

# **Final Annual Report to the Pennsylvania Public Utility Commission**

**Phase III of Act 129**

**Program Year 11**

**(June 1, 2019 – May 31, 2020)**

For Pennsylvania Act 129 of 2008

Energy Efficiency and Conservation Plan

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For

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## 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
HERS	Home Energy Rating System
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 11 (PY11) 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 PY11. 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).<sup>1</sup> 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 PY11 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, 2020.

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<sup>1</sup> The Pennsylvania TRC Test for Phase I was adopted by PUC order at Docket No. M-2009-2108601 on June 23, 2009 (*2009 PA TRC Test Order*). The TRC Test Order for Phase I 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

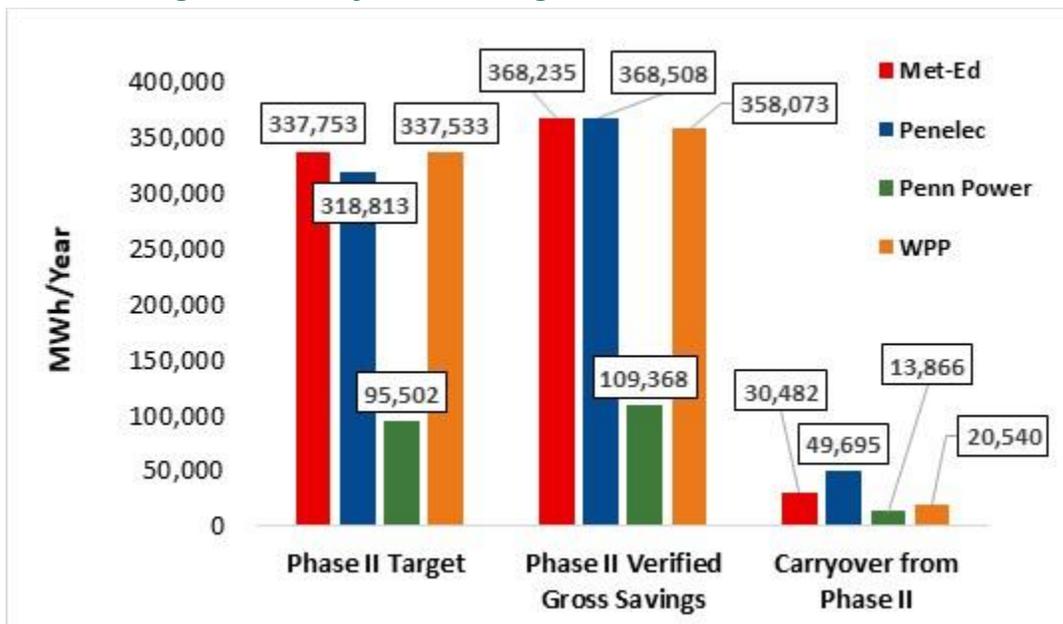
### 2.1 CARRYOVER SAVINGS FROM PHASE II OF ACT 129

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**



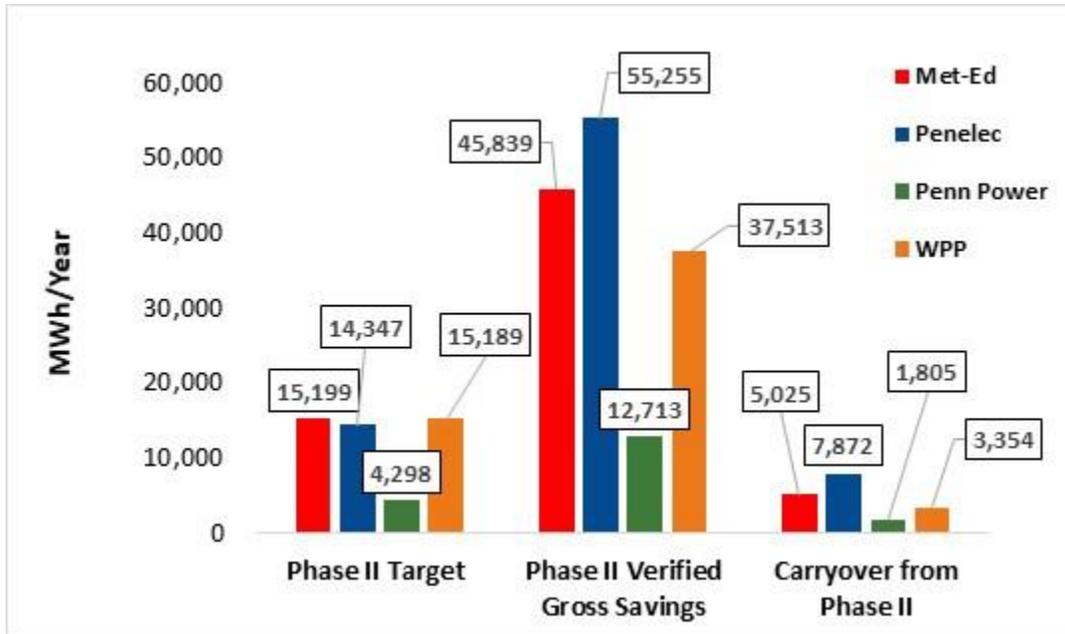
The Commission's Phase III Implementation Order<sup>2</sup> also allowed EDCs to carry over savings in excess of the Phase II Government, Non-Profit, and Institutional (GNI) savings goal and excess savings from the Low-Income (LI) customer segment.<sup>3</sup> Figure 2 shows the calculation of

<sup>2</sup> 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.

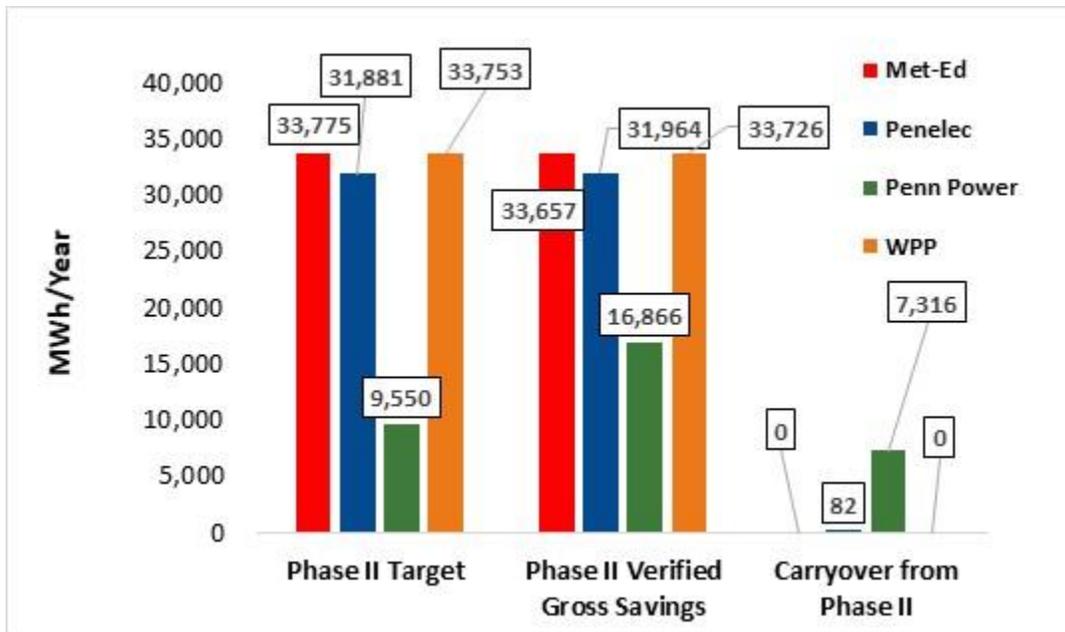
<sup>3</sup> Proportionate to those savings achieved by dedicated low-income programs in Phase III.

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 11 on June 1, 2019, 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 PY11**

EDC	PYRTD MWh	PYRTD MW	PYVTD MWh	PYVTD MW
<b>Met-Ed</b>	142,469	20	143,078	19
<b>Penelec</b>	134,682	17	136,889	16
<b>Penn Power</b>	45,546	6	48,148	7
<b>West Penn Power</b>	132,215	20	132,110	18

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
<b>Met-Ed</b>	601,527	82	643,697	85
<b>Penelec</b>	580,876	73	614,570	73
<b>Penn Power</b>	186,351	25	200,349	27
<b>West Penn Power</b>	576,465	80	604,476	77

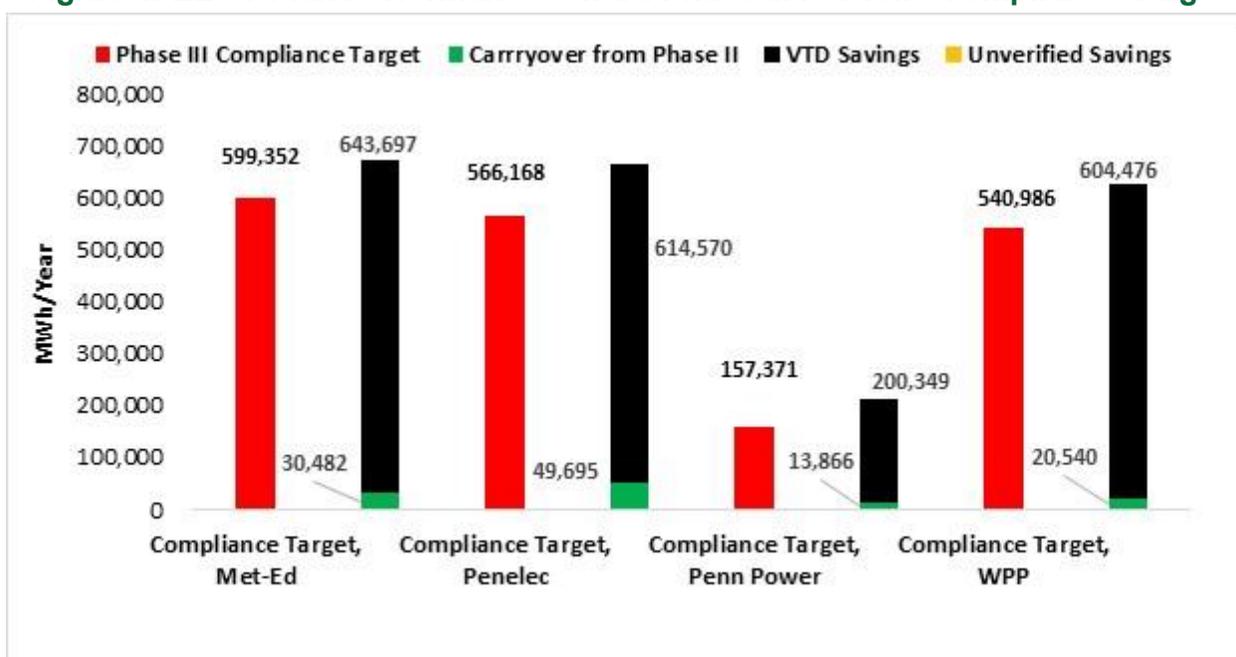
Achievements toward Phase III Energy Savings compliance, including carryover savings from Phase II, are shown in Table 4 below for the four PA EDCs.

**Table 4: Phase III Electric Savings including Phase II Carryover**

EDC	VTD +CO MWh	Compliance Target	Percent of Target to Date
<b>Met-Ed</b>	674,179	599,352	112%
<b>Penelec</b>	664,265	566,168	117%
<b>Penn Power</b>	214,215	157,371	136%
<b>West Penn Power</b>	625,016	540,986	116%

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%

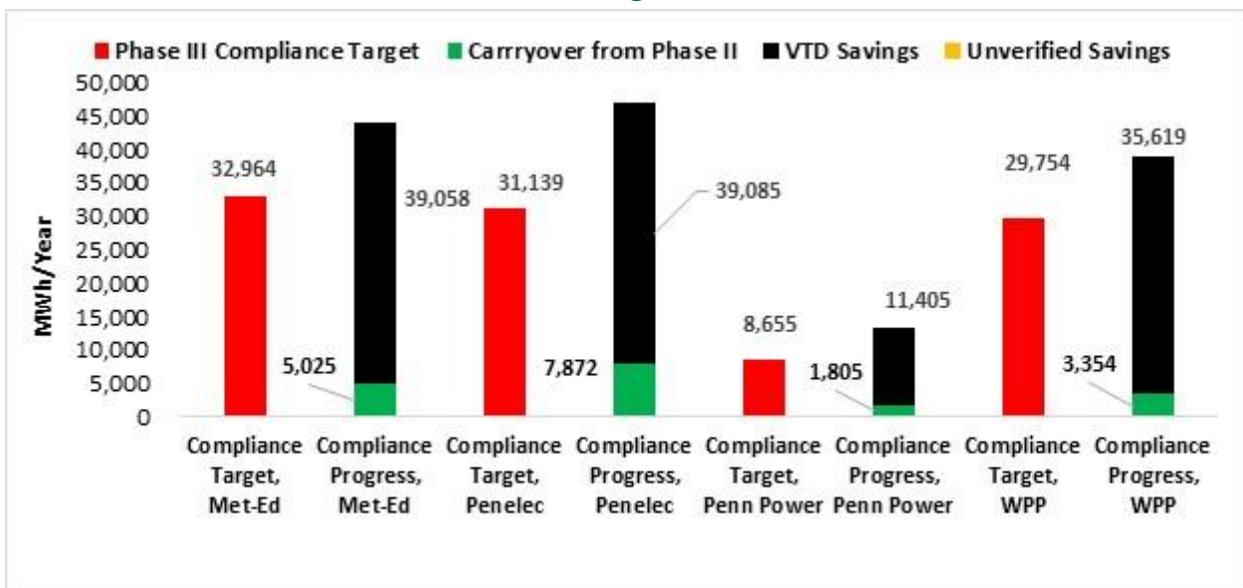
The PA PUC also established a low-income energy savings target of 5.5% of the portfolio savings goal. The second column of Table 6 shows the low-income savings targets, based on verified gross savings, for each EDC. The third column of the table shows the verified low-income impacts, inclusive of Phase 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
<b>Met-Ed</b>	32,964	44,083	134%
<b>Penelec</b>	31,139	46,957	151%
<b>Penn Power</b>	8,655	13,210	153%
<b>West Penn Power</b>	29,754	38,973	131%

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**



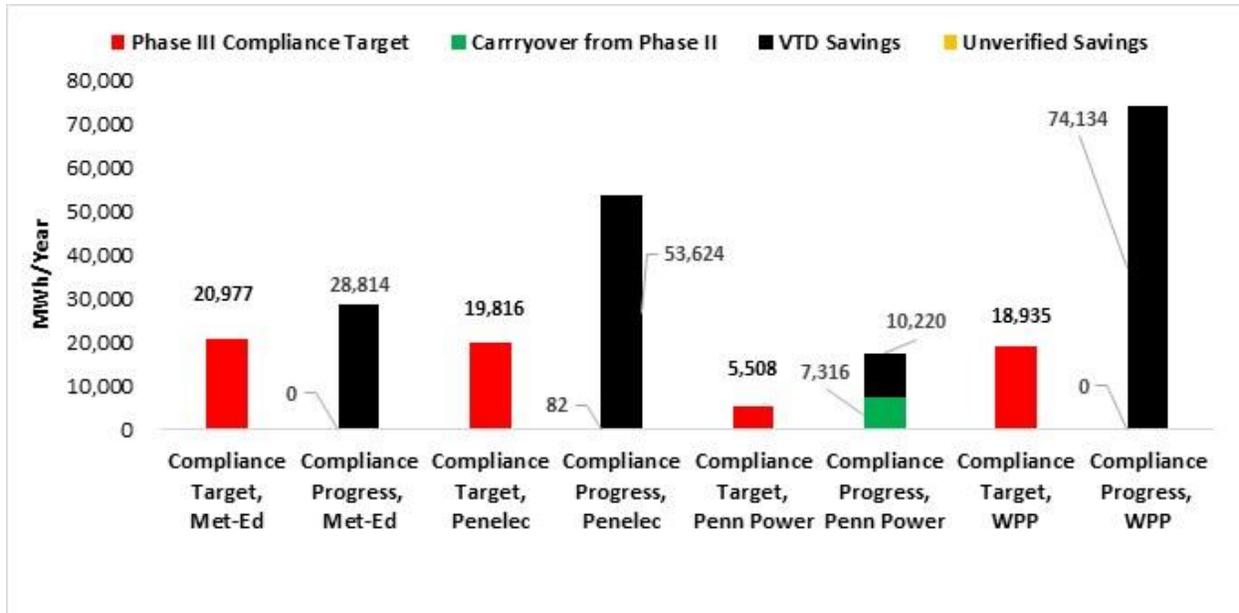
The Phase III Implementation Order established a GNI energy savings target of 3.5% of the portfolio savings goal. The second column of Table 7 shows the GNI savings targets, based on verified gross savings, for each EDC. The third column of the table shows the verified GNI impacts, inclusive of Phase 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
<b>Met-Ed</b>	20,977	28,814	137%
<b>Penelec</b>	19,816	53,706	271%
<b>Penn Power</b>	5,508	17,536	318%
<b>West Penn Power</b>	18,935	74,134	392%

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 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.

