories. Participation in the School Education program does not require the disclosure of account numbers. It is therefore not possible to match customers to Low Income status "SAP tags" in the customer information systems databases. As a result, the program implementer assigned all students in schools that are known to be in low-income areas to the low-income program component, and all other students to the non-low-income component.

ADM included an income battery at the end of verification surveys for most residential measures. PY10 survey results for the EE Kits and LI EE Kits are shown in Figure 28 below. According to the figure, the process of using income status SAP tags from the Companies' customer information system databases appears to separate low-income and non-low-income customers. There are a number of reasons to expect the first bin to lower than 100% for the low-income kits. For example, household income and the number of persons per household can change over time, and this may cause some shifting of customers both in and out of the income qualified group. Furthermore, we have noted lower response rates in low-income customers. Therefore, the survey may have overrepresented customers in the upper range of the qualified incomes. The SAP tag method of identifying low-income customers appears to result in a relatively pure set of income-qualified customers. However, it is noteworthy to consider the efficiency of identifying low-income customers. For example, the number of non-LI EE Kits is approximately five fold larger than the number of LI EE kits. Therefore, the first histogram bin for the non-LI EE kits represents almost as many actual customers as the first bin for the LI EE

kits. This suggests that the low-income benefits are actually greater than reported by the Companies, and an ex-post rather than ex-ante reporting methodology may help to increase the efficiency of identifying low-income customers.

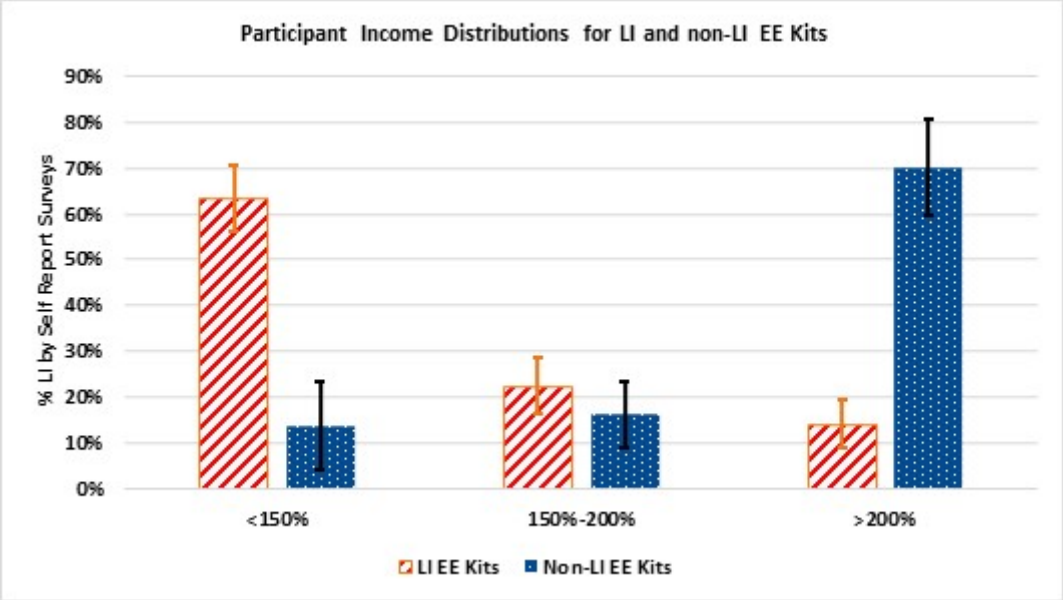

Figure 28: Reported income brackets for LI and Non-LI EE Kit Recipients

The school kits program does not have customer account numbers to cross reference against the Companies' customer information systems databases. As a result, the method for identification of LI School Kit participants is indirect, as described above. PY8 survey results for the School Kits and LI School Kits are shown in Figure 29 below (the income assignment and reporting procedure has not changed since PY8). According to the figure, the indirect process of assigning an "all or none" low-income status to students at schools does not seem to differentiate between income qualified and non-income qualified customers.

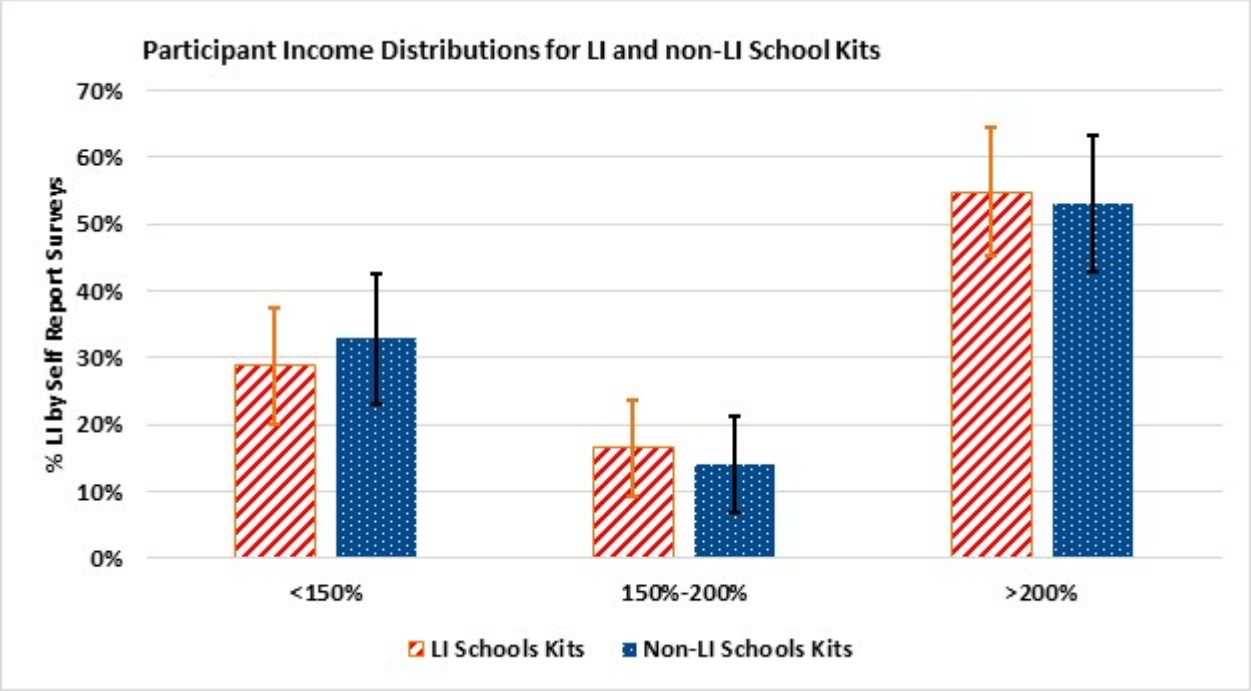

Figure 29: Reported income brackets for LI and Non-LI School Kit Recipients

According to the survey results it is clear that 100% of the LI School Kits customers are not low-income. On the other hand, a significant number of low-income customers are classified as non-income-qualified. ADM decided that robust reporting of the low-income contribution of the School Kits program requires an independent assessment of the number of low-income customers served by the School Education Program Component. Instead of using an all-or-none approach, we estimated the low-income fraction from the percentages of students at each school that are eligible for free or reduced priced lunches, according to the Pennsylvania Department of Education[24]. The Department of Education reports the percent of students at each school that are eligible for free or reduced price lunches. Students from families with incomes below 130% of the Federal Poverty line are eligible for free lunches, while students from families with incomes below 185% of the Federal Poverty line are eligible for reduced price lunches. ADM interpolated between these two points by taking half of the number students that qualify for reduced price lunches (but not free lunches) and adding this value to the number of students that qualify for free lunches at each school. The results are shown below. Accordingly, the School Education Kit program's verified contribution to the low-income sector is taken to be a portion of the verified savings for the low-income component, and a portion of the verified savings for the non-low-income component.