Compliance targets were initially established based on average performance across events for the entire Phase III, beginning with PY9 through PY12, and subsequently reclassified by Commission Order approving the Energy Association of Pennsylvania's (EAP) Petition to Amend the Commission's June 19, 2015 Implementation Order at Docket No. M-2014-2424864 to be the average across all events for PY9 through PY11 with DR programs operating on a voluntary basis during PY12. As a result of the Commission's Order reclassifying the DR target compliance period, the Companies' PYTD results can be considered final Phase III DR results for the SWE to recognize the Companies have exceeded the required DR MW program targets. Also, PY12 DR final results will be reported next year which will reflect much lower results for ME and PP as a result of COVID-19 impacts to participating DR customers and the relief granted to the EDCs, CSPs and customers by the Commission granting approval of EAP's Petition.

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 PY11, there were 4 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 PY11. Table 8 also lists the average DR performance for PY11 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 12% above, 182% above, and 99% 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 8% above, 134% above, and 76% 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 51.4 – 54.7 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 31.7 – 48.0 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 97.2 – 127.6 MW confidence interval of the measurement exceeds the 64.0 MW target.

**Table 8: PY11 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	7/17/2019	15	18	1.5 ± 0.2	50.0 ± 3.0	12.6 ± 3.1	64.1 ± 4.3	
	7/18/2019	16	19	1.7 ± 0.2	40.1 ± 3.1	7.2 ± 2.9	49.0 ± 4.3	
	7/19/2019	15	18	1.4 ± 0.2	44.2 ± 3.0	11.0 ± 3.2	56.5 ± 4.4	
	8/19/2019	15	18	1.4 ± 0.2	48.8 ± 2.9	7.7 ± 3.0	58.0 ± 4.2	
	<b>PYVTD - Average PY11 DR Event Performance</b>							56.9 ± 2.0
	<b>VTD - Average Phase III DR Event Performance</b>							<b>53.0 ± 1.6</b>
Penn Power	7/17/2019	15	18	0.0 ± 0.0	15.4 ± 10.3	1.4 ± 0.8	16.8 ± 10.3	
	7/18/2019	16	19	0.0 ± 0.0	38.6 ± 19.1	2.0 ± 0.9	40.7 ± 19.1	
	7/19/2019	15	18	0.0 ± 0.0	31.0 ± 22.0	2.3 ± 0.9	33.3 ± 22.1	
	8/19/2019	15	18	0.0 ± 0.0	48.6 ± 25.5	1.4 ± 0.9	50.0 ± 25.5	
	<b>PYVTD - Average PY11 DR Event Performance</b>							35.2 ± 11.0
	<b>VTD - Average Phase III DR Event Performance</b>							<b>39.9 ± 8.1</b>
West Penn Power	7/17/2019	15	18	0.7 ± 0.1	88.2 ± 38.8	3.4 ± 1.4	92.3 ± 38.8	
	7/18/2019	16	19	1.0 ± 0.1	124.4 ± 41.1	3.0 ± 1.5	128.4 ± 41.1	
	7/19/2019	15	18	1.0 ± 0.1	93.5 ± 36.0	3.6 ± 1.5	98.0 ± 36.0	
	8/19/2019	15	18	0.8 ± 0.1	62.2 ± 20.8	2.7 ± 1.5	65.7 ± 20.9	
	<b>PYVTD - Average PY11 DR Event Performance</b>							96.1 ± 28.9
	<b>VTD - Average Phase III DR Event Performance</b>							<b>112.4 ± 15.2</b>

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 PY11 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

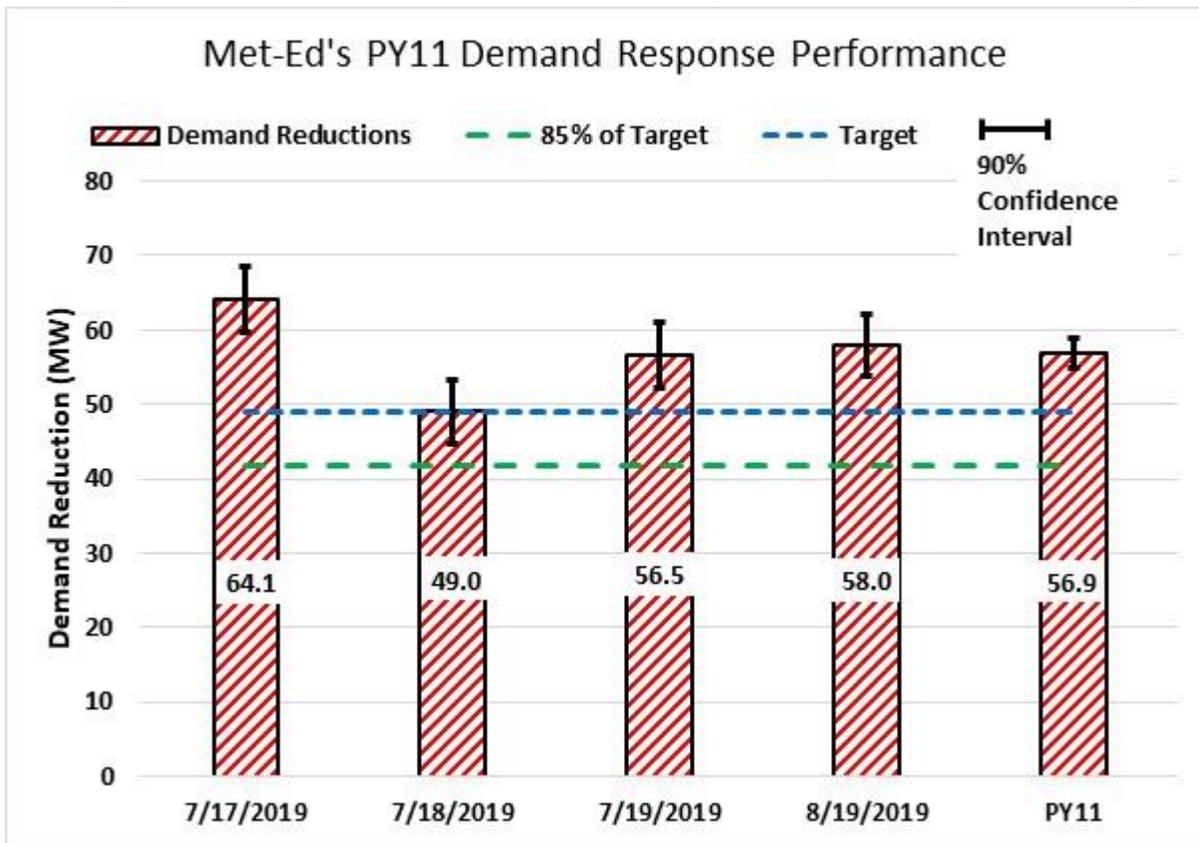


Figure 8: Penn Power Event Performance Compared to 85% Per-Event Target

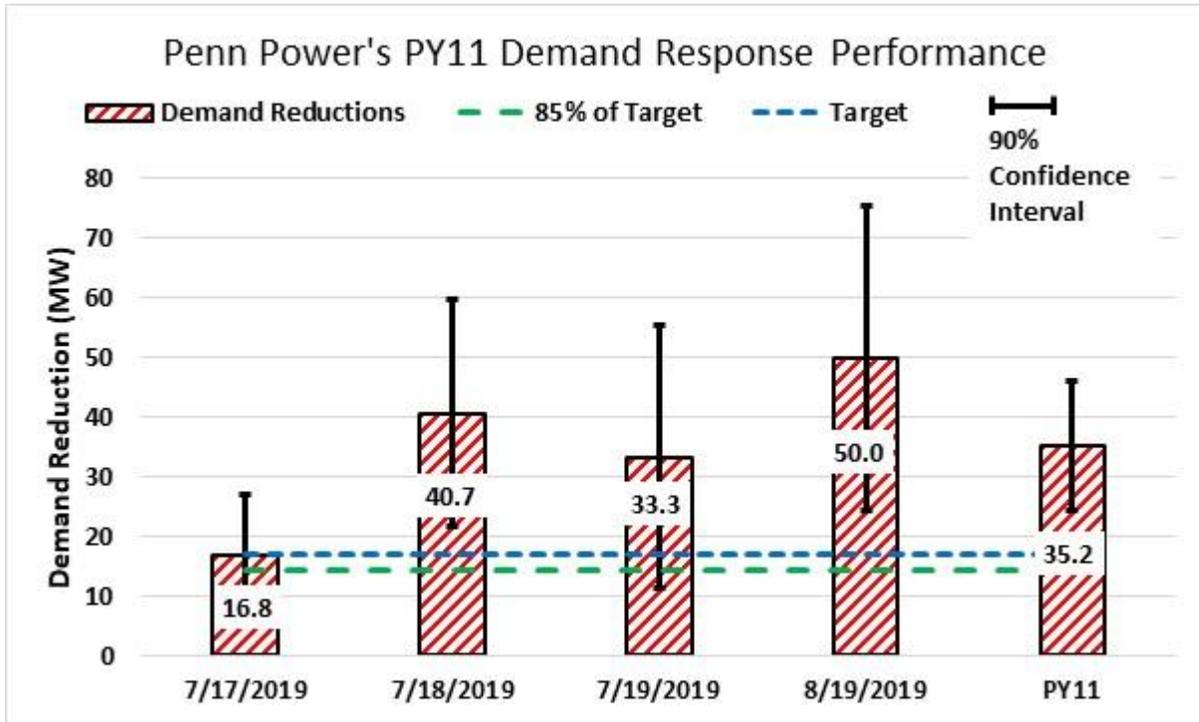
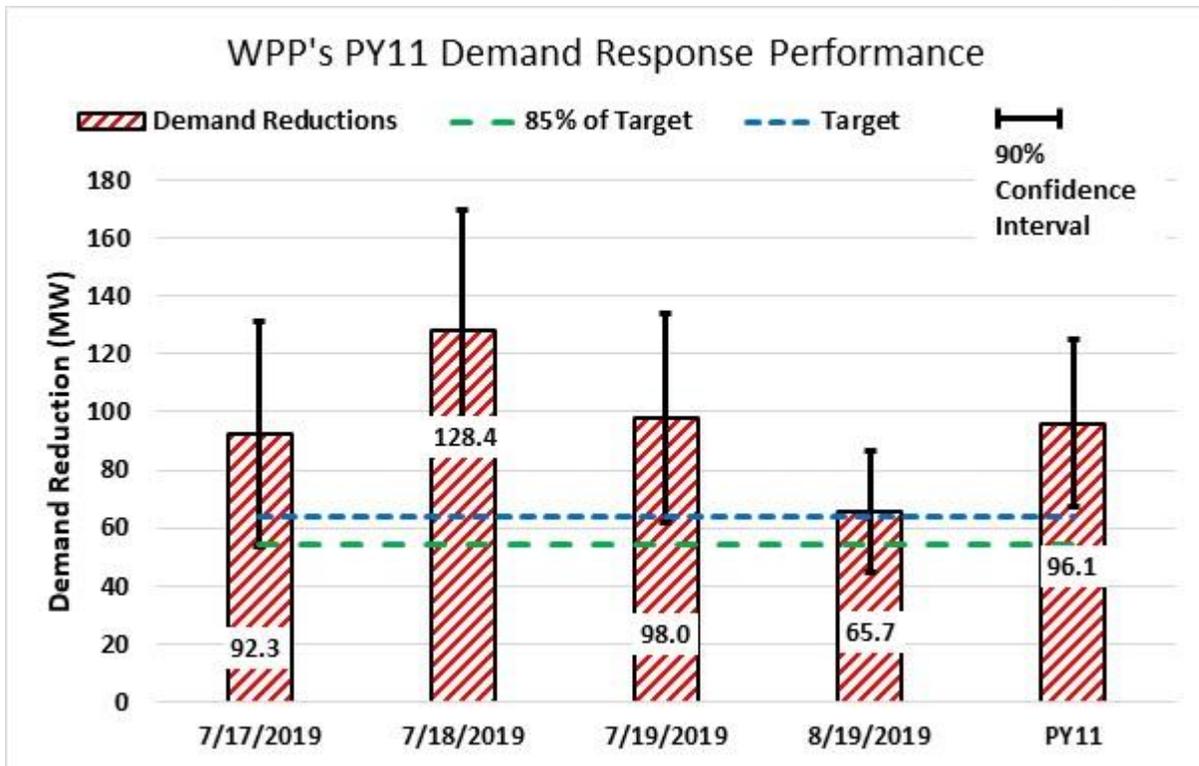


Figure 9: WPP Event Performance Compared to 85% Per-Event Target



## 2.4 PHASE III PERFORMANCE BY CUSTOMER SEGMENT

Table 9 presents the participation, savings, and spending by customer sector for PY11. The residential, Small C&I, and Large C&I sectors are defined by EDC tariff and the residential low-income and governmental/educational/non-profit sector were defined by statute (66 Pa. C.S. § 2806.1). The residential low-income segment is a subset of the residential customer class and the GNI segment will include customers who are part of the Small C&I or Large C&I rate 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 PY11 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 11 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	668,045	13,030	15,004	202	9,050
	PY11 Energy Realization Rate	101%	114%	101%	95%	111%
	PYVTD MWh/yr	75,755	4,159	22,515	33,917	6,732
	PY11 Demand Realization Rate	91%	95%	101%	92%	118%
	PYVTD MW (Energy Efficiency)	9.64	0.49	3.38	4.48	1.23
	PYVTD MW (Demand Response)	9.62	0.00	1.18	41.67	4.42
	Incentives (\$1000)	\$4,069.75	\$74.57	\$993.38	\$2,164.16	\$278.48
Penelec	# participants	473,647	17,553	14,713	107	8,832
	PY11 Energy Realization Rate	98%	111%	107%	101%	111%
	PYVTD MWh/yr	65,715	3,942	25,284	32,267	9,679
	PY11 Demand Realization Rate	92%	100%	109%	96%	119%
	PYVTD MW (Energy Efficiency)	7.32	0.43	3.54	3.72	1.35
	PYVTD MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$3,412.36	\$142.88	\$1,090.81	\$1,554.29	\$410.42
Penn Power	# participants	171,929	3,518	5,594	26	3,311
	PY11 Energy Realization Rate	106%	103%	105%	102%	129%
	PYVTD MWh/yr	23,121	1,114	16,751	5,230	1,932
	PY11 Demand Realization Rate	99%	86%	108%	101%	154%
	PYVTD MW (Energy Efficiency)	3.22	0.13	2.25	0.59	0.33
	PYVTD MW (Demand Response)	1.78	0.00	0.00	33.36	0.07
	Incentives (\$1000)	\$899.93	\$14.75	\$730.23	\$426.96	\$65.46
West Penn Power	# participants	545,081	15,821	15,648	110	9,339
	PY11 Energy Realization Rate	96%	99%	106%	99%	109%
	PYVTD MWh/yr	64,669	3,800	30,227	21,745	11,669
	PY11 Demand Realization Rate	81%	77%	114%	106%	119%
	PYVTD MW (Energy Efficiency)	8.66	0.44	4.49	3.13	1.62
	PYVTD MW (Demand Response)	3.14	0.00	0.83	91.78	0.36
	Incentives (\$1000)	\$2,704.03	\$64.22	\$1,368.52	\$1,806.50	\$477.61

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	1,757,231	48,532	81,552	697	24,239
	P3TD Energy Realization Rate	110%	114%	105%	98%	108%
	VTD MWh/yr	350,041	39,058	102,940	122,844	28,814
	P3TD Demand Realization Rate	101%	107%	112%	98%	112%
	VTD MW (Energy Efficiency)	43.26	4.52	16.26	16.21	4.48
	VTD MW (Demand Response)	5.82	0.00	1.28	37.92	8.02
	Incentives (\$1000)	\$20,830.06	\$427.26	\$5,036.10	\$6,491.33	\$1,408.50
Penelec	# participants	1,517,815	54,605	82,305	476	23,862
	P3TD Energy Realization Rate	110%	111%	106%	97%	101%
	VTD MWh/yr	310,542	39,085	97,757	113,561	53,624
	P3TD Demand Realization Rate	100%	102%	111%	93%	99%
	VTD MW (Energy Efficiency)	34.34	4.19	14.86	13.41	6.68
	VTD MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$6,141.82	\$148.74	\$2,654.86	\$2,457.15	\$511.10
Penn Power	# participants	417,147	15,581	23,211	135	7,828
	P3TD Energy Realization Rate	113%	104%	103%	98%	108%
	VTD MWh/yr	100,952	11,405	50,763	27,009	10,220
	P3TD Demand Realization Rate	106%	96%	108%	95%	124%
	VTD MW (Energy Efficiency)	13.44	1.33	7.51	3.08	1.29
	VTD MW (Demand Response)	2.03	0.00	-0.01	37.58	0.24
	Incentives (\$1000)	\$6,141.82	\$148.74	\$2,654.86	\$2,457.15	\$511.10
West Penn Power	# participants	1,436,279	43,908	78,621	432	23,230
	P3TD Energy Realization Rate	105%	106%	108%	99%	105%
	VTD MWh/yr	315,744	35,619	107,148	71,830	74,134
	P3TD Demand Realization Rate	91%	93%	114%	96%	104%
	VTD MW (Energy Efficiency)	41.27	4.19	15.73	8.83	7.07
	VTD MW (Demand Response)	2.38	0.00	1.43	108.57	0.02
	Incentives (\$1000)	\$17,303.65	\$344.54	\$5,729.60	\$7,160.79	\$3,801.76

## 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 PY11 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	3,319	17,088
	Energy Efficient Homes	345,226	413,311
	Energy Efficient Products	342,988	1,430,288
	Low Income Energy Efficiency	13,030	48,532
	C&I Energy Solutions for Business - Small	432	1,778
	C&I Demand Response - Small	45	139
	C&I Energy Solutions for Business - Large	174	719
	C&I Demand Response - Large	104	247
	Governmental & Institutional Tariff	13	148
	Portfolio Total	705,331	1,912,250
Penelec	Appliance Turn-in	2,881	15,004
	Energy Efficient Homes	166,330	226,991
	Energy Efficient Products	327,150	1,378,026
	Low Income Energy Efficiency	17,553	54,605
	C&I Energy Solutions for Business - Small	707	3,003
	C&I Demand Response - Small	0	0
	C&I Energy Solutions for Business - Large	140	642
	C&I Demand Response - Large	0	0
	Governmental & Institutional Tariff	91	792
	Portfolio Total	514,852	1,679,063
Penn Power	Appliance Turn-in	745	5,081
	Energy Efficient Homes	52,885	23,305
	Energy Efficient Products	126,929	418,306
	Low Income Energy Efficiency	3,518	15,581
	C&I Energy Solutions for Business - Small	265	1,196
	C&I Demand Response - Small	0	3
	C&I Energy Solutions for Business - Large	26	137
	C&I Demand Response - Large	9	24
	Governmental & Institutional Tariff	1	269
	Portfolio Total	184,378	463,902
West Penn Power	Appliance Turn-in	3,535	19,377
	Energy Efficient Homes	209,899	121,755
	Energy Efficient Products	355,744	1,393,148
	Low Income Energy Efficiency	15,821	43,908
	C&I Energy Solutions for Business - Small	765	2,857
	C&I Demand Response - Small	15	48
	C&I Energy Solutions for Business - Large	103	463
	C&I Demand Response - Large	32	79
	Governmental & Institutional Tariff	84	836
	Portfolio Total	585,998	1,582,471

## 2.6 SUMMARY OF IMPACT EVALUATION RESULTS

During PY11 the ADM Tetra Tech team completed gross impact evaluations for all the energy efficiency programs in the portfolio, and net impact evaluations for two 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	99.9%	97.0%	45.0%	97.8%	98.2%	47.0%
Energy Efficient Homes	94.6%	80.8%	92.8%	87.8%	79.2%	90.9%
Energy Efficient Products	116.8%	121.7%	31.3%	114.1%	121.3%	33.0%
Low Income Program	113.3%	93.8%	100.0%	109.9%	98.7%	100.0%
C&I Solutions for Business Program - Small	93.6%	87.8%	62.9%	101.2%	95.4%	78.0%
C&I Solutions for Business Program - Large	95.0%	92.3%	60.4%	101.2%	96.1%	79.7%
Government and Insitutional Tariff Program	92.9%	86.8%	63.5%	101.2%	93.9%	76.8%

**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	96.8%	95.5%	51.0%	99.4%	99.3%	48.0%
Energy Efficient Homes	104.0%	84.6%	96.5%	78.6%	55.6%	97.9%
Energy Efficient Products	113.7%	123.8%	28.0%	114.9%	117.7%	26.3%
Low Income Program	100.2%	83.6%	100.0%	95.6%	73.8%	100.0%
C&I Solutions for Business Program - Small	100.7%	99.1%	77.2%	99.9%	101.5%	63.4%
C&I Solutions for Business Program - Large	101.5%	100.8%	71.9%	98.8%	104.3%	64.7%
Government and Insitutional Tariff Program	100.4%	98.6%	79.5%	97.6%	112.6%	66.0%

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 and PY10. No HIMs were evaluated for net-to-gross in PY11. Table 14 and Table 15 present net-to-gross findings for HIMs studied in PY8, PY9, and PY10, as applied to the PY11 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	21.1%	3.1%	82.0%	20.2%	3.3%	83.1%
C&I Lighting	37.2%	0.7%	63.6%	25.8%	3.3%	77.5%
C&I Custom	44.6%	0.0%	55.4%	16.7%	0.4%	83.6%

**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	22.1%	4.8%	82.6%	21.1%	15.4%	94.2%
C&I Lighting	21.3%	0.8%	79.5%	34.4%	0.4%	66.1%
C&I Custom	47.5%	0.0%	52.5%	44.1%	0.0%	55.9%

## 2.7 SUMMARY OF ENERGY IMPACTS BY PROGRAM

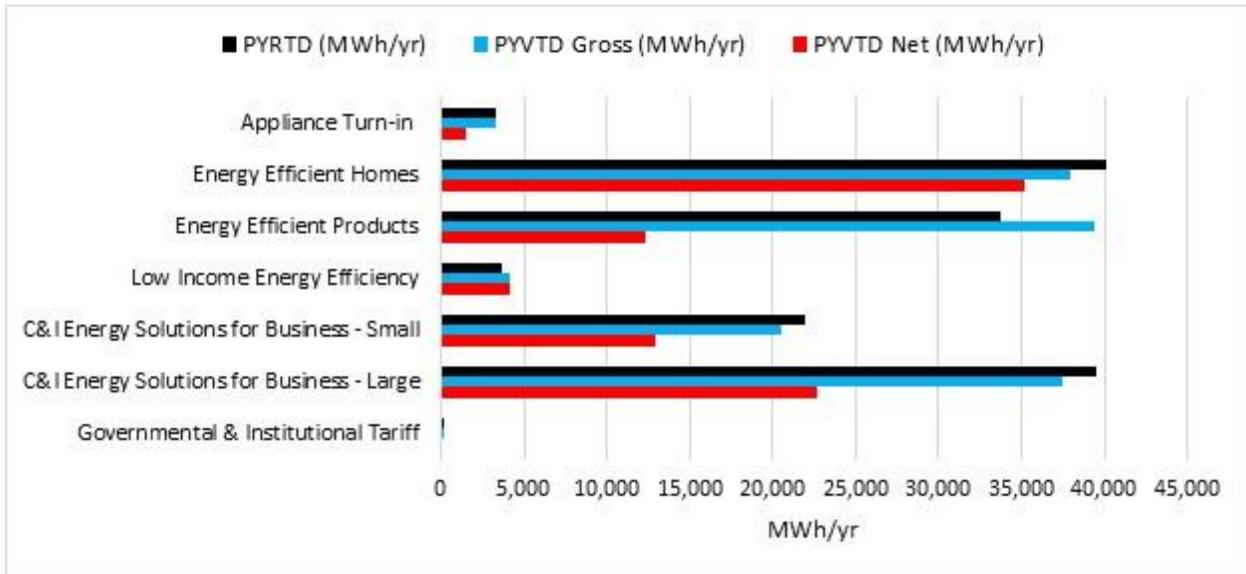
Act 129 compliance targets are based on annualized savings estimates (MWh/year). Each program year, the annual savings achieved by EE&C program activity are recorded as incremental annual, or “first-year”, savings and added to an EDC’s progress toward compliance. Incremental annual savings estimates 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

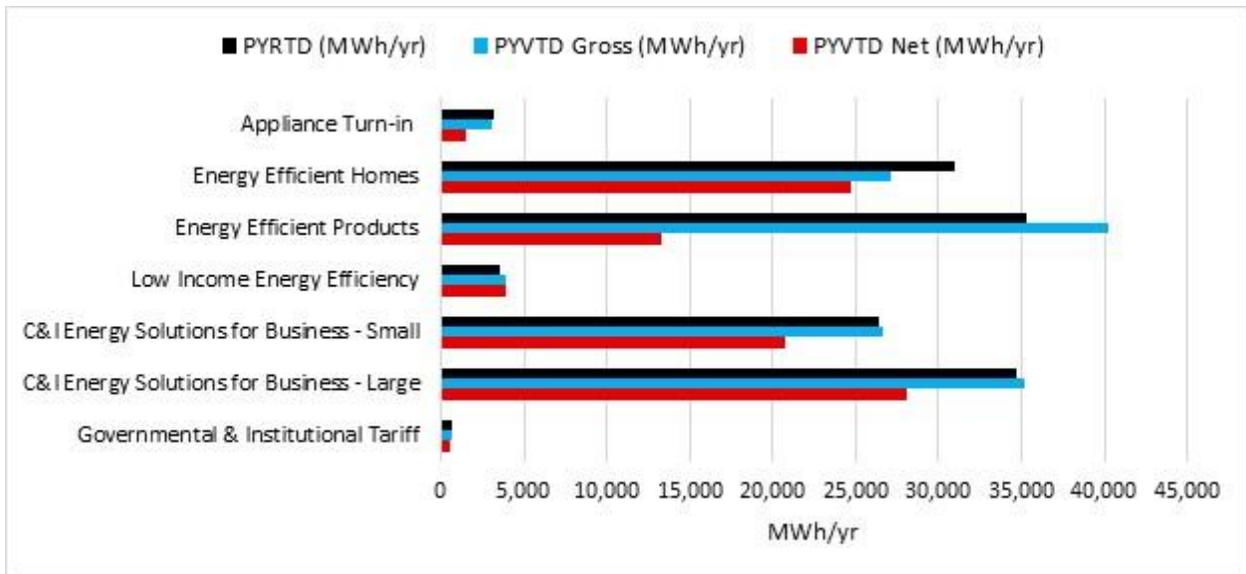
Figure 10, Figure 11, Figure 12, and Figure 13 present summaries of the PYTD energy savings by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Program Year 11. The

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.

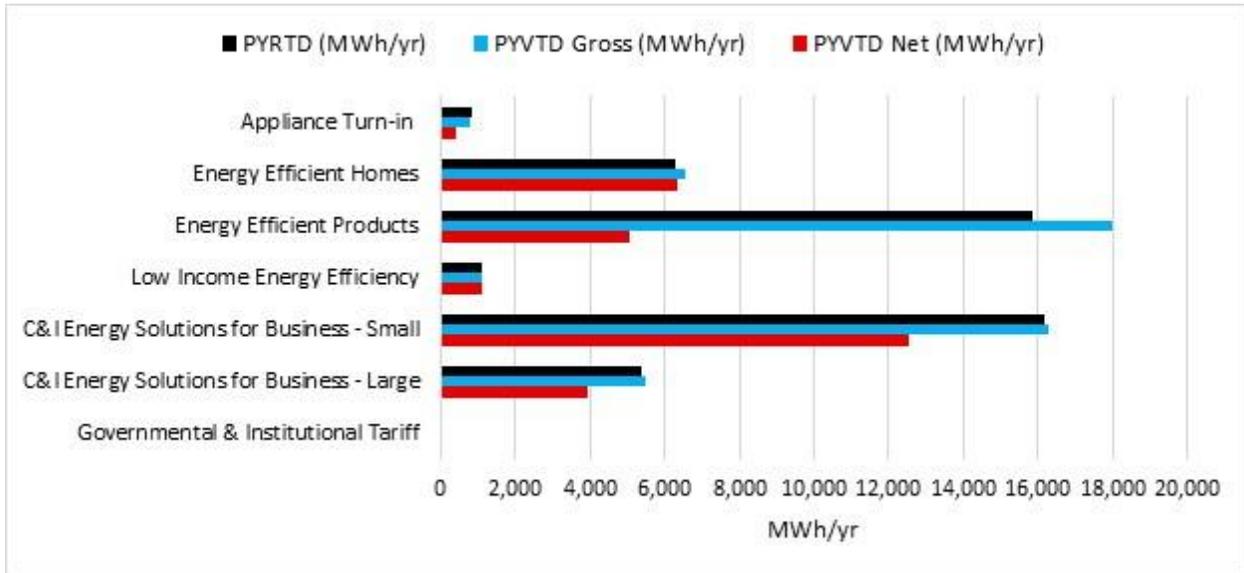
**Figure 10: PYTD Energy Savings by Program for Met-Ed**



**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**

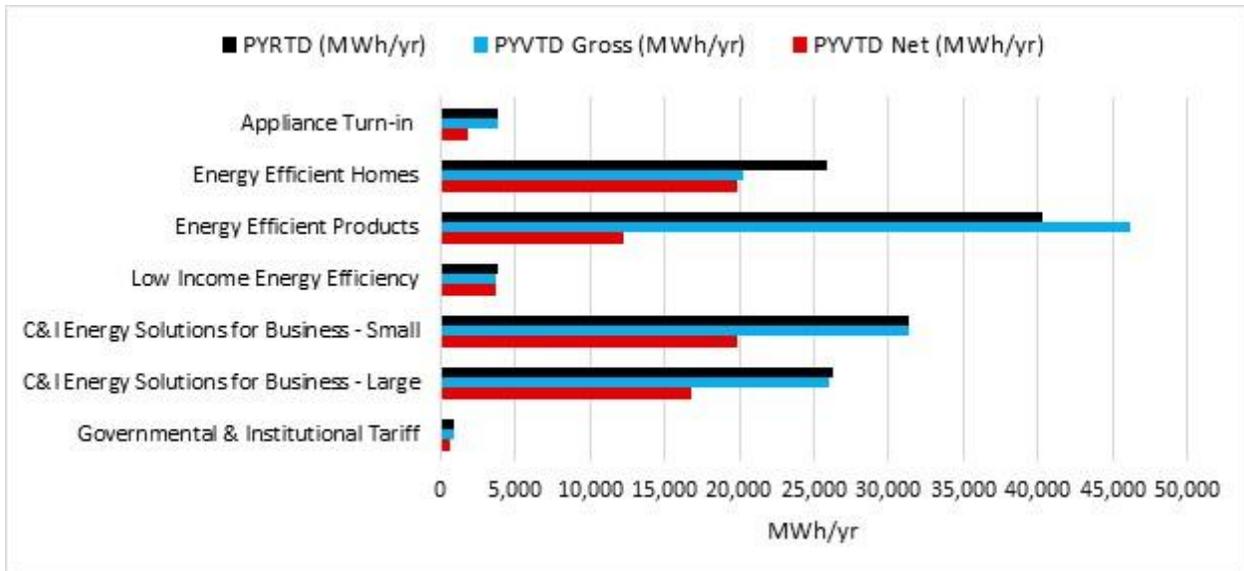
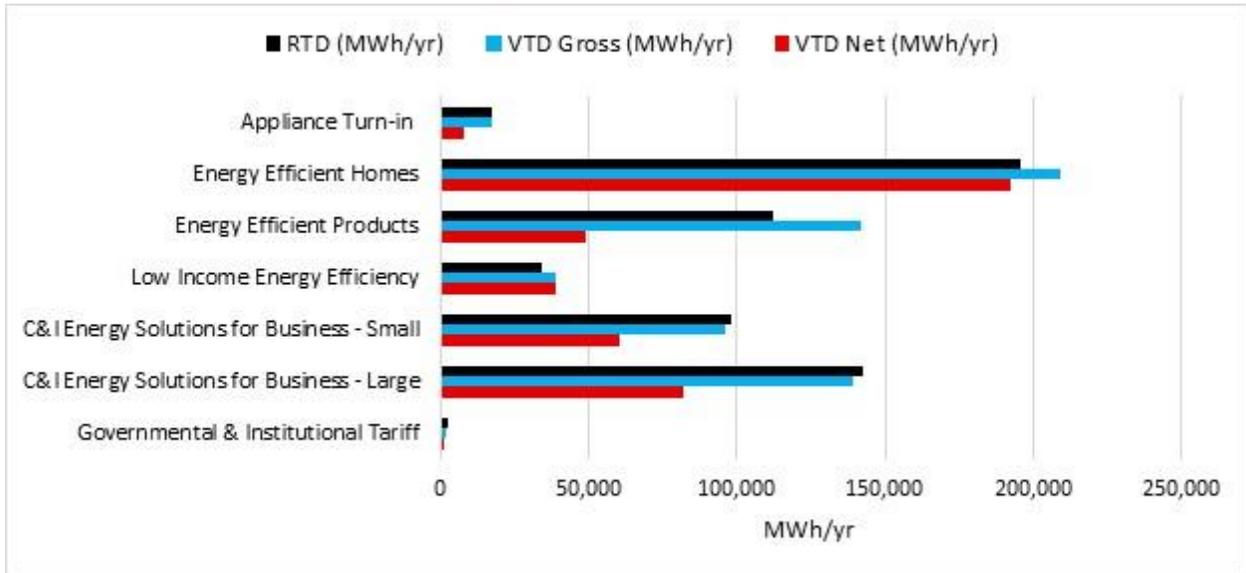
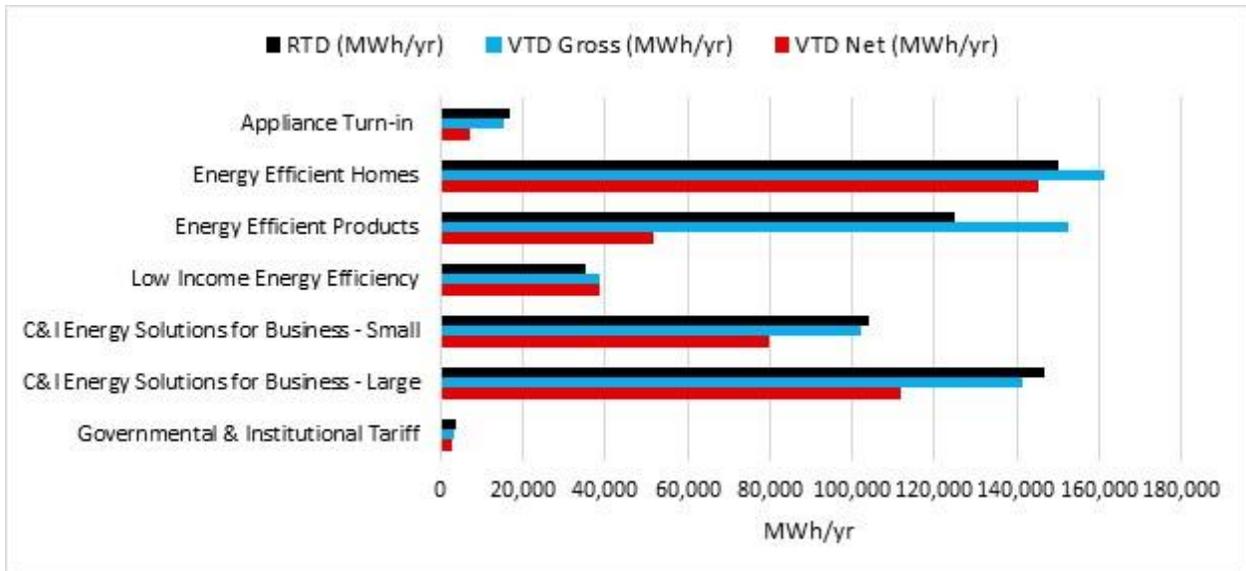


Figure 14, Figure 15, Figure 16, and Figure 17 present summaries of the energy savings by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Phase III of Act 129.