[24] The report can be found on the Pennsylvania Department of Education web site: http://www.education.pa.gov/_layouts/download.aspx?SourceUrl=http://www.education.pa.gov/Documents/Teachers-Administrators/Food%20and%20Nutrition/Reports/2015-2016%20Building%20Data%20Report.xls

Table 340 – Low Income fractions determined from PA Dept. of Education data

EDC	Income Classification	% Low Income
Met-Ed	Res LI	38.61%
Met-Ed	Res	30.87%
Penelec	Res LI	0.00%
Penelec	Res	47.75%
Penn Power	Res LI	45.93%
Penn Power	Res	42.24%
WPP	Res LI	51.42%
WPP	Res	45.12%

A detailed breakdown of reported and verified impacts for the School Education Kits program component is provided in Table 341below.

Table 341 – Detailed Comparison of Reported and Verified Impacts for the School Education Kits Program

EDC	Reported Low-Income Status	Low-Income Status Assigned by ADM	Participants	Repored kWh	Reported kW	Verified kWh	Verified kW
Met-Ed	1	0	595	218,951	25.4	197,376	23.6
Met-Ed	1	1	375	137,700	15.9	124,131	14.8
Met-Ed	0	0	1,280	448,658	51.9	491,938	58.6
Met-Ed	0	1	571	200,303	23.2	219,626	26.2
Penelec	1	0	0	0	0.0	0	0.0
Penelec	1	1	0	0	0.0	0	0.0
Penelec	0	0	1,045	394,222	40.4	380,481	40.8
Penelec	0	1	955	360,299	37.0	347,741	37.3
Penn Power	1	0	113	44,495	5.1	55,648	7.6
Penn Power	1	1	96	37,801	4.3	47,276	6.5
Penn Power	0	0	252	94,700	10.7	96,902	11.5
Penn Power	0	1	185	69,258	7.9	70,869	8.4
WPP	1	0	359	138,832	17.2	150,968	19.0
WPP	1	1	379	146,928	18.2	159,771	20.1
WPP	0	0	1,967	725,997	89.7	765,334	101.0
WPP	0	1	1,618	596,917	73.7	629,261	83.0

O.1.4 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 342, Table 343, Table 344, and Table 345 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 342: EE Kits 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	2,510	122.3%	0.5	5%
LI EE Kits - Standard	3,024	115.7%	0.5	5%
LI School Education Kits	357	90.1%	0.5	16%
Program Total	**5,891**	**117.0%**	**0.5**	**3.5%**

Table 343: EE Kits 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	2,585	120.5%	0.5	6%
LI EE Kits - Standard	3,195	116.0%	0.5	5%
LI School Education Kits	0	0.0%	0.5	0%
Program Total	**5,780**	**118.0%**	**0.5**	**3.9%**

Table 344: EE Kits 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	712	120.9%	0.5	7%
LI EE Kits - Standard	888	119.9%	0.5	6%
LI School Education Kits	82	125.1%	0.5	22%
Program Total	**1,683**	**120.6%**	**0.5**	**4.3%**

Table 345: EE Kits 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	2,087	124.8%	0.5	5%
LI EE Kits - Standard	2,501	115.2%	0.5	5%
LI School Education Kits	286	108.7%	0.5	10%
Program Total	**4,874**	**118.9%**	**0.5**	**3.5%**

O.1.5 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 346, Table 347, Table 348, and Table 349 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 346: EE Kits 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	0.27	124.6%	0.5	5%
LI EE Kits - Standard	0.34	119.3%	0.5	5%
LI School Education Kits	0.04	92.9%	0.5	16%
Program Total	**0.66**	**119.9%**	**0.5**	**3.5%**

Table 347: EE Kits 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	0.26	122.7%	0.5	6%
LI EE Kits - Standard	0.32	122.5%	0.5	5%
LI School Education Kits	0.00	0.0%	0.5	0%
Program Total	**0.57**	**122.6%**	**0.5**	**3.8%**

Table 348: EE Kits 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	0.08	127.7%	0.5	7%
LI EE Kits - Standard	0.10	130.0%	0.5	6%
LI School Education Kits	0.01	150.7%	0.5	22%
Program Total	**0.18**	**130.1%**	**0.5**	**4.3%**

Table 349: EE Kits 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	0.24	124.0%	0.5	5%
LI EE Kits - Standard	0.31	119.7%	0.5	5%
LI School Education Kits	0.04	110.7%	0.5	10%
Program Total	**0.58**	**120.9%**	**0.5**	**3.5%**

O.2 Net Impact Evaluation

A net impact evaluation was not conducted for the LI EE Kits Initiative.

Appendix P Evaluation Detail – Commercial and Industrial Lighting Initiative

P.1 Gross Impact Evaluation

Gross impact evaluation for the Commercial and Industrial Lighting (C&I Lighting) Initiative involved stratified sampling, on-site verifications, and 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.

P.1.1 Gross Impact Evaluation Methodology

As a first step, projects are placed into one of four 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 Sodexo processes rebates with the TRM's Appendix C style calculator (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 2016 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. However, all projects with ex ante savings under 25 MWh are evaluated with TRM hours of use, without exception. Although there can be considerable variation in project-specific impacts as calculated by the TRM and by primary data collection, the two methodologies produce compatible results at the aggregate level.

In rare cases, 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. Figure 30 shows the fraction of verified energy savings, as averaged over the four PA Companies, by primary

evaluation activities. Details regarding gross impact evaluation activities for each sampled project can be found in Appendix B.