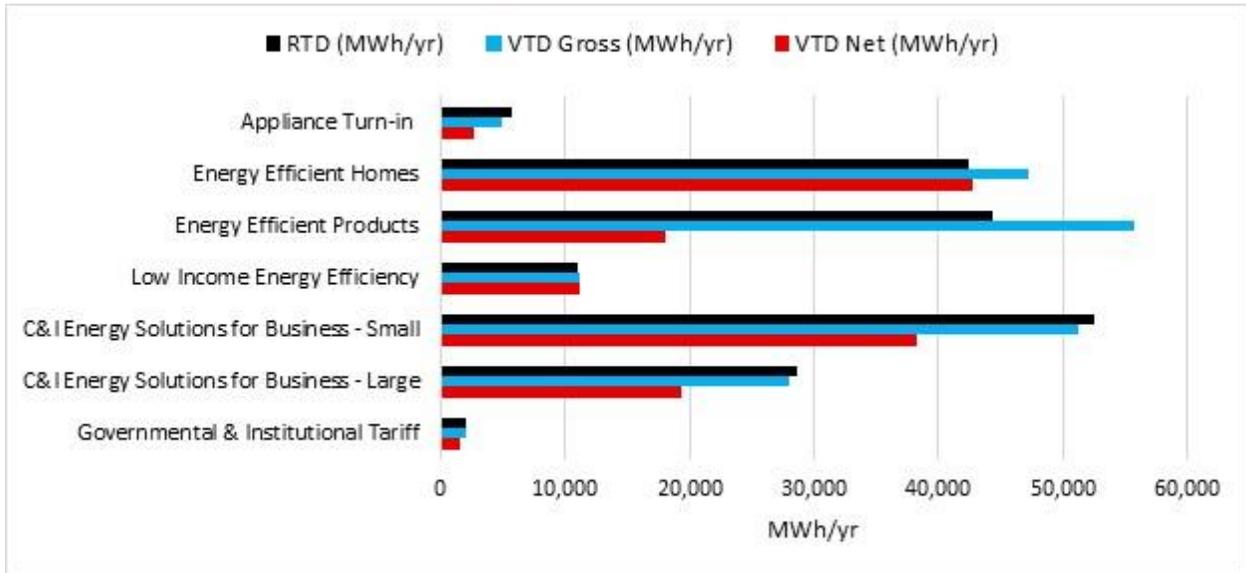
**Figure 14: P3TD Energy Savings by Program for Met-Ed**



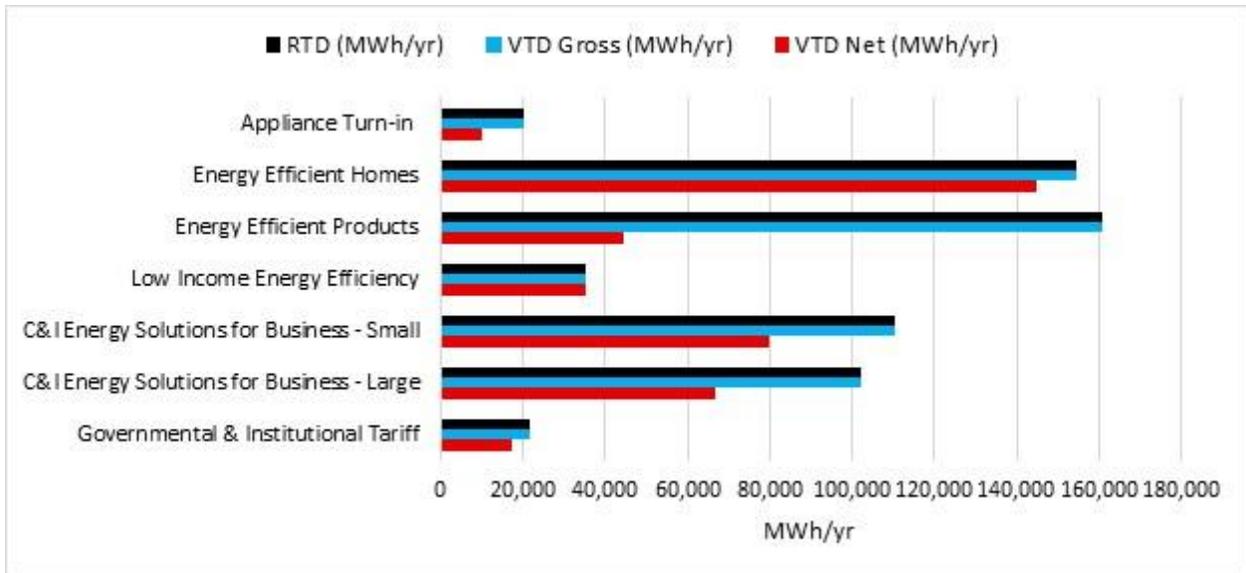
**Figure 15: P3TD Energy Savings by Program for Penelec**



**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 PY11 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	3,350	3,347	1,506	17,208	16,909	7,994
Energy Efficient Homes	40,059	37,908	35,193	195,412	209,079	192,163
Energy Efficient Products	33,766	39,431	12,337	112,368	142,030	48,679
Low Income Energy Efficiency	3,638	4,121	4,121	34,119	38,875	38,875
C&I Energy Solutions for Business - Small	21,973	20,557	12,925	98,131	95,836	60,109
C&I Energy Solutions for Business - Large	39,482	37,526	22,656	142,226	138,949	81,698
Governmental & Institutional Tariff	202	188	119	2,061	2,020	1,292
<b>Portfolio Total</b>	<b>142,469</b>	<b>143,078</b>	<b>88,857</b>	<b>601,527</b>	<b>643,697</b>	<b>430,809</b>

**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	3,183	3,113	1,463	16,514	15,498	7,062
Energy Efficient Homes	30,967	27,179	24,718	150,120	161,292	145,249
Energy Efficient Products	35,263	40,245	13,263	125,077	152,388	51,458
Low Income Energy Efficiency	3,540	3,892	3,892	35,144	38,730	38,730
C&I Energy Solutions for Business - Small	26,348	26,663	20,804	104,101	102,029	79,688
C&I Energy Solutions for Business - Large	34,757	35,166	28,029	146,493	141,341	111,824
Governmental & Institutional Tariff	623	630	484	3,427	3,291	2,648
<b>Portfolio Total</b>	<b>134,682</b>	<b>136,889</b>	<b>92,653</b>	<b>580,876</b>	<b>614,570</b>	<b>436,660</b>

**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	815	789	402	5,635	4,890	2,583
Energy Efficient Homes	6,289	6,540	6,310	42,351	47,279	42,790
Energy Efficient Products	15,828	18,003	5,037	44,302	55,727	18,095
Low Income Energy Efficiency	1,087	1,089	1,089	11,000	11,199	11,199
C&I Energy Solutions for Business - Small	16,149	16,267	12,556	52,452	51,260	38,303
C&I Energy Solutions for Business - Large	5,376	5,459	3,926	28,576	28,046	19,352
Governmental & Institutional Tariff	2	2	2	2,034	1,948	1,464
<b>Portfolio Total</b>	<b>45,546</b>	<b>48,148</b>	<b>29,321</b>	<b>186,351</b>	<b>200,349</b>	<b>133,785</b>

**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	3,787	3,765	1,807	20,737	20,188	9,728
Energy Efficient Homes	25,842	20,312	19,880	159,022	154,402	144,973
Energy Efficient Products	40,255	46,239	12,175	130,150	160,723	44,219
Low Income Energy Efficiency	3,829	3,660	3,660	33,719	35,042	35,042
C&I Energy Solutions for Business - Small	31,387	31,342	19,859	108,748	110,299	79,808
C&I Energy Solutions for Business - Large	26,250	25,948	16,778	103,622	102,199	66,847
Governmental & Institutional Tariff	865	844	558	20,467	21,623	17,130
<b>Portfolio Total</b>	<b>132,215</b>	<b>132,110</b>	<b>74,717</b>	<b>576,465</b>	<b>604,476</b>	<b>397,747</b>

The previously reported VTD savings from prior years have not changed since the prior final annual report was submitted:

### 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<sup>4</sup>, 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<sup>5</sup>. To develop the modified measured lives, we used the adjusted EUL calculator provided by SWE along with the related guidance memo issued August 11, 2020. The modified measure life is the product of the original measure life and the ratio of the net-present value of delta-Watt-years for the dual-baseline stream to a single-baseline stream.

<sup>4</sup> For example, a project may consist of various measures with different lifetimes can have different realization rates by measure.

<sup>5</sup> See also comments in Section 2.10.

**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	26,124	11,756	100,677	46,739
Energy Efficient Homes	107,029	89,686	570,730	477,125
Energy Efficient Products	167,062	58,929	659,187	234,804
Low Income Energy Efficiency	15,571	15,571	152,091	152,091
C&I Energy Solutions for Business - Small	302,102	190,076	1,390,402	873,550
C&I Energy Solutions for Business - Large	549,395	332,085	2,012,365	1,185,834
Governmental & Institutional Tariff	2,779	1,765	29,529	18,892
<b>Portfolio Total</b>	<b>1,170,063</b>	<b>699,868</b>	<b>4,914,981</b>	<b>2,989,036</b>

**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	24,256	11,401	94,783	43,869
Energy Efficient Homes	81,357	69,478	505,319	426,744
Energy Efficient Products	166,147	61,310	664,208	236,255
Low Income Energy Efficiency	21,605	21,605	167,312	167,312
C&I Energy Solutions for Business - Small	391,585	305,637	1,490,207	1,168,433
C&I Energy Solutions for Business - Large	517,583	412,445	2,057,079	1,633,179
Governmental & Institutional Tariff	9,316	7,162	48,649	39,162
<b>Portfolio Total</b>	<b>1,211,849</b>	<b>889,037</b>	<b>5,027,557</b>	<b>3,714,955</b>

**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	6,201	3,163	30,423	16,286
Energy Efficient Homes	17,857	14,624	149,365	121,388
Energy Efficient Products	69,406	21,881	272,288	92,100
Low Income Energy Efficiency	4,983	4,983	50,692	50,692
C&I Energy Solutions for Business - Small	238,583	184,531	756,045	566,781
C&I Energy Solutions for Business - Large	79,327	57,305	408,795	283,901
Governmental & Institutional Tariff	34	27	29,025	21,823
<b>Portfolio Total</b>	<b>416,391</b>	<b>286,515</b>	<b>1,696,632</b>	<b>1,152,971</b>

**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	29,497	14,158	122,788	60,312
Energy Efficient Homes	44,326	38,282	367,765	309,048
Energy Efficient Products	193,169	62,143	686,953	211,467
Low Income Energy Efficiency	18,475	18,475	140,561	140,561
C&I Energy Solutions for Business - Small	463,048	293,909	1,628,520	1,180,999
C&I Energy Solutions for Business - Large	385,457	249,413	1,503,842	986,218
Governmental & Institutional Tariff	12,584	8,313	322,381	255,356
<b>Portfolio Total</b>	<b>1,146,555</b>	<b>684,693</b>	<b>4,772,809</b>	<b>3,143,961</b>

The previously reported VTD lifetime savings from prior years have not changed since the prior final annual report was submitted.

## 2.8 SUMMARY OF DEMAND IMPACTS BY PROGRAM

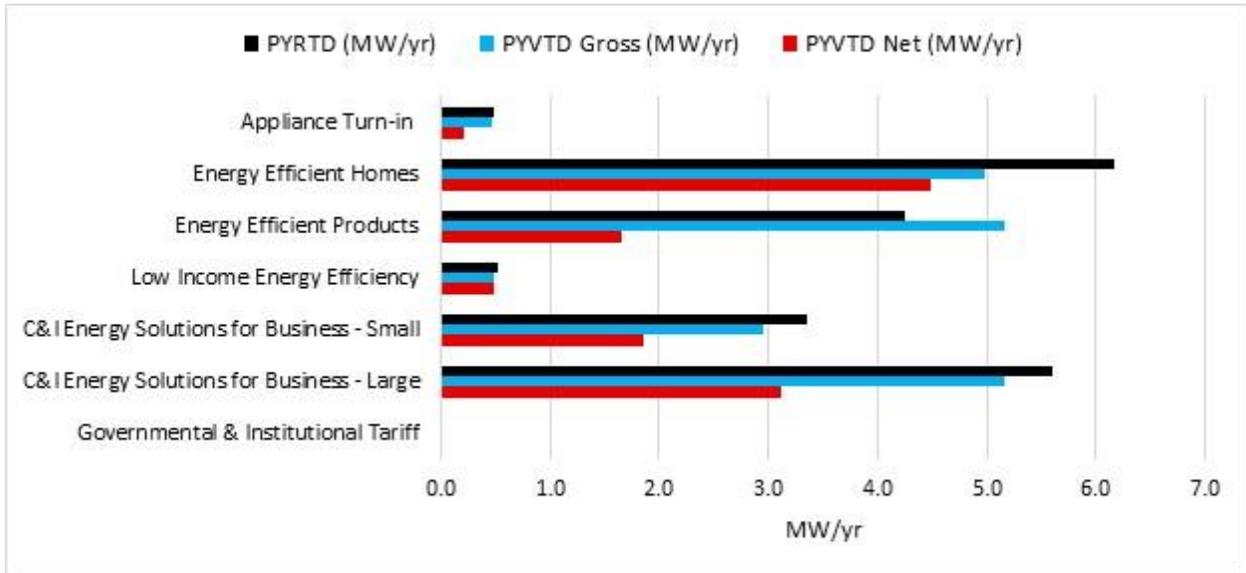
Phase III EE&C programs achieve peak demand reductions in two primary ways. The first is through coincident reductions from energy efficiency measures and the second is through dedicated demand response offerings that exclusively target temporary demand reductions on peak days. Energy efficiency reductions 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.

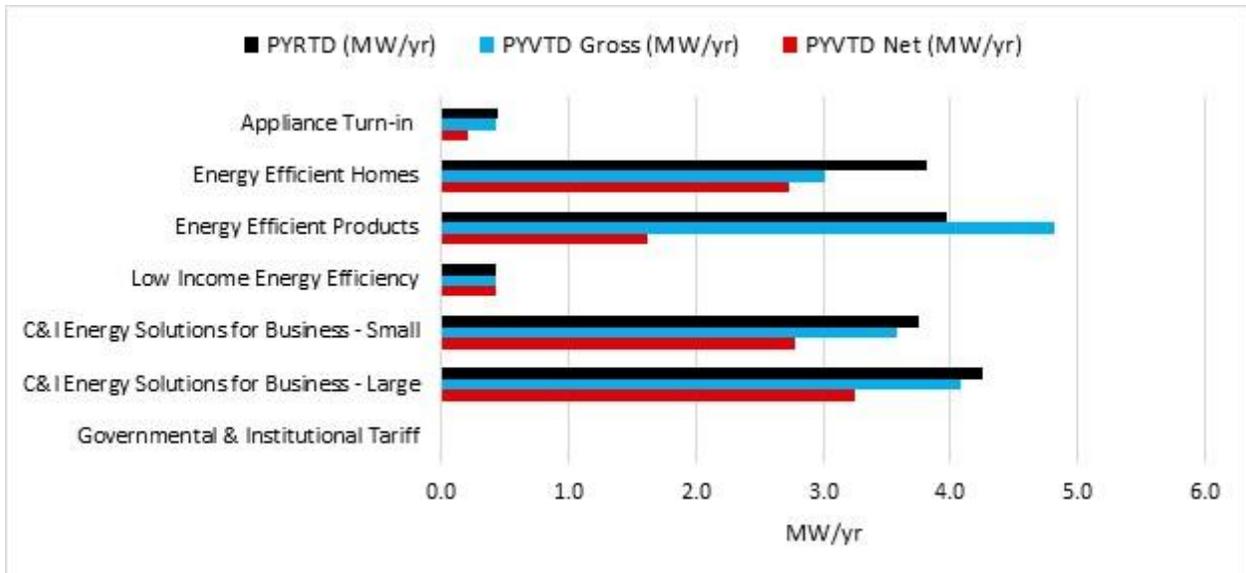
### 2.8.1 Energy Efficiency

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 11.