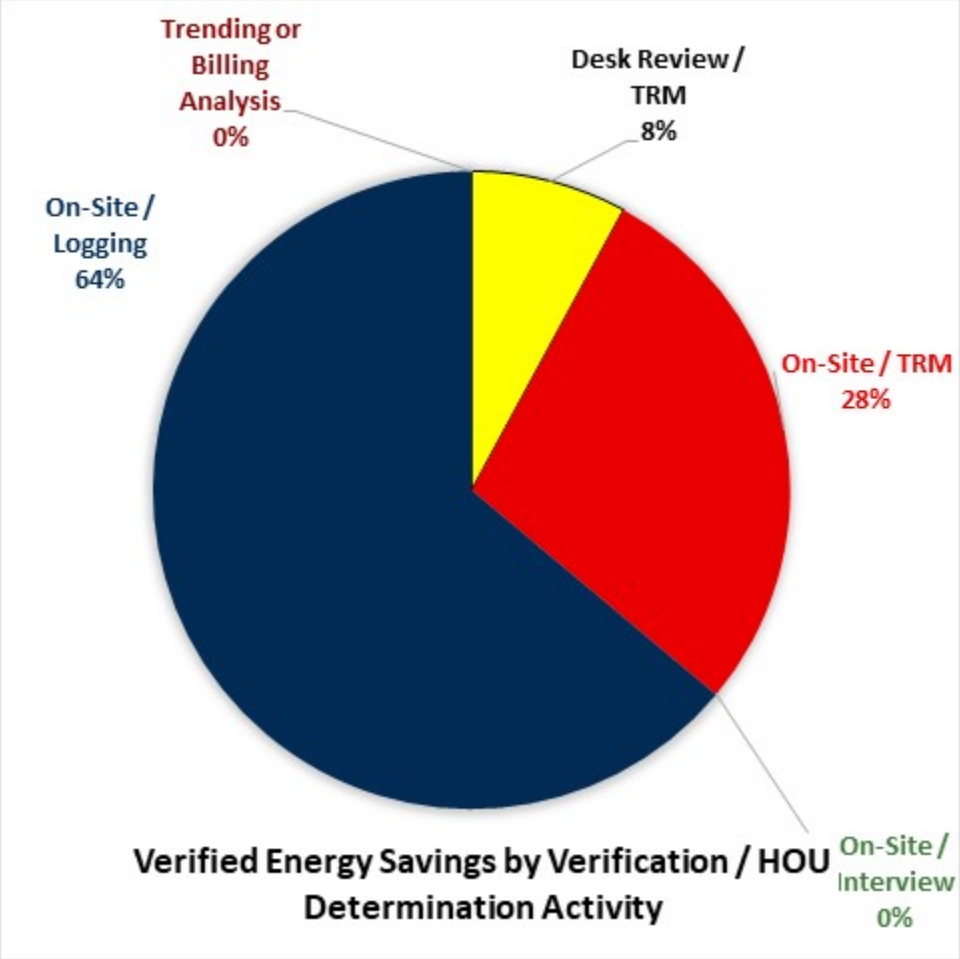

Figure 30 – Fraction of verified energy savings by evaluation activity.

As a final step in lighting 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.

P.1.2 Sampling

Projects are placed into four 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 three 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, and evaluated in advance of rebate approval to ensure that customers' incentives are determined from verified energy savings. The smallest projects, those with expected impacts under 25 MWh, are placed in a separate stratum. For these projects, hours of use are determined by application of deemed hours in the PA TRM. The sample designs for the four EDCs are shown in Table 350, Table 351, Table 352, and Table 353.

Table 350: CI Lighting Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Lighting-Certainty	750	12	12	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	47	10	
Lighting-2	25	290	12	
Lighting-1	0	333	7	
Program Total	**n/a**	**682**	**41**	

Table 351: CI Lighting Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Lighting-Certainty	750	5	5	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	47	13	
Lighting-2	25	383	15	
Lighting-1	0	618	8	
Program Total	**n/a**	**1,053**	**41**	

Table 352: CI Lighting Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Lighting-Certainty	750	1	1	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	20	13	
Lighting-2	25	140	15	
Lighting-1	0	159	7	
Program Total	**n/a**	**320**	**36**	

Table 353: CI Lighting Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Lighting-Certainty	750	3	3	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	58	13	
Lighting-2	25	344	14	
Lighting-1	0	582	7	
Program Total	**n/a**	**987**	**37**	

P.1.3 Results for Energy

The gross realization rates for energy, 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. Figure 31 plots the verified energy savings against the reported energy savings for all evaluated lighting projects for the program year. The figure includes data points from all four EDCs, and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficient of variation of 0.5, but the actual error ratios tend to be somewhat lower than 0.5.

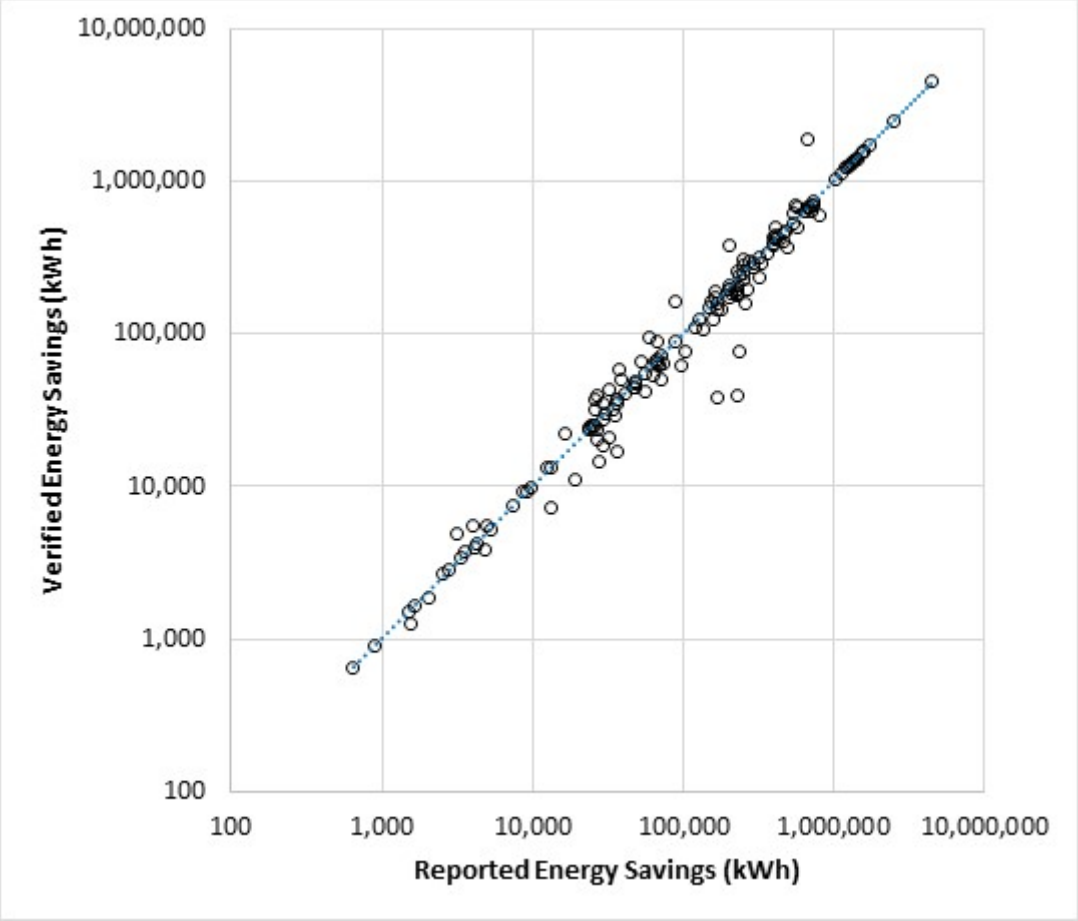

Figure 31: Verified vs. Reported Energy Savings for Sampled Lighting Projects.

Table 354: CI Lighting Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	19,137	100.2%	0.5	0%
Lighting-3	250	15,874	96.8%	0.5	20%
Lighting-2	25	21,530	99.6%	0.5	20%
Lighting-1	0	4,115	93.8%	0.5	27%
Program Total	**n/a**	**60,656**	**98.7%**	**0.5**	**9.0%**

Table 355: CI Lighting Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	5,234	96.4%	0.5	0%
Lighting-3	250	18,319	112.8%	0.5	17%
Lighting-2	25	26,089	109.5%	0.5	18%
Lighting-1	0	5,221	110.0%	0.5	25%
Program Total	**n/a**	**54,863**	**109.4%**	**0.5**	**11.7%**

Table 356: CI Lighting Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	1,393	100.3%	0.5	0%
Lighting-3	250	7,487	103.6%	0.5	12%
Lighting-2	25	9,021	83.3%	0.5	18%
Lighting-1	0	1,830	95.0%	0.5	27%
Program Total	**n/a**	**19,731**	**93.3%**	**0.5**	**8.5%**

Table 357: CI Lighting Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	3,501	100.0%	0.5	0%
Lighting-3	250	20,969	96.4%	0.5	18%
Lighting-2	25	25,019	85.9%	0.5	19%
Lighting-1	0	4,953	101.7%	0.5	27%
Program Total	**n/a**	**54,443**	**92.3%**	**0.5**	**10.2%**

P.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 358, Table 359, Table 360, and Table 361 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 358: CI Lighting Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	2.92	101.8%	0.5	0%
Lighting-3	250	2.12	99.0%	0.5	20%
Lighting-2	25	2.75	102.0%	0.5	20%
Lighting-1	0	0.50	95.1%	0.5	27%
Program Total	**n/a**	**8.29**	**100.7%**	**0.5**	**8.7%**

Table 359: CI Lighting Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	0.65	96.6%	0.5	0%
Lighting-3	250	2.40	95.3%	0.5	17%
Lighting-2	25	3.63	95.2%	0.5	18%
Lighting-1	0	0.67	98.0%	0.5	25%
Program Total	**n/a**	**7.35**	**95.6%**	**0.5**	**10.3%**

Table 360: CI Lighting Initiative Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	0.16	100.0%	0.5	0%
Lighting-3	250	0.97	113.2%	0.5	12%
Lighting-2	25	1.25	75.3%	0.5	18%
Lighting-1	0	0.25	93.1%	0.5	27%
Program Total	**n/a**	**2.63**	**92.4%**	**0.5**	**8.3%**

Table 361: CI Lighting Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	0.47	100.0%	0.5	0%
Lighting-3	250	2.39	105.8%	0.5	18%
Lighting-2	25	3.02	82.5%	0.5	19%
Lighting-1	0	0.59	99.5%	0.5	27%
Program Total	**n/a**	**6.47**	**93.9%**	**0.5**	**10.3%**

P.2 NET IMPACT EVALUATION

P.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted a net-to-gross (NTG) evaluation in PY10. The evaluation assessed free ridership and spillover through participant customer and vendor surveys following the Pennsylvania Evaluation Framework. NTG was assessed for each EDC at the major measure category level (i.e., custom, lighting, and other prescriptive), as custom and lighting qualified as high-impact measures in PY10.

Free ridership was assessed through the participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. 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. Similar to the participant 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.

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-reports at the measure-category level (i.e., lighting, HVAC, and food service). Following the Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates, as vendors on average reported that their sales of program-qualifying equipment accounted for less than 90 percent of their total sales of high-efficiency products.

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.

P.2.2 Sampling

Net impact evaluation used a similar sampling scheme as gross impact evaluation. Stratification by MWh was necessary because commercial and industrial programs tend to concentrate impacts among a relatively small number of high-savings projects. The high fraction of program verified impacts in the certainty strata means that attainment of relative precision targets hinge on achieving a census or near-census of those strata Tetra Tech attempted to reach all customers in the "Certainty" strata, but not all decision makers for these customers responded to the survey. For net impact analysis, the "Lighting-Certainty" strata are combined with the "Lighting-3" strata to ensure that these high-saving strata will have adequate sample sizes, given realistic expectations of response rates. The sample designs for the four EDCs are shown in Table 362, Table 363, Table 364, and Table 365 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 362: CI Lighting Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Lighting-3	59	24	41%
Lighting-2	290	78	27%
Lighting-1	333	44	13%
Program Total	**682**	**146**	**21.4%**

Table 363: CI Lighting Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Lighting-3	52	21	40%
Lighting-2	383	94	25%
Lighting-1	618	65	11%
Program Total	**1,053**	**180**	**17.1%**

Table 364: CI Lighting Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Lighting-3	21	13	62%
Lighting-2	140	47	34%
Lighting-1	159	26	16%
Program Total	**320**	**86**	**26.9%**

Table 365: CI Lighting Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Lighting-3	61	21	34%
Lighting-2	344	75	22%
Lighting-1	582	56	10%
Program Total	**987**	**152**	**15.4%**

P.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 366, Table 367, Table 368, and Table 369 for Met-Ed, Penelec, Penn Power, and WPP respectively. The net-to-gross results show that overall net-to-gross for the commercial lighting is relatively high, with an average of 77% across the four EDCs.

Table 366: CI Lighting Initiative Net-to-Gro ss Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Lighting-3	34,542	40.5%	1.1%	60.6%	11.3%
Lighting-2	21,441	28.4%	0.1%	71.7%	7.0%
Lighting-1	3,860	48.0%	0.1%	52.1%	10.1%
Program Total	**59,843**	**36.6%**	**0.7%**	**64.1%**	**6.8%**

Table 367: CI Lighting Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Lighting-3	25,709	15.5%	3.6%	88.0%	12.1%
Lighting-2	28,562	35.7%	3.2%	67.5%	6.5%
Lighting-1	5,741	39.9%	2.6%	62.7%	8.4%
Program Total	**60,012**	**27.5%**	**3.3%**	**75.8%**	**6.7%**

Table 368 CI Lighting Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Lighting-3	9,157	11.4%	0.0%	88.6%	12.3%
Lighting-2	7,511	35.0%	1.9%	66.9%	8.6%
Lighting-1	1,738	42.7%	2.4%	59.7%	12.9%
Program Total	**18,406**	**24.0%**	**1.0%**	**77.1%**	**7.7%**

Table 369 CI Lighting Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Lighting-3	23,707	35.5%	0.0%	64.5%	12.7%
Lighting-2	21,501	32.8%	1.4%	68.7%	7.4%
Lighting-1	5,037	30.2%	0.0%	69.9%	9.1%
Program Total	**50,246**	**33.8%**	**0.6%**	**66.8%**	**6.7%**

Appendix Q Evaluation Detail – Commercial and Industrial Custom Initiative

Q.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.

Q.1.1 Gross Impact Evaluation Methodology

As a first step, projects are spaced 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 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.

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 32 shows the fraction of verified energy savings, as averaged over the four PA Companies, by primary evaluation activities. Details regarding gross impact evaluation activities for each sampled project can be found in Appendix B.

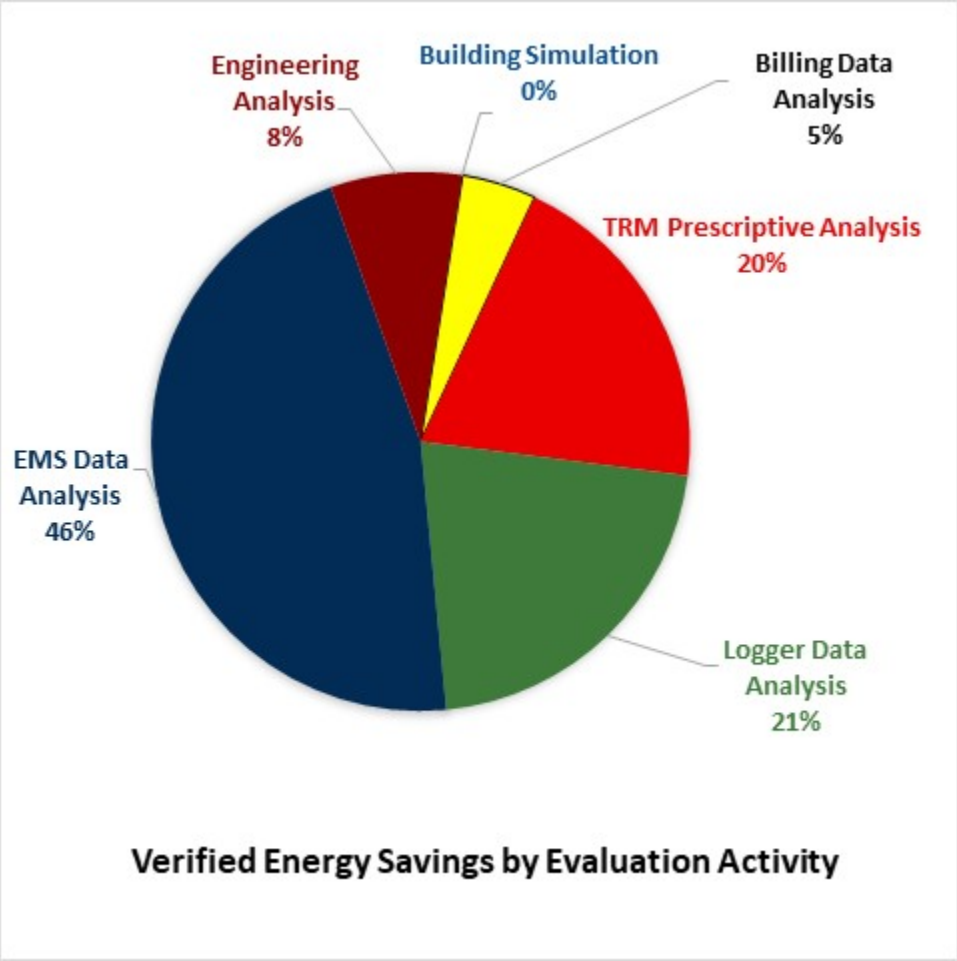

Figure 32 – Fraction of verified energy savings by evaluation activity.