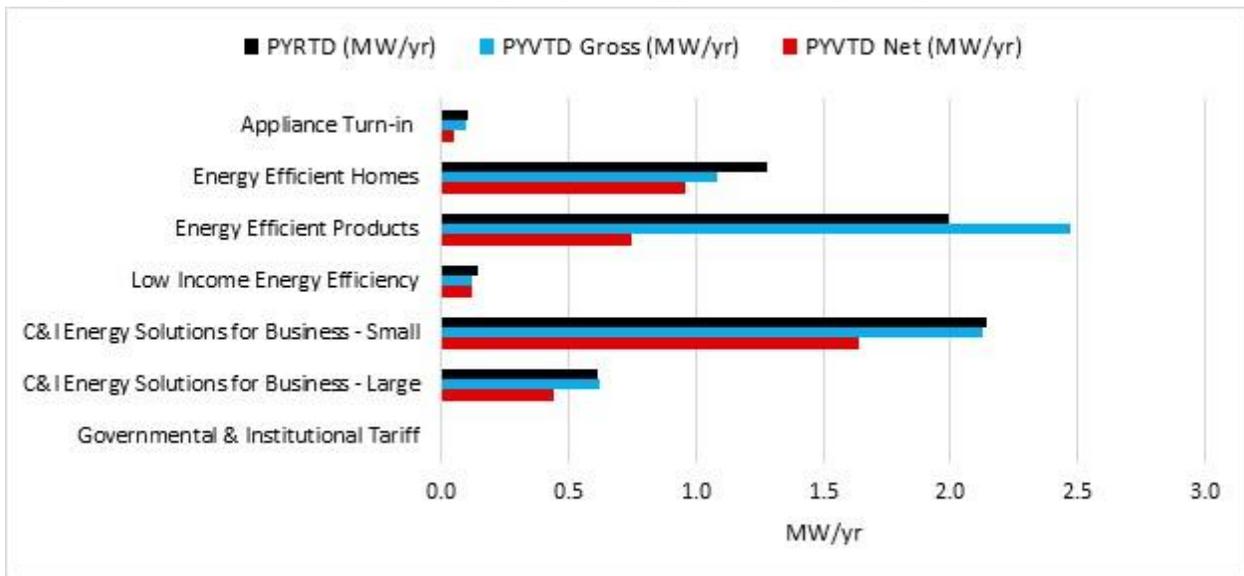
**Figure 18: PYTD Demand Savings by Energy Efficiency Program for Met-Ed**



**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**

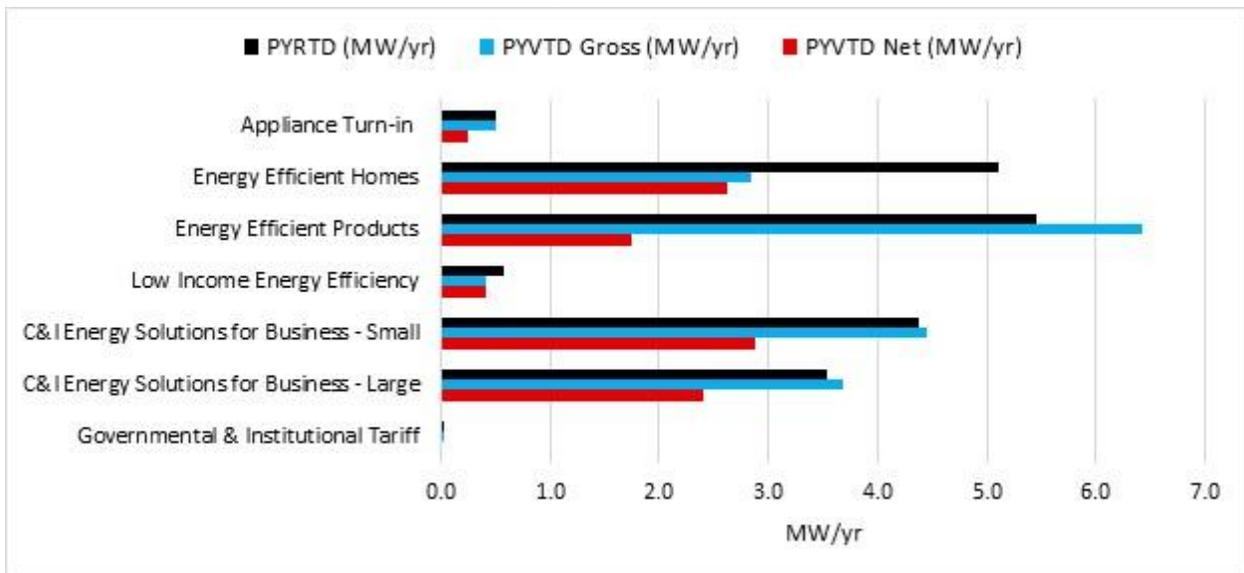
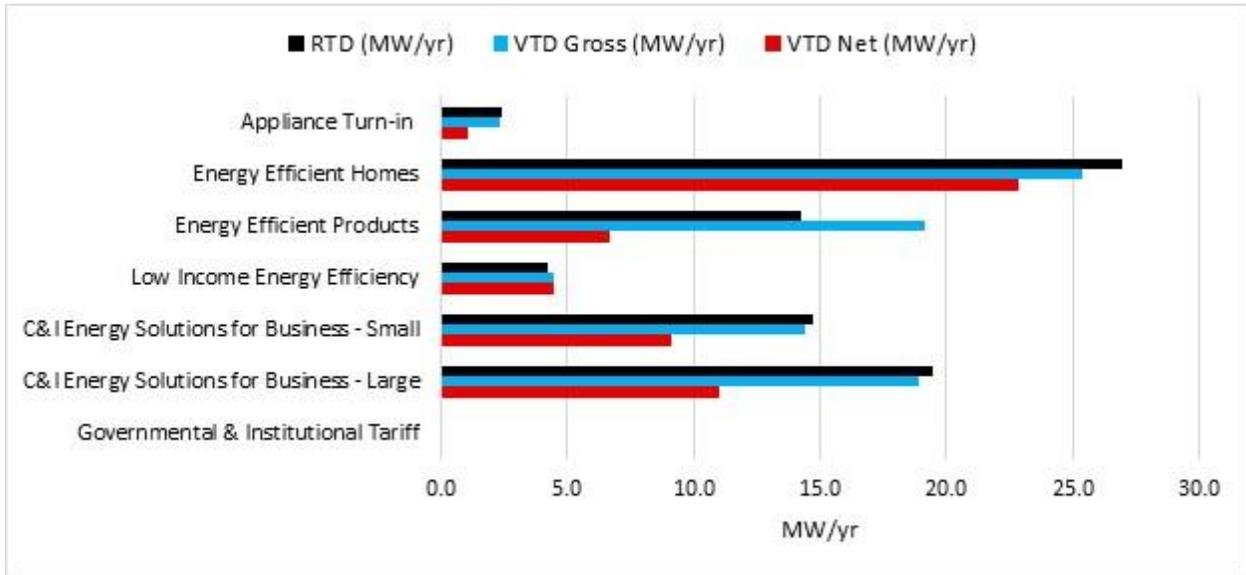
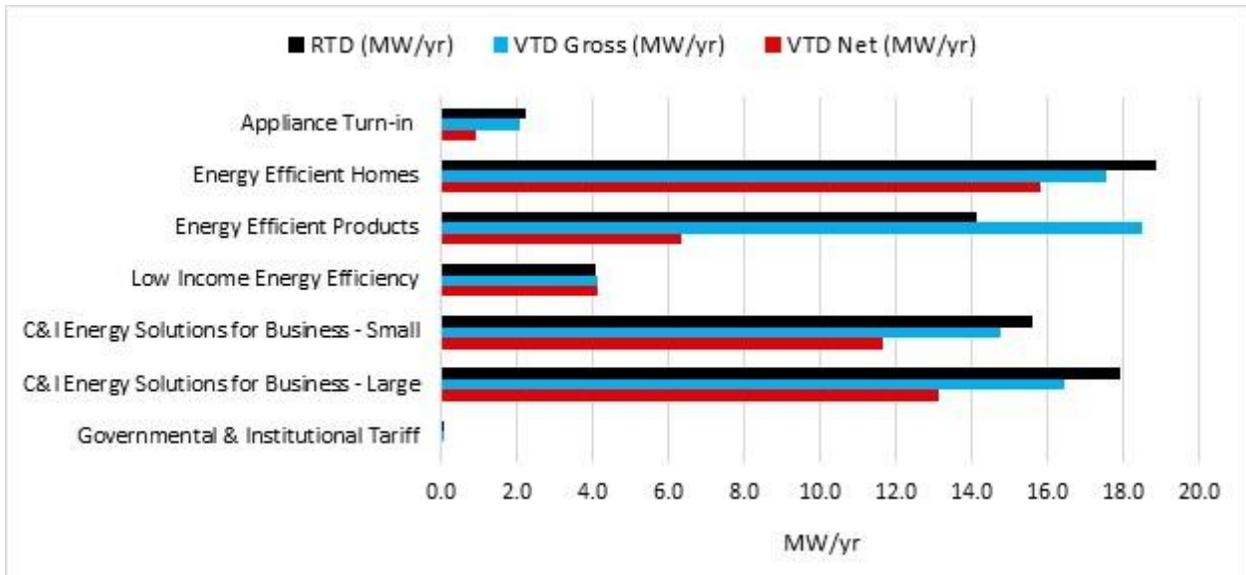


Figure 22, Figure 23, Figure 24, and Figure 25 present summaries of the P3TD demand savings by energy efficiency program for Met-Ed, Penelec, Penn Power, and WPP respectively for Phase III of Act 129.

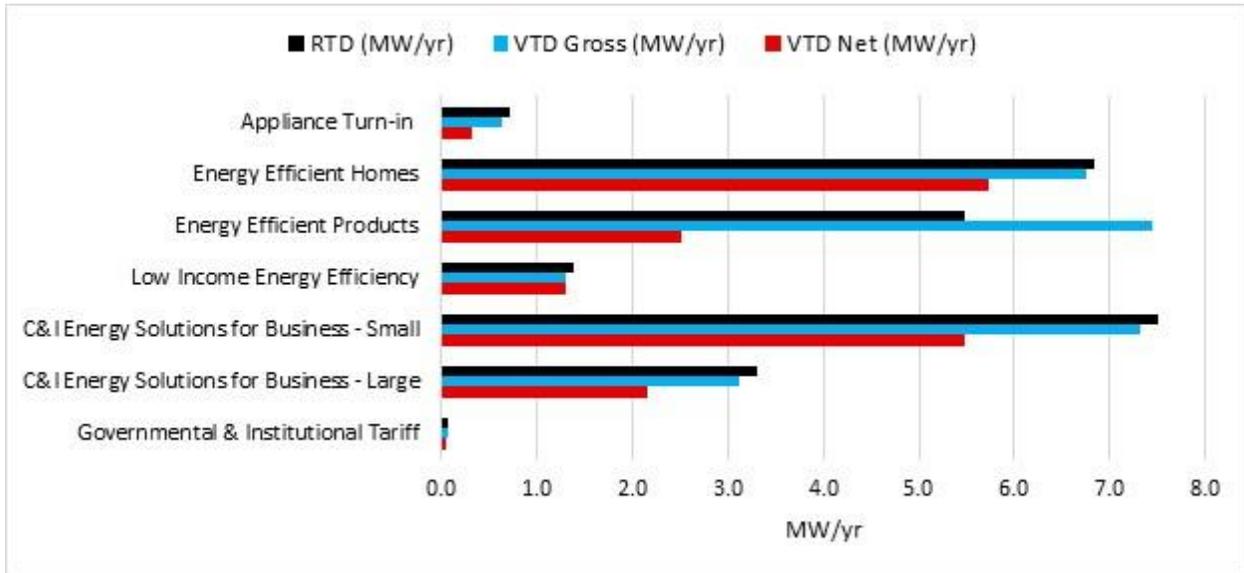
**Figure 22: P3TD Demand Savings by Energy Efficiency Program for Met-Ed**



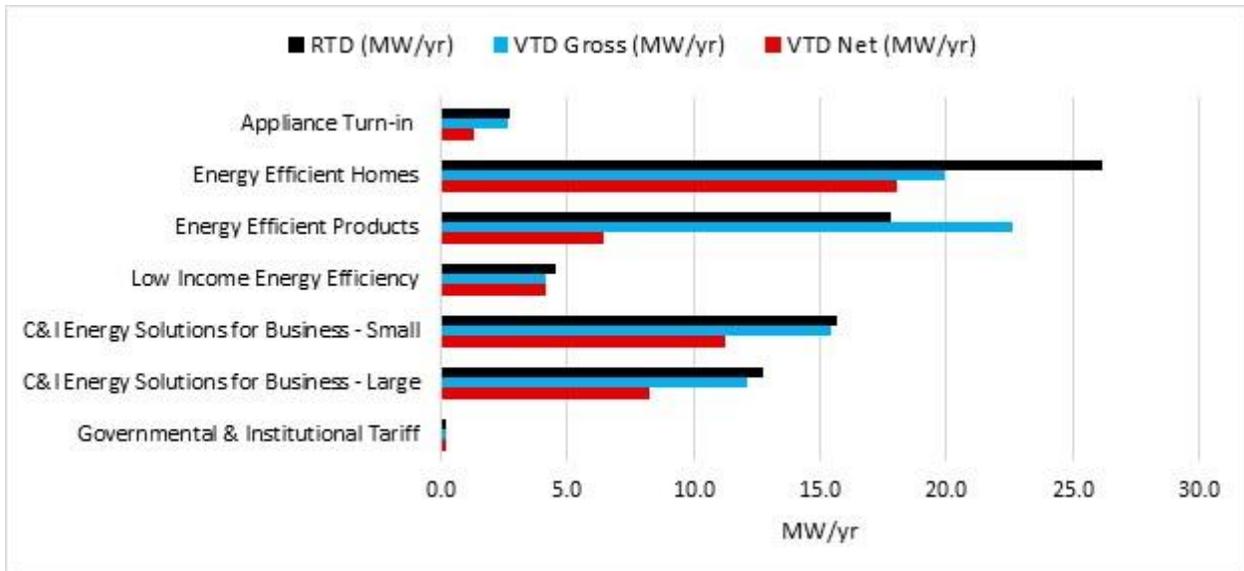
**Figure 23: P3TD Demand Savings by Energy Efficiency Program for Penelec**



**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	0.49	0.47	0.21	2.44	2.33	1.10
Energy Efficient Homes	6.16	4.97	4.48	26.96	25.39	22.86
Energy Efficient Products	4.24	5.17	1.65	14.27	19.16	6.69
Low Income Energy Efficiency	0.51	0.48	0.48	4.25	4.50	4.50
C&I Energy Solutions for Business - Small	3.35	2.95	1.86	14.74	14.39	9.08
C&I Energy Solutions for Business - Large	5.60	5.17	3.12	19.44	18.93	11.05
Governmental & Institutional Tariff	0.02	0.01	0.01	0.04	0.03	0.02
<b>Portfolio Total</b>	<b>20.37</b>	<b>19.22</b>	<b>11.80</b>	<b>82.12</b>	<b>84.73</b>	<b>55.30</b>

**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	0.44	0.43	0.20	2.22	2.07	0.94
Energy Efficient Homes	3.81	3.02	2.74	18.85	17.56	15.79
Energy Efficient Products	3.97	4.81	1.61	14.12	18.47	6.34
Low Income Energy Efficiency	0.43	0.43	0.43	4.10	4.15	4.15
C&I Energy Solutions for Business - Small	3.75	3.57	2.78	15.60	14.74	11.66
C&I Energy Solutions for Business - Large	4.25	4.08	3.25	17.92	16.45	13.13
Governmental & Institutional Tariff	0.01	0.01	0.01	0.07	0.06	0.05
<b>Portfolio Total</b>	<b>16.66</b>	<b>16.36</b>	<b>11.02</b>	<b>72.88</b>	<b>73.49</b>	<b>52.06</b>

**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	0.10	0.10	0.05	0.72	0.63	0.33
Energy Efficient Homes	1.28	1.08	0.96	6.84	6.75	5.73
Energy Efficient Products	1.99	2.47	0.75	5.49	7.45	2.52
Low Income Energy Efficiency	0.15	0.12	0.12	1.38	1.31	1.31
C&I Energy Solutions for Business - Small	2.14	2.12	1.64	7.51	7.32	5.47
C&I Energy Solutions for Business - Large	0.61	0.62	0.44	3.31	3.13	2.16
Governmental & Institutional Tariff	0.00	0.00	0.00	0.07	0.07	0.05
<b>Portfolio Total</b>	<b>6.28</b>	<b>6.51</b>	<b>3.97</b>	<b>25.31</b>	<b>26.65</b>	<b>17.57</b>