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.

Q.1.2 Sampling

Projects are placed into three strata. The first stratum or "certainty" stratum consists of projects that are expected to result in energy savings in excess of 500 MWh. All of these projects are sampled for evaluation, and nearly all of them are evaluated prior to rebate approval. Therefore, the gross realization rate for the certainty stratum is essentially 100% by design, although reported impacts may at times be lower than the 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, the certainty stratum is evaluated with the highest level of rigor, and are evaluated in advance of rebate approval to ensure that customers' incentives are determined from verified energy savings. The next largest projects, those with expected impacts above 250 MWh, are placed in a separate stratum and evaluated with primary data collection and a high level of rigor. Projects with impacts below 250 MWh are assigned a level of rigor assigned on a case by case basis. In this stratum, if the weighted MWh uncertainty (as determined from the sample scheme and a review of project documentation) is low, then basic rigor is preferred. The sample designs for the four EDCs are shown in Table 370, Table 371, Table 372, and Table 373.

Table 370: CI Custom Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	1	1	On-Site Verification, Metering
Custom-2	250	8	8	
Custom-1	0	41	10	
Program Total	**n/a**	**50**	**19**	

Table 371: CI Custom Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	5	5	On-Site Verification, Metering
Custom-2	250	6	4	
Custom-1	0	108	15	
Program Total	**n/a**	**119**	**24**	

Table 372: CI Custom Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	1	1	On-Site Verification, Metering
Custom-2	250	3	3	
Custom-1	0	18	8	
Program Total	**n/a**	**22**	**12**	

Table 373: CI Custom Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	1	1	On-Site Verification, Metering
Custom-2	250	4	3	
Custom-1	0	47	14	
Program Total	**n/a**	**52**	**18**	

Q.1.3 Results for Energy

The gross realization rates for energy, 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. Figure 33 plots the verified energy savings against the reported energy savings for all evaluated lighting projects for all in 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.

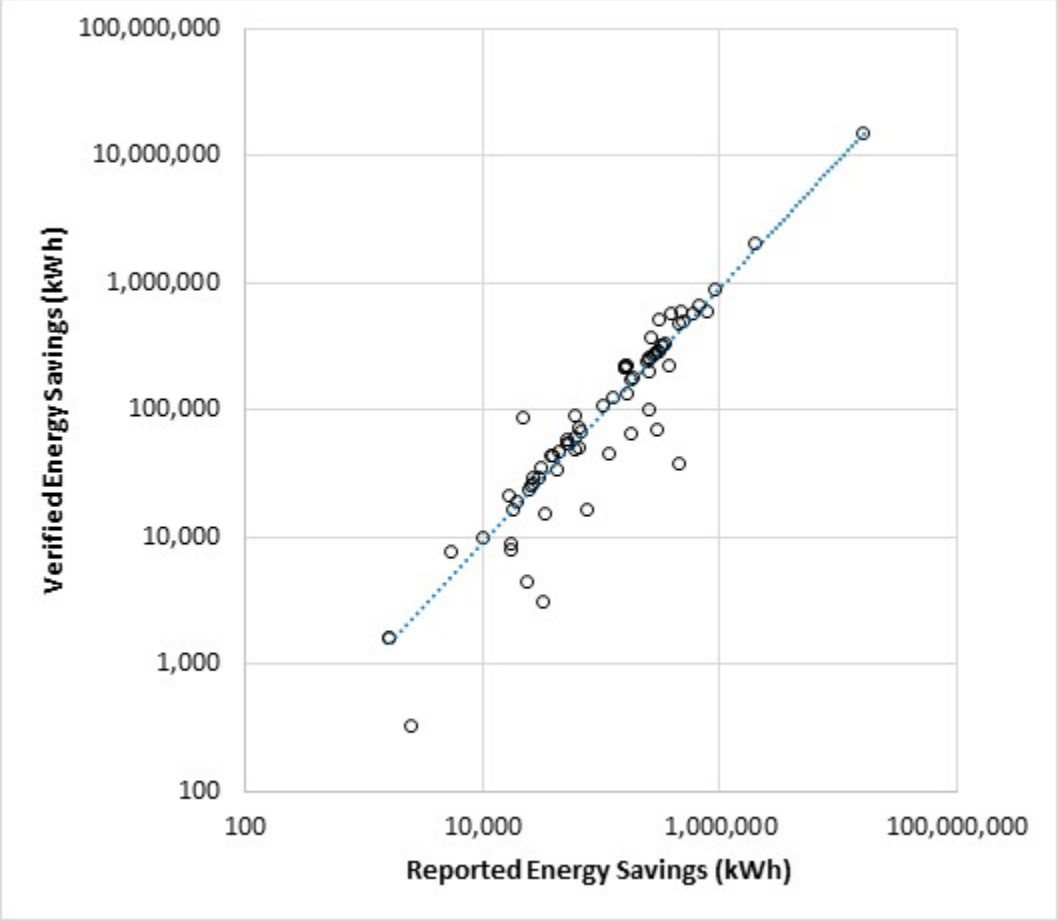

Figure 33: Verified vs. Reported Energy Savings for Sampled Custom Projects.

Table 374: 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-Certainty	500	583	100.0%	0.5	0%
Custom-2	250	2,492	97.0%	0.5	0%
Custom-1	0	2,950	107.4%	0.5	20%
Program Total	**n/a**	**6,026**	**102.4%**		**10.4%**

Table 375: 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-Certainty	500	20,145	91.3%	0.5	0%
Custom-2	250	2,004	101.5%	0.5	21%
Custom-1	0	3,806	111.9%	0.5	17%
Program Total	**n/a**	**25,955**	**95.1%**		**3.3%**

Table 376: 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-Certainty	500	900	100.0%	0.5	0%
Custom-2	250	1,124	138.3%	0.5	0%
Custom-1	0	638	91.6%	0.5	19%
Program Total	**n/a**	**2,663**	**114.1%**		**4.2%**

Table 377: 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-Certainty	500	340	98.7%	0.5	0%
Custom-2	250	1,558	49.3%	0.5	21%
Custom-1	0	3,477	90.4%	0.5	16%
Program Total	**n/a**	**5,375**	**79.0%**		**9.9%**

Q.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 378, Table 379, Table 380, and Table 381 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 378: 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-Certainty	500	0.06	100.0%	0.5	0%
Custom-2	250	0.20	81.9%	0.5	0%
Custom-1	0	0.29	82.8%	0.5	20%
Program Total	**n/a**	**0.55**	**84.3%**		**8.6%**

Table 379: 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-Certainty	500	2.45	86.8%	0.5	0%
Custom-2	250	0.16	120.3%	0.5	21%
Custom-1	0	0.64	52.2%	0.5	17%
Program Total	**n/a**	**3.26**	**81.6%**		**2.2%**

Table 380: 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-Certainty	500	0.14	100.0%	0.5	0%
Custom-2	250	0.21	100.8%	0.5	0%
Custom-1	0	0.09	34.6%	0.5	19%
Program Total	**n/a**	**0.45**	**86.9%**		**1.4%**

Table 381: 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-Certainty	500	0.04	98.7%	0.5	0%
Custom-2	250	0.20	52.8%	0.5	21%
Custom-1	0	0.48	53.3%	0.5	16%
Program Total	**n/a**	**0.72**	**55.6%**		**6.5%**

Q.2 NET IMPACT EVALUATION

Q.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted a net-to-gross (NTG) evaluation in PY8. The evaluation assessed free ridership and spillover through participant customer and vendor surveys following the Pennsylvania Evaluation Framework. NTG was assessed for each EDC at the major measure category level (i.e., custom, lighting, and other prescriptive), as custom and lighting qualified as high-impact measures in PY10.