**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	0.51	0.50	0.24	2.69	2.62	1.26
Energy Efficient Homes	5.11	2.84	2.63	26.17	19.96	18.00
Energy Efficient Products	5.46	6.42	1.75	17.77	22.61	6.42
Low Income Energy Efficiency	0.57	0.42	0.42	4.53	4.12	4.12
C&I Energy Solutions for Business - Small	4.38	4.45	2.88	15.65	15.46	11.27
C&I Energy Solutions for Business - Large	3.53	3.69	2.40	12.74	12.13	8.26
Governmental & Institutional Tariff	0.02	0.02	0.01	0.20	0.21	0.17
<b>Portfolio Total</b>	<b>19.58</b>	<b>18.34</b>	<b>10.33</b>	<b>79.75</b>	<b>77.10</b>	<b>49.50</b>

The previously reported VTD demand reductions from prior years have not changed since the prior final annual report was submitted:

### 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	9.6	16%	5.8	10%
Met-Ed	C&I Demand Response Program – Small	1.5	5%	3.4	7%
Met-Ed	C&I Demand Response Program – Large	45.8	3%	43.8	3%
Penn Power	Residential Behavioral Demand Response	1.8	25%	2.0	9%
Penn Power	C&I Demand Response Program – Small	0.0	0%	0.0	58%
Penn Power	C&I Demand Response Program – Large	33.4	33%	37.8	21%
WPP	Residential Behavioral Demand Response	3.1	24%	2.4	12%
WPP	C&I Demand Response Program – Small	0.9	6%	1.4	17%
WPP	C&I Demand Response Program – Large	92.1	31%	108.6	14%

## 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 Met-Ed for a CHP project in PY11.

**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 in PY11	CHP	None	None	None
Fuel Switching Measures Implemented in Phase III	CHP	CHP	None	CHP
PY11 Energy Savings Achieved via Fuel Switching (MWh/yr)	10,033	0	0	0
PY11 Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	51,088	0	0	0
PY11 Incentive Payments for Fuel Switching Measures (\$1000)	301	0	0	0
VTD Energy Savings Achieved via Fuel Switching (MWh/yr)	10,033	15,024	0	14,003
P3TD Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	51,088	55,178	0	4,779
P3TD Incentive Payments for Fuel Switching Measures (\$1000)	301	575	0	420

## 2.10 SUMMARY OF COST-EFFECTIVENESS RESULTS

A detailed breakdown of portfolio finances and cost-effectiveness is presented for Met-Ed, Penelec, Penn Power, and West Penn Power in Table 31, Table 32, Table 33, and Table 34. TRC benefits in these tables were calculated using gross verified impacts. Net present value (NPV) PY11 costs and benefits are expressed in 2019 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 <sup>[1]</sup>	7,580		32,423	
2	EDC Incentives to Trade Allies	0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	23,315		83,944	
4	Incremental Measure Costs (Just row 3 for Appliance Recycling)	30,703		115,384	
		EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	37	178	50	1,621
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	866	1,980	2,887	9,427
7	Marketing <sup>[4]</sup>	323	866	440	4,000
8	Program Delivery <sup>[5]</sup>	297	3,840	937	19,297
9	EDC Evaluation Costs	1,149		3,470	
10	SWE Audit Costs	256		1,216	
11	Program Overhead Costs (Sum of rows 5 through 10)	9,792		43,346	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	2,827		2,332	
13	Total NPV TRC Costs <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	43,322		145,905	
14	Total NPV Lifetime Electric Energy Benefits	36,208		150,447	
15	Total NPV Lifetime Electric Capacity Benefits	12,277		55,108	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	6,146		19,639	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	297		422	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	54,929		225,616	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.27		1.55	

[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 <sup>[1]</sup>	6,611		30,924	
2	EDC Incentives to Trade Allies	0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	26,315		99,185	
4	Incremental Measure Costs (Just row 3 for Appliance Recycling)	32,760		129,256	
		EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	34	76	47	1,379
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	715	1,663	2,476	8,718
7	Marketing <sup>[4]</sup>	294	587	406	2,852
8	Program Delivery <sup>[5]</sup>	267	3,133	1,034	16,910
9	EDC Evaluation Costs	1,022		3,107	
10	SWE Audit Costs	232		1,102	
11	Program Overhead Costs (Sum of rows 5 through 10)	8,024		38,031	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		2,288	
13	Total NPV TRC Costs <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	40,784		153,245	
14	Total NPV Lifetime Electric Energy Benefits	35,337		146,729	
15	Total NPV Lifetime Electric Capacity Benefits	7,964		40,698	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	6,260		20,835	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	57		-1,543	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	49,617		206,719	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.22		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

**Table 33: Summary of Program Finances – Penn Power**

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)	
1	EDC Incentives to Participants <sup>[1]</sup>	2,137		10,960	
2	EDC Incentives to Trade Allies	0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	8,716		30,832	
4	Incremental Measure Costs (Just row 3 for Appliance Recycling)	10,812		41,509	
		EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	10	48	14	436
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	282	583	968	2,631
7	Marketing <sup>[4]</sup>	86	196	119	978
8	Program Delivery <sup>[5]</sup>	113	1,114	395	5,747
9	EDC Evaluation Costs	288		915	
10	SWE Audit Costs	72		342	
11	Program Overhead Costs (Sum of rows 5 through 10)	2,793		12,545	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0	
13	Total NPV TRC Costs <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	13,605		48,594	
14	Total NPV Lifetime Electric Energy Benefits	12,200		47,860	
15	Total NPV Lifetime Electric Capacity Benefits	4,734		20,521	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	2,265		6,881	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-581		-1,053	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	18,618		74,208	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.37		1.53	

[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 <sup>[1]</sup>	6,421		30,405	
2	EDC Incentives to Trade Allies	0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	25,662		101,027	
4	Incremental Measure Costs (Just row 3 for Appliance Recycling)	31,882		130,346	
		EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	38	213	54	1,772
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	888	2,280	3,207	10,441
7	Marketing <sup>[4]</sup>	327	943	428	4,294
8	Program Delivery <sup>[5]</sup>	306	5,783	973	20,981
9	EDC Evaluation Costs	1,163		3,512	
10	SWE Audit Costs	240		1,140	
11	Program Overhead Costs (Sum of rows 5 through 10)	12,181		46,802	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		192	
13	Total NPV TRC Costs <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	44,063		160,992	
14	Total NPV Lifetime Electric Energy Benefits	33,545		137,866	
15	Total NPV Lifetime Electric Capacity Benefits	13,413		58,138	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	5,872		18,581	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-419		-3,181	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	52,411		211,404	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.19		1.31	

[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 PY11, cost and benefits are expressed in 2019 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 64% and 55%, portfolio gross TRCs would increase by 16% and portfolio net TRCs would increase by 7%, 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**

EDC	Gross		Net	
	Dual Baseline	Without Dual Baseline	Dual Baseline	Without Dual Baseline
Met-Ed	1.27	1.46	1.12	1.20
Penelec	1.22	1.41	1.10	1.17
Penn Power	1.37	1.62	1.21	1.30
WPP	1.19	1.38	1.04	1.10
Average	1.26	1.47	1.12	1.19

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 PY11. This by itself does not bias TRC results in any way, but TRC measurements in PY11-12 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, 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 2019, 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 20% 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 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 30% to 54% of total avoided costs associated with demand response in PY11, 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 PY11 would decrease by 30%, while the TRC for residential and Small C&I customers would decrease by 54%.

The combination of these alternative calculations would reduce TRC by 65% to 77% 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: PY11 Gross TRC Ratios by Program (\$1,000) for Met-Ed<sup>1</sup>**

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$1,117	\$628	1.78	\$489
Energy Efficient Homes	\$9,827	\$6,149	1.60	\$3,678
Energy Efficient Products	\$12,756	\$10,079	1.27	\$2,677
Low Income Energy Efficiency	\$741	\$1,641	0.45	-\$901
<b>Residential Subtotal</b>	<b>\$24,440</b>	<b>\$18,497</b>	<b>1.32</b>	<b>\$5,944</b>
C&I Energy Solutions for Business - Small	\$9,586	\$6,591	1.45	\$2,995
C&I Energy Solutions for Business - Large	\$18,703	\$16,635	1.12	\$2,068
Governmental & Institutional Tariff	\$80	\$101	0.78	-\$22
C&I Demand Response Program – Small	\$105	\$77	1.36	\$28
C&I Demand Response Program – Large	\$2,016	\$1,420	1.42	\$596
<b>Non-Residential Subtotal</b>	<b>\$30,488</b>	<b>\$24,825</b>	<b>1.23</b>	<b>\$5,663</b>
<b>Portfolio Total</b>	<b>\$54,929</b>	<b>\$43,322</b>	<b>1.27</b>	<b>\$11,607</b>

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

**Table 37: PY11 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	\$983	\$586	1.68	\$397
Energy Efficient Homes	\$7,239	\$4,064	1.78	\$3,175
Energy Efficient Products	\$11,974	\$8,724	1.37	\$3,250
Low Income Energy Efficiency	\$1,030	\$1,845	0.56	-\$815
<b>Residential Subtotal</b>	<b>\$21,226</b>	<b>\$15,219</b>	<b>1.39</b>	<b>\$6,007</b>
C&I Energy Solutions for Business - Small	\$12,193	\$11,678	1.04	\$515
C&I Energy Solutions for Business - Large	\$15,970	\$13,539	1.18	\$2,432
Governmental & Institutional Tariff	\$228	\$347	0.66	-\$119
<b>Non-Residential Subtotal</b>	<b>\$28,391</b>	<b>\$25,564</b>	<b>1.11</b>	<b>\$2,827</b>
<b>Portfolio Total</b>	<b>\$49,617</b>	<b>\$40,784</b>	<b>1.22</b>	<b>\$8,834</b>

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

**Table 38: PY11 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	\$250	\$151	1.65	\$99
Energy Efficient Homes	\$2,228	\$1,581	1.41	\$647
Energy Efficient Products	\$5,324	\$3,124	1.70	\$2,200
Low Income Energy Efficiency	\$199	\$530	0.37	-\$332
<b>Residential Subtotal</b>	<b>\$8,001</b>	<b>\$5,386</b>	<b>1.49</b>	<b>\$2,615</b>
C&I Energy Solutions for Business - Small	\$6,852	\$5,643	1.21	\$1,209
C&I Energy Solutions for Business - Large	\$2,292	\$2,113	1.08	\$179
Governmental & Institutional Tariff	\$1	\$24	0.05	-\$22
C&I Demand Response Program – Small	\$0	\$8	0.00	-\$8
C&I Demand Response Program – Large	\$1,471	\$431	3.41	\$1,040
<b>Non-Residential Subtotal</b>	<b>\$10,617</b>	<b>\$8,218</b>	<b>1.29</b>	<b>\$2,398</b>
<b>Portfolio Total</b>	<b>\$18,618</b>	<b>\$13,605</b>	<b>1.37</b>	<b>\$5,013</b>

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

**Table 39: PY11 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	\$1,188	\$647	1.84	\$541
Energy Efficient Homes	\$6,528	\$4,444	1.47	\$2,085
Energy Efficient Products	\$14,049	\$11,050	1.27	\$2,999
Low Income Energy Efficiency	\$779	\$3,584	0.22	-\$2,804
<b>Residential Subtotal</b>	<b>\$22,545</b>	<b>\$19,724</b>	<b>1.14</b>	<b>\$2,821</b>
C&I Energy Solutions for Business - Small	\$14,021	\$13,063	1.07	\$958
C&I Energy Solutions for Business - Large	\$11,436	\$9,343	1.22	\$2,093
Governmental & Institutional Tariff	\$293	\$309	0.95	-\$16
C&I Demand Response Program – Small	\$63	\$41	1.55	\$22
C&I Demand Response Program – Large	\$4,054	\$1,584	2.56	\$2,470
<b>Non-Residential Subtotal</b>	<b>\$29,866</b>	<b>\$24,340</b>	<b>1.23</b>	<b>\$5,527</b>
<b>Portfolio Total</b>	<b>\$52,411</b>	<b>\$44,063</b>	<b>1.19</b>	<b>\$8,348</b>

<sup>1</sup> 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 PY11 cost-effectiveness for Met-Ed, Penelec, Penn Power, and WPP respectively, using net verified savings to calculate benefits.

**Table 40: PY11 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	\$503	\$628	0.80	-\$125
Energy Efficient Homes	\$8,039	\$5,825	1.38	\$2,214
Energy Efficient Products	\$4,208	\$4,822	0.87	-\$614
Low Income Energy Efficiency	\$741	\$1,641	0.45	-\$901
<b>Residential Subtotal</b>	<b>\$13,490</b>	<b>\$12,916</b>	<b>1.04</b>	<b>\$574</b>
C&I Energy Solutions for Business - Small	\$6,049	\$4,620	1.31	\$1,429
C&I Energy Solutions for Business - Large	\$12,037	\$11,102	1.08	\$935
Governmental & Institutional Tariff	\$50	\$86	0.59	-\$35
C&I Demand Response Program – Small	\$105	\$77	1.36	\$28
C&I Demand Response Program – Large	\$2,016	\$1,420	1.42	\$596
<b>Non-Residential Subtotal</b>	<b>\$20,257</b>	<b>\$17,305</b>	<b>1.17</b>	<b>\$2,952</b>
<b>Portfolio Total</b>	<b>\$33,746</b>	<b>\$30,220</b>	<b>1.12</b>	<b>\$3,526</b>

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

**Table 41: PY11 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	\$462	\$586	0.79	-\$124
Energy Efficient Homes	\$6,425	\$4,019	1.60	\$2,405
Energy Efficient Products	\$4,145	\$4,366	0.95	-\$222
Low Income Energy Efficiency	\$1,030	\$1,845	0.56	-\$815
<b>Residential Subtotal</b>	<b>\$12,061</b>	<b>\$10,817</b>	<b>1.12</b>	<b>\$1,244</b>
C&I Energy Solutions for Business - Small	\$9,515	\$9,423	1.01	\$92
C&I Energy Solutions for Business - Large	\$12,750	\$10,973	1.16	\$1,777
Governmental & Institutional Tariff	\$175	\$290	0.60	-\$115
<b>Non-Residential Subtotal</b>	<b>\$22,440</b>	<b>\$20,686</b>	<b>1.08</b>	<b>\$1,754</b>
<b>Portfolio Total</b>	<b>\$34,502</b>	<b>\$31,503</b>	<b>1.10</b>	<b>\$2,999</b>

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

**Table 42: PY11 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	\$127	\$151	0.84	-\$24
Energy Efficient Homes	\$1,739	\$1,403	1.24	\$336
Energy Efficient Products	\$1,605	\$1,421	1.13	\$184
Low Income Energy Efficiency	\$199	\$530	0.37	-\$332
<b>Residential Subtotal</b>	<b>\$3,670</b>	<b>\$3,505</b>	<b>1.05</b>	<b>\$165</b>
C&I Energy Solutions for Business - Small	\$5,275	\$4,446	1.19	\$829
C&I Energy Solutions for Business - Large	\$1,628	\$1,539	1.06	\$89
Governmental & Institutional Tariff	\$1	\$23	0.04	-\$23
C&I Demand Response Program – Small	\$0	\$8	0.00	-\$8
C&I Demand Response Program – Large	\$1,471	\$431	3.41	\$1,040
<b>Non-Residential Subtotal</b>	<b>\$8,376</b>	<b>\$6,448</b>	<b>1.30</b>	<b>\$1,928</b>
<b>Portfolio Total</b>	<b>\$12,046</b>	<b>\$9,953</b>	<b>1.21</b>	<b>\$2,093</b>

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

**Table 43: PY11 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	\$570	\$647	0.88	-\$77
Energy Efficient Homes	\$5,811	\$4,097	1.42	\$1,714
Energy Efficient Products	\$4,084	\$5,255	0.78	-\$1,172
Low Income Energy Efficiency	\$779	\$3,584	0.22	-\$2,804
<b>Residential Subtotal</b>	<b>\$11,244</b>	<b>\$13,583</b>	<b>0.83</b>	<b>-\$2,339</b>
C&I Energy Solutions for Business - Small	\$8,891	\$8,839	1.01	\$52
C&I Energy Solutions for Business - Large	\$7,388	\$6,327	1.17	\$1,061
Governmental & Institutional Tariff	\$193	\$231	0.84	-\$38
C&I Demand Response Program – Small	\$63	\$41	1.55	\$22
C&I Demand Response Program – Large	\$4,054	\$1,584	2.56	\$2,470
<b>Non-Residential Subtotal</b>	<b>\$20,589</b>	<b>\$17,022</b>	<b>1.21</b>	<b>\$3,567</b>
<b>Portfolio Total</b>	<b>\$31,833</b>	<b>\$30,605</b>	<b>1.04</b>	<b>\$1,228</b>

<sup>1</sup> 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	\$5,263	\$2,591	2.03	\$2,672
Energy Efficient Homes	\$47,053	\$27,555	1.71	\$19,497
Energy Efficient Products	\$51,994	\$31,891	1.63	\$20,103
Low Income Energy Efficiency	\$9,483	\$11,352	0.84	-\$1,868
<b>Residential Subtotal</b>	<b>\$113,793</b>	<b>\$73,389</b>	<b>1.55</b>	<b>\$40,404</b>
C&I Energy Solutions for Business - Small	\$41,662	\$24,413	1.71	\$17,249
C&I Energy Solutions for Business - Large	\$61,023	\$43,664	1.40	\$17,359
Governmental & Institutional Tariff	\$687	\$645	1.06	\$41
C&I Demand Response Program – Small	\$725	\$291	2.49	\$434
C&I Demand Response Program – Large	\$7,726	\$3,502	2.21	\$4,224
<b>Non-Residential Subtotal</b>	<b>\$111,823</b>	<b>\$72,515</b>	<b>1.54</b>	<b>\$39,308</b>
<b>Portfolio Total</b>	<b>\$225,616</b>	<b>\$145,905</b>	<b>1.55</b>	<b>\$79,711</b>

<sup>1</sup> 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	\$4,488	\$2,431	1.85	\$2,057
Energy Efficient Homes	\$40,372	\$23,048	1.75	\$17,324
Energy Efficient Products	\$52,510	\$27,754	1.89	\$24,757
Low Income Energy Efficiency	\$10,005	\$11,447	0.87	-\$1,441
<b>Residential Subtotal</b>	<b>\$107,375</b>	<b>\$64,679</b>	<b>1.66</b>	<b>\$42,696</b>
C&I Energy Solutions for Business - Small	\$41,781	\$36,035	1.16	\$5,746
C&I Energy Solutions for Business - Large	\$56,495	\$51,117	1.11	\$5,379
Governmental & Institutional Tariff	\$1,068	\$1,413	0.76	-\$346
<b>Non-Residential Subtotal</b>	<b>\$99,344</b>	<b>\$88,565</b>	<b>1.12</b>	<b>\$10,779</b>
<b>Portfolio Total</b>	<b>\$206,719</b>	<b>\$153,245</b>	<b>1.35</b>	<b>\$53,475</b>

<sup>1</sup> 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	\$1,392	\$839	1.66	\$553
Energy Efficient Homes	\$13,030	\$9,106	1.43	\$3,924
Energy Efficient Products	\$18,209	\$9,262	1.97	\$8,947
Low Income Energy Efficiency	\$2,869	\$3,447	0.83	-\$578
<b>Residential Subtotal</b>	<b>\$35,500</b>	<b>\$22,655</b>	<b>1.57</b>	<b>\$12,845</b>
C&I Energy Solutions for Business - Small	\$20,641	\$14,802	1.39	\$5,839
C&I Energy Solutions for Business - Large	\$10,992	\$9,134	1.20	\$1,859
Governmental & Institutional Tariff	\$704	\$491	1.43	\$213
C&I Demand Response Program – Small	\$15	\$34	0.44	-\$19
C&I Demand Response Program – Large	\$6,356	\$1,478	4.30	\$4,877
<b>Non-Residential Subtotal</b>	<b>\$38,708</b>	<b>\$25,939</b>	<b>1.49</b>	<b>\$12,769</b>
<b>Portfolio Total</b>	<b>\$74,208</b>	<b>\$48,594</b>	<b>1.53</b>	<b>\$25,614</b>

<sup>1</sup> 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	\$5,748	\$2,857	2.01	\$2,891
Energy Efficient Homes	\$32,535	\$23,486	1.39	\$9,050
Energy Efficient Products	\$53,690	\$34,273	1.57	\$19,417
Low Income Energy Efficiency	\$8,544	\$12,428	0.69	-\$3,884
<b>Residential Subtotal</b>	<b>\$100,517</b>	<b>\$73,043</b>	<b>1.38</b>	<b>\$27,474</b>
C&I Energy Solutions for Business - Small	\$44,552	\$40,377	1.10	\$4,175
C&I Energy Solutions for Business - Large	\$41,169	\$34,167	1.20	\$7,002
Governmental & Institutional Tariff	\$6,948	\$8,019	0.87	-\$1,071
C&I Demand Response Program – Small	\$363	\$176	2.07	\$187
C&I Demand Response Program – Large	\$17,854	\$5,210	3.43	\$12,645
<b>Non-Residential Subtotal</b>	<b>\$110,886</b>	<b>\$87,949</b>	<b>1.26</b>	<b>\$22,937</b>
<b>Portfolio Total</b>	<b>\$211,404</b>	<b>\$160,992</b>	<b>1.31</b>	<b>\$50,411</b>

<sup>1</sup> 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	\$2,500	\$2,591	0.96	-\$91
Energy Efficient Homes	\$38,888	\$26,039	1.49	\$12,850
Energy Efficient Products	\$18,405	\$15,088	1.22	\$3,317
Low Income Energy Efficiency	\$9,483	\$11,352	0.84	-\$1,868
<b>Residential Subtotal</b>	<b>\$69,277</b>	<b>\$55,070</b>	<b>1.26</b>	<b>\$14,207</b>
C&I Energy Solutions for Business - Small	\$26,183	\$16,801	1.56	\$9,382
C&I Energy Solutions for Business - Large	\$36,140	\$27,364	1.32	\$8,776
Governmental & Institutional Tariff	\$439	\$484	0.91	-\$45
C&I Demand Response Program – Small	\$725	\$291	2.49	\$434
C&I Demand Response Program – Large	\$7,726	\$3,502	2.21	\$4,224
<b>Non-Residential Subtotal</b>	<b>\$71,214</b>	<b>\$48,443</b>	<b>1.47</b>	<b>\$22,771</b>
<b>Portfolio Total</b>	<b>\$140,491</b>	<b>\$103,512</b>	<b>1.36</b>	<b>\$36,979</b>

<sup>1</sup> 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	\$2,038	\$2,431	0.84	-\$393
Energy Efficient Homes	\$34,235	\$22,651	1.51	\$11,585
Energy Efficient Products	\$18,128	\$13,434	1.35	\$4,694
Low Income Energy Efficiency	\$10,005	\$11,447	0.87	-\$1,441
<b>Residential Subtotal</b>	<b>\$64,406</b>	<b>\$49,963</b>	<b>1.29</b>	<b>\$14,444</b>
C&I Energy Solutions for Business - Small	\$32,838	\$29,290	1.12	\$3,548
C&I Energy Solutions for Business - Large	\$44,909	\$39,181	1.15	\$5,728
Governmental & Institutional Tariff	\$861	\$1,211	0.71	-\$350
<b>Non-Residential Subtotal</b>	<b>\$78,608</b>	<b>\$69,682</b>	<b>1.13</b>	<b>\$8,926</b>
<b>Portfolio Total</b>	<b>\$143,015</b>	<b>\$119,645</b>	<b>1.20</b>	<b>\$23,369</b>

<sup>1</sup> 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	\$735	\$839	0.88	-\$104
Energy Efficient Homes	\$10,353	\$8,132	1.27	\$2,221
Energy Efficient Products	\$6,240	\$4,301	1.45	\$1,938
Low Income Energy Efficiency	\$2,869	\$3,447	0.83	-\$578
<b>Residential Subtotal</b>	<b>\$20,196</b>	<b>\$16,720</b>	<b>1.21</b>	<b>\$3,476</b>
C&I Energy Solutions for Business - Small	\$15,364	\$11,300	1.36	\$4,064
C&I Energy Solutions for Business - Large	\$7,501	\$6,430	1.17	\$1,070
Governmental & Institutional Tariff	\$529	\$398	1.33	\$131
C&I Demand Response Program – Small	\$15	\$34	0.44	-\$19
C&I Demand Response Program – Large	\$6,356	\$1,478	4.30	\$4,877
<b>Non-Residential Subtotal</b>	<b>\$29,764</b>	<b>\$19,641</b>	<b>1.52</b>	<b>\$10,123</b>
<b>Portfolio Total</b>	<b>\$49,961</b>	<b>\$36,361</b>	<b>1.37</b>	<b>\$13,600</b>

<sup>1</sup> 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	\$2,766	\$2,857	0.97	-\$91
Energy Efficient Homes	\$27,224	\$21,755	1.25	\$5,468
Energy Efficient Products	\$15,456	\$15,702	0.98	-\$246
Low Income Energy Efficiency	\$8,544	\$12,428	0.69	-\$3,884
<b>Residential Subtotal</b>	<b>\$53,989</b>	<b>\$52,742</b>	<b>1.02</b>	<b>\$1,247</b>
C&I Energy Solutions for Business - Small	\$32,486	\$31,169	1.04	\$1,318
C&I Energy Solutions for Business - Large	\$26,896	\$23,883	1.13	\$3,013
Governmental & Institutional Tariff	\$5,521	\$6,581	0.84	-\$1,060
C&I Demand Response Program – Small	\$363	\$176	2.07	\$187
C&I Demand Response Program – Large	\$17,854	\$5,210	3.43	\$12,645
<b>Non-Residential Subtotal</b>	<b>\$83,121</b>	<b>\$67,018</b>	<b>1.24</b>	<b>\$16,103</b>
<b>Portfolio Total</b>	<b>\$137,111</b>	<b>\$119,760</b>	<b>1.14</b>	<b>\$17,351</b>

<sup>1</sup> 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 PY11 expenditures, by program, compared to the budget estimates set forth in the EE&C plan for PY11 for Met-Ed, Penelec, Penn Power, and WPP. All the dollars in these tables are presented in 2019 dollars

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

Program	PY11 Budget from EE&C Plan	PY11 Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 1,139.17	\$ 820.72	0.72
Energy Efficient Homes Program	\$ 6,497.86	\$ 4,908.30	0.76
Energy Efficient Products Program	\$ 5,143.44	\$ 2,835.29	0.55
Low Income Energy Efficiency Program	\$ 3,759.19	\$ 1,618.74	0.43
C&I Energy Solutions for Business Program - Small	\$ 4,444.93	\$ 2,340.43	0.53
C&I Demand Response Program - Small	\$ 201.56	\$ 85.75	0.43
C&I Energy Solutions for Business Program - Large	\$ 4,099.76	\$ 3,098.18	0.76
C&I Demand Response Program - Large	\$ 1,808.16	\$ 1,598.91	0.88
Governmental & Institutional Tariff Program	\$ 352.60	\$ 65.95	0.19
<b>Total</b>	<b>\$ 27,446.69</b>	<b>\$ 17,372.27</b>	<b>0.63</b>

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

Program	PY11 Budget from EE&C Plan	PY11 Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 1,189.08	\$ 752.13	0.63
Energy Efficient Homes Program	\$ 5,981.62	\$ 3,859.61	0.65
Energy Efficient Products Program	\$ 4,813.56	\$ 2,444.31	0.51
Low Income Energy Efficiency Program	\$ 4,164.24	\$ 1,802.20	0.43
C&I Energy Solutions for Business Program - Small	\$ 4,718.89	\$ 2,758.78	0.58
C&I Energy Solutions for Business Program - Large	\$ 3,658.43	\$ 2,888.38	0.79
Governmental & Institutional Tariff Program	\$ 577.40	\$ 128.86	0.22
<b>Total</b>	<b>\$ 25,103.23</b>	<b>\$ 14,634.27</b>	<b>0.58</b>

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

Program	PY11 Budget from EE&C Plan	PY11 Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 275.27	\$ 192.41	0.70
Energy Efficient Homes Program	\$ 1,770.10	\$ 918.51	0.52
Energy Efficient Products Program	\$ 698.51	\$ 946.54	1.36
Low Income Energy Efficiency Program	\$ 1,249.75	\$ 526.31	0.42
C&I Energy Solutions for Business Program - Small	\$ 1,185.85	\$ 1,343.19	1.13
C&I Demand Response Program - Small	\$ 69.47	\$ 7.66	0.11
C&I Energy Solutions for Business Program - Large	\$ 826.49	\$ 497.06	0.60
C&I Demand Response Program - Large	\$ 622.84	\$ 475.33	0.76
Governmental & Institutional Tariff Program	\$ 117.07	\$ 23.03	0.20
<b>Total</b>	<b>\$ 6,815.34</b>	<b>\$ 4,930.02</b>	<b>0.72</b>

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

Program	PY11 Budget from EE&C Plan	PY11 Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 1,136.45	\$ 847.88	0.75
Energy Efficient Homes Program	\$ 4,873.94	\$ 3,097.96	0.64
Energy Efficient Products Program	\$ 4,645.32	\$ 3,232.40	0.70
Low Income Energy Efficiency Program	\$ 3,957.69	\$ 3,567.96	0.90
C&I Energy Solutions for Business Program - Small	\$ 4,748.22	\$ 3,581.03	0.75
C&I Demand Response Program - Small	\$ 255.57	\$ 42.35	0.17
C&I Energy Solutions for Business Program - Large	\$ 3,239.08	\$ 2,367.90	0.73
C&I Demand Response Program - Large	\$ 2,300.16	\$ 1,771.00	0.77
Governmental & Institutional Tariff Program	\$ 481.91	\$ 93.80	0.19
<b>Total</b>	<b>\$ 25,638.34</b>	<b>\$ 18,602.29</b>	<b>0.73</b>

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 PY11 for Met-Ed, Penelec, Penn Power, and WPP respectively. All the dollars in these tables are presented in 2016 dollars.

Please note that the Companies' acquisition costs through Phase III PY11 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 PY11	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 4,180.52	\$ 3,199.54	0.77
Energy Efficient Homes Program	\$ 23,616.09	\$ 19,338.09	0.82
Energy Efficient Products Program	\$ 16,496.43	\$ 9,499.01	0.58
Low Income Energy Efficiency Program	\$ 13,660.08	\$ 9,383.82	0.69
C&I Energy Solutions for Business Program - Small	\$ 15,263.44	\$ 8,047.89	0.53
C&I Demand Response Program - Small	\$ 577.88	\$ 267.58	0.46
C&I Energy Solutions for Business Program - Large	\$ 12,947.96	\$ 10,395.07	0.80
C&I Demand Response Program - Large	\$ 5,185.87	\$ 3,919.21	0.76
Governmental & Institutional Tariff Program	\$ 1,121.41	\$ 259.76	0.23
<b>Total</b>	<b>\$ 93,049.66</b>	<b>\$ 64,309.97</b>	<b>0.69</b>

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

Program	Phase III Budget from EE&C Plan through PY11	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 4,345.66	\$ 2,944.05	0.68
Energy Efficient Homes Program	\$ 21,958.31	\$ 16,483.63	0.75
Energy Efficient Products Program	\$ 15,652.06	\$ 8,813.27	0.56
Low Income Energy Efficiency Program	\$ 15,049.09	\$ 9,666.52	0.64
C&I Energy Solutions for Business Program - Small	\$ 15,993.74	\$ 9,358.69	0.59
C&I Energy Solutions for Business Program - Large	\$ 11,678.15	\$ 9,606.51	0.82
Governmental & Institutional Tariff Program	\$ 1,882.23	\$ 519.48	0.28
<b>Total</b>	<b>\$ 86,559.23</b>	<b>\$ 57,392.15</b>	<b>0.66</b>

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

Program	Phase III Budget from EE&C Plan through PY11	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 1,002.61	\$ 930.76	0.93
Energy Efficient Homes Program	\$ 6,446.64	\$ 4,991.89	0.77
Energy Efficient Products Program	\$ 3,499.29	\$ 2,759.94	0.79
Low Income Energy Efficiency Program	\$ 4,571.79	\$ 2,975.16	0.65
C&I Energy Solutions for Business Program - Small	\$ 4,187.56	\$ 4,140.10	0.99
C&I Demand Response Program - Small	\$ 195.28	\$ 34.35	0.18
C&I Energy Solutions for Business Program - Large	\$ 2,644.75	\$ 1,919.70	0.73
C&I Demand Response Program - Large	\$ 1,751.47	\$ 1,404.99	0.80
Governmental & Institutional Tariff Program	\$ 415.91	\$ 230.05	0.55
<b>Total</b>	<b>\$ 24,715.29</b>	<b>\$ 19,386.94</b>	<b>0.78</b>

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

Program	Phase III Budget from EE&C Plan through PY11	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 4,163.45	\$ 3,502.56	0.84
Energy Efficient Homes Program	\$ 17,618.16	\$ 15,729.84	0.89
Energy Efficient Products Program	\$ 15,329.27	\$ 10,925.41	0.71
Low Income Energy Efficiency Program	\$ 14,350.87	\$ 12,381.98	0.86
C&I Energy Solutions for Business Program - Small	\$ 15,546.34	\$ 10,687.38	0.69
C&I Demand Response Program - Small	\$ 727.39	\$ 174.33	0.24
C&I Energy Solutions for Business Program - Large	\$ 10,880.52	\$ 7,989.81	0.73
C&I Demand Response Program - Large	\$ 6,546.47	\$ 4,951.37	0.76
Governmental & Institutional Tariff Program	\$ 1,523.77	\$ 1,357.28	0.89
<b>Total</b>	<b>\$ 86,686.23</b>	<b>\$ 67,699.97</b>	<b>0.78</b>

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 PY11	PY11 VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,129	3,347	0.55
Energy Efficient Homes Program	34,738	37,908	1.09
Energy Efficient Products Program	21,909	39,431	1.80
Low Income Energy Efficiency Program	7,742	4,121	0.53
C&I Energy Solutions for Business Program - Small	28,814	20,557	0.71
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	36,771	37,526	1.02
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	1,240	188	0.15
<b>Total</b>	<b>137,343</b>	<b>143,078</b>	<b>1.04</b>

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

Program	EE&C Plan Projections for PY11	PY11 VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,925	3,113	0.45
Energy Efficient Homes Program	29,547	27,179	0.92
Energy Efficient Products Program	23,324	40,245	1.73
Low Income Energy Efficiency Program	7,492	3,892	0.52
C&I Energy Solutions for Business Program - Small	29,677	26,663	0.90
C&I Energy Solutions for Business Program - Large	32,144	35,166	1.09
Governmental & Institutional Tariff Program	1,616	630	0.39
<b>Total</b>	<b>130,728</b>	<b>136,889</b>	<b>1.05</b>