Free ridership was assessed through the participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. 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. Similar to the participant 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.

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-reports at the measure-category level (i.e., lighting, HVAC, and food service). Following the Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates, as vendors on average reported that their sales of program-qualifying equipment accounted for less than 90 percent of their total sales of high-efficiency products.

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.

Q.2.2 Sampling

Net impact evaluation used a similar sampling scheme as gross impact evaluation. Stratification by MWh was necessary because commercial and industrial programs tend to concentrate impacts among a relatively small number of high-savings projects. The high fraction of program verified impacts in the certainty strata means that attainment of relative precision targets hinge on achieving a census or near-census of those strata Tetra Tech attempted to reach all customers in the "Certainty" strata, but not all decision makers for these customers responded to the survey. For net impact analysis, the "Custom-Certainty" strata are combined with the "Custom-2" strata to ensure that these high-saving strata will have adequate sample sizes, given realistic expectations of response rates.

The sample designs for the four EDCs are shown in Table 382, Table 383, Table 384, and Table 385 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 382: CI Custom Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom-2	9	8	89%
Custom-1	41	18	44%
Program Total	**50**	**26**	**52.0%**

Table 383: CI Custom Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom-2	11	9	82%
Custom-1	108	25	23%
Program Total	**119**	**34**	**28.6%**

Table 384: CI Custom Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom-2	4	4	100%
Custom-1	18	7	39%
Program Total	**22**	**11**	**50.0%**

Table 385: CI Custom Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom-2	5	2	40%
Custom-1	47	19	40%
Program Total	**52**	**21**	**40.4%**

Q.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 386, Table 387, Table 388, and Table 389 for Met-Ed, Penelec, Penn Power, and WPP respectively. Despite the difficulty of achieving a census of the largest customers, overall net-to-gross ratios for the custom initiatives were in a reasonably tight range around 50%. Inspection of stratum-level NTG ratios for all four EDCs suggests that NTG ratios are lower for custom projects than for lighting projects, and this is particularly true for large custom projects.

Table 386: CI Custom Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom-2	3,000	43.6%	0.0%	56.4%	8.5%
Custom-1	3,169	48.3%	0.0%	51.7%	12.7%
Program Total	**6,168**	**46.1%**	**0.0%**	**53.9%**	**7.6%**

Table 387: CI Custom Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom-2	20,435	8.4%	0.5%	92.1%	10.2%
Custom-1	4,259	42.2%	0.0%	57.8%	12.6%
Program Total	**24,694**	**14.2%**	**0.4%**	**86.2%**	**9.2%**

Table 388: CI Custom Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom-2	2,455	36.5%	0.0%	63.5%	0.0%
Custom-1	585	53.1%	0.0%	46.9%	21.3%
Program Total	**3,040**	**39.7%**	**0.0%**	**60.3%**	**3.2%**

Table 389: CI Custom Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom-2	1,105	50.0%	0.0%	50.0%	39.4%
Custom-1	3,143	40.4%	0.0%	59.6%	12.7%
Program Total	**4,248**	**42.9%**	**0.0%**	**57.1%**	**13.3%**

Appendix R Evaluation Detail – Commercial and Industrial Prescriptive Initiative

R.1 Gross Impact Evaluation

Gross impact evaluation for the Commercial and Industrial Prescriptive (C&I Prescriptive) Initiative involved stratified sampling, on-site verifications, and project-specific data collection and calculations.

R.1.1 Gross Impact Evaluation Methodology

As a first step, projects are spaced into one of three sampling strata as described in the next section. 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, but most projects can be evaluated with a combination of verification of measure installation and a TRM-based calculation. The first step in the M&V planning process is to check that the project is sufficiently documented and that sufficient data exist to identify the proper TRM protocol (or IMP) and the values of key input parameters as required by the protocol. Details regarding gross impact evaluation activities for each sampled project can be found in Appendix B.

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.

R.1.2 Sampling

Projects are placed into two strata. The impact evaluation activities are similar for both strata. The sample designs for the four EDCs are shown in Table 390, Table 391, Table 392, and Table 393.

Table 390: CI Prescriptive Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	7	5	Desk Review, On-Site Verification
Prescriptive-1	0	36	24	
Program Total	**n/a**	**43**	**29**	

Table 391: CI Prescriptive Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	8	5	Desk Review, On-Site Verification
Prescriptive-1	0	53	24	
Program Total	**n/a**	**61**	**29**	

Table 392: CI Prescriptive Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	1	1	Desk Review, On-Site Verification
Prescriptive-1	0	14	14	
Program Total	**n/a**	**15**	**15**	

Table 393: CI Prescriptive Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	5	3	Desk Review, On-Site Verification
Prescriptive-1	0	52	27	
Program Total	**n/a**	**57**	**30**	

R.1.3 Results for Energy

The gross realization rates for energy, 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. Figure 34 plots the verified energy savings against the reported energy savings for all evaluated lighting 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.

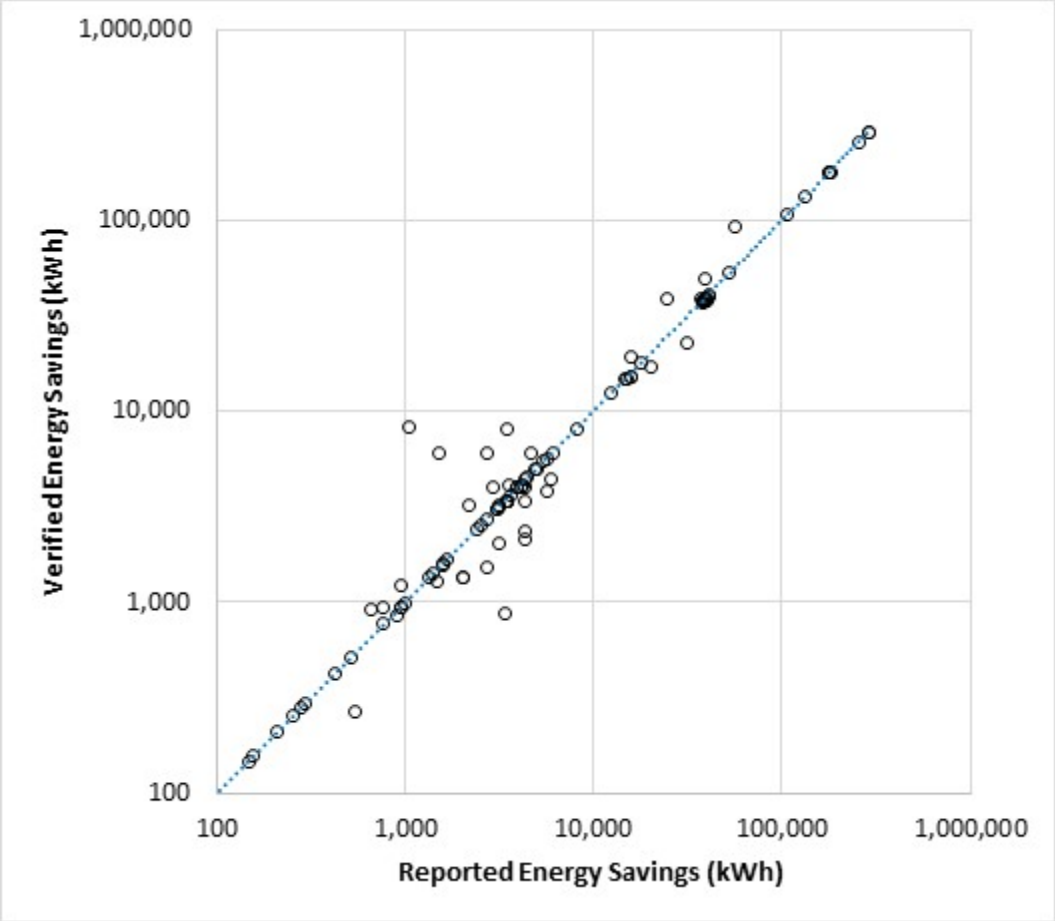

Figure 34: Verified vs. Reported Energy Savings for Sampled Prescriptive Projects.

Table 394: 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.
Prescriptive-2	20	1,177	99.1%	0.4	14%
Prescriptive-1	0	227	101.8%	0.4	7%
Program Total	**n/a**	**1,405**	**99.5%**		**11.5%**

Table 395: 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.
Prescriptive-2	20	1,264	106.0%	0.4	16%
Prescriptive-1	0	224	97.5%	0.4	9%
Program Total	**n/a**	**1,488**	**104.7%**		**14.3%**

Table 396: 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.
Prescriptive-2	20	41	95.9%	0.4	0%
Prescriptive-1	0	124	98.6%	0.4	0%
Program Total	**n/a**	**164**	**97.9%**		**0.0%**

Table 397: 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.
Prescriptive-2	20	708	99.5%	0.4	21%
Prescriptive-1	0	434	110.1%	0.4	8%
Program Total	**n/a**	**1,142**	**103.5%**		**13.4%**

R.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 398, Table 399, Table 400, and Table 401 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 398: 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.
Prescriptive-2	20	0.15	99.7%	0.4	14%
Prescriptive-1	0	0.08	39.1%	0.4	7%
Program Total	**n/a**	**0.23**	**78.7%**		**9.0%**

Table 399: 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.
Prescriptive-2	20	0.13	42.2%	0.4	16%
Prescriptive-1	0	0.06	29.5%	0.4	9%
Program Total	**n/a**	**0.19**	**38.1%**		**4.6%**

Table 400: 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.
Prescriptive-2	20	0.00	100.0%	0.4	0%
Prescriptive-1	0	0.01	89.1%	0.4	0%
Program Total	**n/a**	**0.01**	**89.6%**		**0.0%**

Table 401: 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.
Prescriptive-2	20	0.02	100.0%	0.4	21%
Prescriptive-1	0	0.04	75.6%	0.4	8%
Program Total	**n/a**	**0.06**	**83.3%**		**7.8%**

R.2 NET IMPACT EVALUATION

R.2.1 Net Impact Evaluation Methodology

The Net-to-Gross evaluation methodology for the prescriptive measures performed for PY10 was identical to the methodology used for lighting and custom measures.

R.2.2 Sampling

Sample sizes for prescriptive measures were relatively small, as the initiative accounted for less than 1% of gross and net impacts. The sample designs for the four EDCs are shown in Table 402, Table 403, Table 404, and Table 405 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 402: CI Prescriptive Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Prescriptive-2	7	4	57%
Prescriptive-1	36	11	31%
Program Total	**43**	**15**	**34.9%**

Table 403: CI Prescriptive Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Prescriptive-2	8	7	88%
Prescriptive-1	53	33	62%
Program Total	**61**	**40**	**65.6%**

Table 404: CI Prescriptive Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Prescriptive-2	1	1	100%
Prescriptive-1	14	9	64%
Program Total	**15**	**10**	**66.7%**

Table 405: CI Prescriptive Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Prescriptive-2	5	4	80%
Prescriptive-1	52	26	50%
Program Total	**57**	**30**	**52.6%**

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 386, Table 387, Table 388, and Table 389 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 406: CI Prescriptive Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Prescriptive-2	1,167	50.0%	0.0%	50.0%	23.6%
Prescriptive-1	232	26.3%	0.0%	73.7%	18.1%
Program Total	**1,398**	**46.1%**	**0.0%**	**53.9%**	**18.7%**

Table 407: CI Prescriptive Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Prescriptive-2	1,339	44.8%	0.0%	55.2%	9.6%
Prescriptive-1	219	58.1%	0.0%	41.9%	7.7%
Program Total	**1,558**	**46.7%**	**0.0%**	**53.3%**	**8.6%**

Table 408 CI Prescriptive Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Prescriptive-2	39	62.5%	0.0%	37.5%	0.0%
Prescriptive-1	122	53.8%	0.0%	46.2%	14.3%
Program Total	**161**	**55.9%**	**0.0%**	**44.1%**	**11.4%**

Table 409 CI Prescriptive Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Prescriptive-2	704	50.8%	0.0%	49.2%	16.1%
Prescriptive-1	478	58.8%	0.0%	41.2%	10.0%
Program Total	**1,182**	**54.0%**	**0.0%**	**46.0%**	**10.9%**

Appendix S Evaluation Detail – C&I Appliance Turn-In Initiative

S.1 Gross Impact Evaluation

Gross impact evaluation for the Commercial Appliance Turn-In (ATI) Initiative involved 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.

S.1.1 Gross Impact Evaluation Methodology

The primary activity for this initiative was to conduct a desk review of reported energy savings by equipment type and EDC. ADM also conducted telephone surveys to ascertain the two most influential factors in gross realization rates: the verification rate, and the part-use factor.

S.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 410, Table 411, Table 412, and Table 413. Desk review is considered to be the primary evaluation activity, although verification surveys were also conducted for all EDCs.

Table 410: C&I ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	64	14 / 64	Phone Surveys / Desk Review
Freezers	9	2 / 9	
Dehumidifiers	0	0 / 0	
RACs	8	4 / 8	
Program Total	**81**	**20 / 81**	

Table 411: C&I ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	88	14 / 88	Phone Surveys / Desk Review
Freezers	19	4 / 19	
Dehumidifiers	0	0 / 0	
RACs	9	4 / 9	
Program Total	**116**	**22 / 116**	

Table 412: C&I ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	16	2 / 16	Phone Surveys / Desk Review
Freezers	3	0 / 3	
Dehumidifiers	0	0 / 0	
RACs	1	0 / 1	
Program Total	**20**	**2 / 20**	

Table 413: C&I ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	85	9 / 85	Phone Surveys / Desk Review
Freezers	18	4 / 18	
Dehumidifiers	0	0 / 0	
RACs	15	2 / 15	
Program Total	**118**	**15 / 118**	

S.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 414, Table 415, Table 416, Table 417, and for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 414: 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.
Refrigerators	60	114.7%	0.5	0.0%
Freezers	7	94.5%	0.5	0.0%
Dehumidifiers	0	0.0%	0.5	0.0%
RACs	1	125.1%	0.5	0.0%
Program Total	**69**	**112.6%**	**0.5**	**0.0%**

Table 415: C&I ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	93	84.9%	0.5	0.0%
Freezers	16	87.6%	0.5	0.0%
Dehumidifiers	0	0.0%	0.5	0.0%
RACs	1	94.7%	0.5	0.0%
Program Total	**110**	**85.4%**	**0.5**	**0.0%**

Table 416: 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.
Refrigerators	17	97.9%	0.5	0.0%
Freezers	3	103.4%	0.5	0.0%
Dehumidifiers	0	0.0%	0.5	0.0%
RACs	0	100.4%	0.5	0.0%
Program Total	**20**	**98.6%**	**0.5**	**0.0%**

Table 417: C&I ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	87	104.4%	0.5	0.0%
Freezers	16	124.4%	0.5	0.0%
Dehumidifiers	0	0.0%	0.5	0.0%
RACs	2	96.0%	0.5	0.0%
Program Total	**104**	**107.2%**	**0.5**	**0.0%**

S.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 418, Table 419, Table 420, and Table 421 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 418: 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.
Refrigerators	0.01	114.7%	0.5	0.0%
Freezers	0.00	94.5%	0.5	0.0%
Dehumidifiers	0.00	0.0%	0.5	0.0%
RACs	0.00	6.1%	0.5	0.0%
Program Total	**0.01**	**89.6%**	**0.5**	**0.0%**

Table 419: C&I ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.01	84.9%	0.5	0.0%
Freezers	0.00	87.6%	0.5	0.0%
Dehumidifiers	0.00	0.0%	0.5	0.0%
RACs	0.00	4.6%	0.5	0.0%
Program Total	**0.01**	**72.3%**	**0.5**	**0.0%**

Table 420: C&I ATI Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.00	97.9%	0.5	0.0%
Freezers	0.00	103.4%	0.5	0.0%
Dehumidifiers	0.00	0.0%	0.5	0.0%
RACs	0.00	4.9%	0.5	0.0%
Program Total	**0.00**	**88.8%**	**0.5**	**0.0%**

Table 421: C&I ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.01	104.4%	0.5	0.0%
Freezers	0.00	124.3%	0.5	0.0%
Dehumidifiers	0.00	0.0%	0.5	0.0%
RACs	0.00	4.7%	0.5	0.0%
Program Total	**0.02**	**81.4%**	**0.5**	**0.0%**

S.2 Net Impact Evaluation

S.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 Turn-In program were taken to be the same as the Net-to-Gross ratios for the Residential Appliance Turn-In program.

Appendix T Evaluation Detail – Commercial and Industrial Direct Install Initiative

T.1 Gross Impact Evaluation

In PY10, there no projects approved in the Commercial and Industrial Direct Install (C&I Direct Install) initiative.

T.2 Net Impact Evaluation

An independent net impact evaluation was not conducted for this initiative because the initiative had no participation.

Appendix U Evaluation Detail – Behavioral Demand Response Initiative

U.1 Data Gathering

Interval meter data dating back to January of 2017 through August of 2017 was requested from FirstEnergy for all treatment and control group participants. A map of customer account numbers to treatment v. control group assignment was provided by Oracle. Furthermore, historical weather data for 2017 was obtained from DegreeDays.net for the Allegheny County Airport.

U.2 Data Preparation

Per the guidance set forth by the Act 129 Evaluation Framework and the 2016 TRM, ADM utilized a post-only model with lagged customer-specific control variables to conduct our analysis. We first isolated the data set into event and baseline data sets to reduce the computing resources necessary to conduct our analysis. Because the treatment effect is isolated at the hourly level per event day, limiting the post-only data to solely the hours of the events has no bearing on the result. The event day data was defined as 2 p.m. to 6 p.m. on the three event days

The experimental cohort for Penn Power began participation in the summer of 2017 (PY9), with AMI data available beginning February of 2017; while the experimental cohorts began participation in the summer of 2018 (PY10), with verified AMI data available beginning January of 2018. Hourly interval meter data dating back to February of 2017 was provided for all control and treatment group customers. Hourly weather data was obtained from the KAGC airport weather station for Penn Power and West Penn Power customers, while Met-Ed utilized weather data from the KRDG weather station. An event-hour indicator was generated with a value of 1 for all hours falling under the event-period and a 0 otherwise.

Baseline control variables were created for all participants in a similar fashion to the three control variables used in the lagged seasonal model. ADM created three customer-specific control variables that represented average energy demand during typical periods of “no cooling,” “medium cooling,” and “high cooling.” Periods of “no cooling” were defined as non-holiday weekday hours between 2 p.m. and 6 p.m. in May of 2017 with a temperature above or equal to 60 degrees Fahrenheit and below 70 degrees. “Medium cooling” was defined similarly to “no cooling” except for referring to periods in which the temperature was equal to or above 70 degrees and below 80 degrees. “High cooling” was defined in the same with the exception to referring to temperatures above 80 degrees.

U.1 Regression Analysis

Similar to the evaluation of the Residential Behavioral Modification subprogram, ADM utilized a post-only model which made use of customer-specific baseline control variables generated in the month immediately prior to the first event day (i.e., May of 2017). ADM restricted the baseline period to the month immediately prior to the first event day as it is believed that most of the demand reduction is due to reductions in cooling load during the event period. Therefore, restricting the baseline period to May of 2017 provides the closest match in temperature available during the pre-treatment period. Furthermore, ADM generated three baseline variables for each customer ("no cooling," "medium cooling," and "high cooling") to capture the variability in each customer's energy demand during periods that can typically be attributed to different levels of cooling demand based on the temperature.

The post-only model is specified in the equation below:

$$kW_{ieh} = \beta_0 + \beta_1 * (NoCooling_i + MediumCooling_i + HighCooling_i) +$$

$$\beta_2 * \text{datetime}_{eh} + \tau_{eh} * \text{datetime}_{eh} * \text{treatment}_i + \varepsilon$$

The variables above are defined in Table 422 below. The regression coefficient of the interaction between the date/time of each event hour and the treatment indicator variable represents the average treatment effect per home for each hour of each event. A negative regression coefficient represents demand savings per household. Multiplying each coefficient by the number of treatment homes represents the total demand savings for each event-hour.

Table 422: Definition of variables in the lagged seasonal regression model.

Variable	Definition
kW_{ieh}	Customer i's energy demand during each event hour.
β_0	Intercept of the regression equation.
β_1	A matrix of regression coefficients representing the impact of the pre-treatment baseline variables on the regression equation.
β_1	A matrix of regression coefficients representing the main effect of time.
$NoCooling_i$	A customer's average baseline usage during periods of no cooling, as defined in the previous section.
$MediumCooling_i$	A customer's average baseline usage during periods of medium cooling, as defined in the previous section.
$HighCooling_i$	A customer's average baseline usage during periods of high cooling, as defined in the previous section.
treatment_i	The treatment indicator variable. Equal to one for the treatment group and zero for the control group.
datetime_{eh}	A matrix of indicator variables representing each hour of each event period.
τ_{eh}	A matrix of regression coefficients representing the treatment effect in each of hour of each event day.
ε	The error term.

Appendix V Report Validation

V.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 423: Report Update Timestamp

Tables and Charts Updated on 11/08/19, at 13:12

BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION

Joint Petition for Approval of Energy	:	
Efficiency and Conservation Plans Phase III of	:	**Docket No. M-2015-2514767**
Metropolitan Edison Company, Pennsylvania	:	**Docket No. M-2015-2514768**
Electric Company, Pennsylvania Power,	:	**Docket No. M-2015-2514769**
Company and West Penn Power Company	:	**Docket No. M-2015-2514772**

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a true copy of the foregoing document upon the parties via First-Class Mail, listed below, in accordance with the requirements of § 1.54 (relating to service by a party).

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