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

Program	EE&C Plan Projections for PY11	PY11 VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	1,645	789	0.48
Energy Efficient Homes Program	8,498	6,540	0.77
Energy Efficient Products Program	3,217	18,003	5.60
Low Income Energy Efficiency Program	2,086	1,089	0.52
C&I Energy Solutions for Business Program - Small	8,551	16,267	1.90
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	7,585	5,459	0.72
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	473	2	0.00
<b>Total</b>	<b>32,054</b>	<b>48,148</b>	<b>1.50</b>

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

Program	EE&C Plan Projections for PY11	PY11 VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,671	3,765	0.56
Energy Efficient Homes Program	29,943	20,312	0.68
Energy Efficient Products Program	20,241	46,239	2.28
Low Income Energy Efficiency Program	7,051	3,660	0.52
C&I Energy Solutions for Business Program - Small	30,136	31,342	1.04
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	27,395	25,948	0.95
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	1,517	844	0.56
<b>Total</b>	<b>122,954</b>	<b>132,110</b>	<b>1.07</b>

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 PY11	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	24,517	16,909	0.69
Energy Efficient Homes Program	138,879	209,079	1.51
Energy Efficient Products Program	91,836	142,030	1.55
Low Income Energy Efficiency Program	30,736	38,875	1.26
C&I Energy Solutions for Business Program - Small	105,384	95,836	0.91
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	125,655	138,949	1.11
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	4,243	2,020	0.48
<b>Total</b>	<b>521,250</b>	<b>643,697</b>	<b>1.23</b>

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

Program	EE&C Plan through PY11	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	27,702	15,498	0.56
Energy Efficient Homes Program	118,912	161,292	1.36
Energy Efficient Products Program	97,067	152,388	1.57
Low Income Energy Efficiency Program	29,552	38,730	1.31
C&I Energy Solutions for Business Program - Small	107,450	102,029	0.95
C&I Energy Solutions for Business Program - Large	111,939	141,341	1.26
Governmental & Institutional Tariff Program	5,498	3,291	0.60
<b>Total</b>	<b>498,121</b>	<b>614,570</b>	<b>1.23</b>

**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 PY11	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,581	4,890	0.74
Energy Efficient Homes Program	33,971	47,279	1.39
Energy Efficient Products Program	23,038	55,727	2.42
Low Income Energy Efficiency Program	8,276	11,199	1.35
C&I Energy Solutions for Business Program - Small	32,369	51,260	1.58
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	26,425	28,046	1.06
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	1,856	1,948	1.05
<b>Total</b>	<b>132,516</b>	<b>200,349</b>	<b>1.51</b>

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

Program	EE&C Plan through PY11	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	26,683	20,188	0.76
Energy Efficient Homes Program	119,665	154,402	1.29
Energy Efficient Products Program	87,816	160,723	1.83
Low Income Energy Efficiency Program	27,863	35,042	1.26
C&I Energy Solutions for Business Program - Small	105,598	110,299	1.04
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	100,543	102,199	1.02
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	5,307	21,623	4.07
<b>Total</b>	<b>473,474</b>	<b>604,476</b>	<b>1.28</b>

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 PY11 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 and Penn Power is now exceeding the plan savings, but the other two EDCs are short of participation and savings targets. 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. All the overarching recommendations are intended to reduce noncompliance risks for Phase IV. 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, 3.3.7, 3.4.7, 3.8.6, and 3.10.5.

**Table 68: Summary of Evaluation Recommendations**

Evaluation Activity	Finding	Recommendation
General Evaluation	While the Phase III programs have performed well in PY9-PY11, there is great uncertainty related to the depth and duration of the COVID-induced economic disruption.	Consider early testing of Phase IV contingency strategies related to compliance with demand reduction targets early in Phase IV.
Tracking Review / General Evaluation	Program participation rates have been suppressed since late PY11.	To the extent possible, fully utilize Phase III funding to maximize carryover into Phase IV. If possible, consider overdriving measures that have high short lead times (so that they can be operational by May 31, 2021), and high energy savings.
General Evaluation	The Companies expect to have Carryover Savings for Phase IV due to strong program performance in PY8-PY11.	Given that energy savings can be carried over, but demand reductions cannot, prioritize measures with low demand reductions for the rest of Phase III, and measures with high demand reductions in Phase IV.

### 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 Figure 26. 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<sup>6</sup>.

**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				✓		✓	✓			✓		✓	✓		

<sup>6</sup> The asterisk for West Penn Power’s Small C/I Behavioral Pilot indicate that the COVID-Induced severe economic disruption in the small commercial sector posed insurmountable challenges both for implementation and evaluation. A formal process evaluation will not be conducted and no savings will be reported for this program.

### 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 PY11 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	3,319	2,881	745	3,535
PYRTD MWh/yr	3,350	3,183	815	3,787
PYRTD MW/yr	0.49	0.44	0.10	0.51
PYTD Incentives (\$1000)	193.03	165.70	41.15	201.13

#### 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliance Turn-In	3,347	0.47	99.9%	97.0%
Penelec	Appliance Turn-In	3,113	0.43	97.8%	98.2%
Penn Power	Appliance Turn-In	789	0.10	96.8%	95.5%
WPP	Appliance Turn-In	3,765	0.50	99.4%	99.3%

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.

### 3.1.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

Data to support evaluation, measurement, and verification of this program are collected with remote online and telephone surveys. As a result, the PY11 evaluation was not altered due to COVID-19 induced social distancing measures.

### 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Appliance Turn-In	3,347	45.0%	1,506
Penelec	Appliance Turn-In	3,113	47.0%	1,463
Penn Power	Appliance Turn-In	789	51.0%	402
WPP	Appliance Turn-In	3,765	48.0%	1,807

#### 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 PY11. However, a full net impact evaluation was conducted by Tetra Tech in PY10. 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 PY11. 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**

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)						
PYRTD	3,350	0.49	3,183	0.44	815	0.10	3,787	0.51
PYVTD Gross	3,347	0.47	3,113	0.43	789	0.10	3,765	0.50
PYVTD Net	1,506	0.21	1,463	0.20	402	0.05	1,807	0.24
RTD	17,208	2.44	16,514	2.22	5,635	0.72	20,737	2.69
VTD Gross	16,909	2.33	15,498	2.07	4,890	0.63	20,188	2.62
VTD Net	7,994	1.10	7,062	0.94	2,583	0.33	9,728	1.26

### 3.1.5 Process Evaluation

This program underwent process evaluation in PY10. 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<sup>7 8</sup>

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 2019 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

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<sup>7</sup> 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.

<sup>8</sup> 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 <sup>[1]</sup>	193		982		193		982	
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 <sup>[2]</sup>	3	1	4	99	3	1	4	99
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	56	81	202	386	56	81	202	386
7	Marketing <sup>[4]</sup>	23	87	61	444	23	87	61	444
8	Program Delivery <sup>[5]</sup>	0	325	0	1,447	0	325	0	1,447
9	EDC Evaluation Costs	33		112		33		112	
10	SWE Audit Costs	19		91		19		91	
11	Program Overhead Costs (Sum of rows 5 through 10)	628		2,845		628		2,845	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	628		2,591		628		2,591	
14	Total NPV Lifetime Electric Energy Benefits	899		3,988		405		1,889	
15	Total NPV Lifetime Electric Capacity Benefits	218		1,275		98		610	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	1,117		5,263		503		2,500	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.78		2.03		0.80		0.96	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	166		853		166		853	
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 <sup>[2]</sup>	3	1	4	92	3	1	4	92
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	61	73	223	353	61	73	223	353
7	Marketing <sup>[4]</sup>	26	75	60	395	26	75	60	395
8	Program Delivery <sup>[5]</sup>	0	292	0	1,324	0	292	0	1,324
9	EDC Evaluation Costs	35		121		35		121	
10	SWE Audit Costs	21		99		21		99	
11	Program Overhead Costs (Sum of rows 5 through 10)	586		2,672		586		2,672	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	586		2,431		586		2,431	
14	Total NPV Lifetime Electric Energy Benefits	791		3,394		372		1,546	
15	Total NPV Lifetime Electric Capacity Benefits	192		1,093		90		492	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	983		4,488		462		2,038	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.68		1.85		0.79		0.84	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	41		283		41		283	
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 <sup>[2]</sup>	0	0	0	36	0	0	0	36
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	11	21	49	134	11	21	49	134
7	Marketing <sup>[4]</sup>	6	19	18	134	6	19	18	134
8	Program Delivery <sup>[5]</sup>	0	84	0	499	0	84	0	499
9	EDC Evaluation Costs	8		27		8		27	
10	SWE Audit Costs	3		22		3		22	
11	Program Overhead Costs (Sum of rows 5 through 10)	151		919		151		919	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	151		839		151		839	
14	Total NPV Lifetime Electric Energy Benefits	204		1,102		104		582	
15	Total NPV Lifetime Electric Capacity Benefits	46		290		23		153	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	250		1,392		127		735	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.65		1.66		0.84		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 <sup>[1]</sup>	201		1,086		201		1,086	
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 <sup>[2]</sup>	3	1	4	114	3	1	4	114
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	56	84	209	430	56	84	209	430
7	Marketing <sup>[4]</sup>	24	92	61	510	24	92	61	510
8	Program Delivery <sup>[5]</sup>	0	337	0	1,607	0	337	0	1,607
9	EDC Evaluation Costs	33		112		33		112	
10	SWE Audit Costs	17		84		17		84	
11	Program Overhead Costs (Sum of rows 5 through 10)	647		3,129		647		3,129	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	647		2,857		647		2,857	
14	Total NPV Lifetime Electric Energy Benefits	961		4,530		461		2,181	
15	Total NPV Lifetime Electric Capacity Benefits	227		1,219		109		585	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	1,188		5,748		570		2,766	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.84		2.01		0.88		0.97	
<p>[1] Includes direct install equipment costs and costs for EE&amp;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</p>									

**3.1.7 Status of Recommendations**

The most recent process evaluation for this program occurred in PY10. Findings and recommendations from that process evaluation effort are available in the PY10 annual report.

## 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, Residential Energy Audits, New Homes, and Behavioral Demand Response.

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 PY11 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	158,549	166,330	23,735	154,213
PYRTD MWh/yr	40,059	30,967	6,289	25,842
PYRTD MW/yr	6.16	3.81	1.28	5.11
PYTD Incentives (\$1000)	2,291.25	2,006.34	296.25	786.18

### 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	EE Kits	12,395	1.45	95.9%	100.7%
Met-Ed	Home Energy Reports	23,668	2.67	95.5%	70.1%
Met-Ed	Direct Install	75	0.01	95.6%	96.0%
Met-Ed	New Homes	1,770	0.84	78.1%	93.5%
<b>Met-Ed Total</b>		<b>37,908</b>	<b>4.97</b>	<b>95%</b>	<b>81%</b>
Penelec	EE Kits	14,132	1.48	92.1%	97.1%
Penelec	Home Energy Reports	12,527	1.40	83.2%	65.5%
Penelec	Direct Install	212	0.02	98.4%	90.5%
Penelec	New Homes	308	0.11	90.7%	93.6%
<b>Penelec Total</b>		<b>27,179</b>	<b>3.02</b>	<b>88%</b>	<b>79%</b>
Penn Power	EE Kits	123	0.01	92.2%	94.3%
Penn Power	Home Energy Reports	5,625	0.63	108.0%	79.5%
Penn Power	Direct Install	17	0.00	103.2%	100.7%
Penn Power	New Homes	776	0.44	83.4%	92.8%
<b>Penn Power Total</b>		<b>6,540</b>	<b>1.08</b>	<b>104%</b>	<b>85%</b>
WPP	EE Kits	843	0.11	102.4%	109.6%
WPP	Home Energy Reports	17,774	1.93	78.2%	46.7%
WPP	Direct Install	239	0.03	98.0%	106.6%
WPP	New Homes	1,456	0.77	70.7%	91.1%
<b>WPP Total</b>		<b>20,312</b>	<b>2.84</b>	<b>79%</b>	<b>56%</b>

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.

### 3.2.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

Data to support evaluation, measurement, and verification of the EE kits and Direct Install portions of the program are collected with remote online and telephone surveys, while customer billing data are used to evaluate the Home Energy Reports program component. As a result, the PY11 evaluation for these program components was not altered due to COVID-19 induced social distancing measures. Evaluation of the New Homes program component requires on-site visits. Fortunately, ADM completes field work by March for a given program year (homes that are completed after March tend to fall into the subsequent program year), so the PY11 evaluation effort for New Homes was not impacted by the COVID-19 pandemic.

### 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<sup>9</sup>.

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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	EE Kits	12,395	82.0%	10,161
Met-Ed	Home Energy Reports	23,668	100.0%	23,668
Met-Ed	Direct Install	75	95.0%	72
Met-Ed	New Homes	1,770	73.0%	1,292
<b>Met-Ed Total</b>		<b>37,908</b>	<b>92.8%</b>	<b>35,193</b>
Penelec	EE Kits	14,132	83.1%	11,748
Penelec	Home Energy Reports	12,527	100.0%	12,527
Penelec	Direct Install	212	103.0%	218
Penelec	New Homes	308	73.0%	225
<b>Penelec Total</b>		<b>27,179</b>	<b>90.9%</b>	<b>24,718</b>
Penn Power	EE Kits	123	82.6%	101
Penn Power	Home Energy Reports	5,625	100.0%	5,625
Penn Power	Direct Install	17	100.0%	17
Penn Power	New Homes	776	73.0%	567
<b>Penn Power Total</b>		<b>6,540</b>	<b>96.5%</b>	<b>6,310</b>
WPP	EE Kits	843	94.2%	794
WPP	Home Energy Reports	17,774	100.0%	17,774
WPP	Direct Install	239	104.0%	249
WPP	New Homes	1,456	73.0%	1,063
<b>WPP Total</b>		<b>20,312</b>	<b>97.9%</b>	<b>19,880</b>

### 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 PY11, 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.

<sup>9</sup> This estimation assumes that non-participant spillover is negligible.

### 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 PY11. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

**Table 81: PYTD and P3TD Savings Summary**

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)						
PYRTD	40,059	6.16	30,967	3.81	6,289	1.28	25,842	5.11
PYVTD Gross	37,908	4.97	27,179	3.02	6,540	1.08	20,312	2.84
PYVTD Net	35,193	4.48	24,718	2.74	6,310	0.96	19,880	2.63
RTD	195,412	26.96	150,120	18.85	42,351	6.84	159,022	26.17
VTD Gross	209,079	25.39	161,292	17.56	47,279	6.75	154,402	19.96
VTD Net	192,163	22.86	145,249	15.79	42,790	5.73	144,973	18.00

### 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 only program component to undergo process evaluation in PY11 was Behavioral Demand Response (BDR). The process evaluation for Behavioral Demand Response is described in section 3.8.4. 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%
<b>Program Total</b>		<b>822,218</b>	<b>2,242</b>	<b>7.6%</b>

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 qualitative 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 2019 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 <sup>[1]</sup>	2,291		12,103		2,291		12,103	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	1,241		7,190		916		5,551	
4	Incremental Measure Costs (Sum of rows 1 through 3)	3,532		19,294		3,207		17,654	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	10	64	13	748	10	64	13	748
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	223	831	793	3,976	223	831	793	3,976
7	Marketing <sup>[4]</sup>	95	164	139	972	95	164	139	972
8	Program Delivery <sup>[5]</sup>	0	974	0	3,381	0	974	0	3,381
9	EDC Evaluation Costs	187		615		187		615	
10	SWE Audit Costs	69		320		69		320	
11	Program Overhead Costs (Sum of rows 5 through 10)	2,617		10,957		2,617		10,957	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	6,149		27,555		5,825		26,039	
14	Total NPV Lifetime Electric Energy Benefits	3,793		24,528		3,195		20,569	
15	Total NPV Lifetime Electric Capacity Benefits	2,042		9,445		1,777		7,857	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,044		2,913		856		2,363	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	2,949		10,167		2,212		8,100	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	9,827		47,053		8,039		38,888	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.60		1.71		1.38		1.49	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	2,006		11,108		2,006		11,108	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	204		4,921		160		4,504	
4	Incremental Measure Costs (Sum of rows 1 through 3)	2,210		16,029		2,166		15,612	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	9	4	12	617	9	4	12	617
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	192	694	737	3,703	192	694	737	3,703
7	Marketing <sup>[4]</sup>	83	181	128	931	83	181	128	931
8	Program Delivery <sup>[5]</sup>	0	496	0	2,295	0	496	0	2,295
9	EDC Evaluation Costs	130		504		130		504	
10	SWE Audit Costs	64		303		64		303	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,853		9,232		1,853		9,232	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	4,064		23,048		4,019		22,651	
14	Total NPV Lifetime Electric Energy Benefits	2,863		21,702		2,456		18,412	
15	Total NPV Lifetime Electric Capacity Benefits	670		6,323		570		5,316	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,172		3,162		975		2,620	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	2,533		9,184		2,424		7,888	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	7,239		40,372		6,425		34,235	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.78		1.75		1.60		1.51	

[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 <sup>[1]</sup>	296		3,380		296		3,380	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	662		3,534		484		2,484	
4	Incremental Measure Costs (Sum of rows 1 through 3)	958		6,914		780		5,864	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	3	10	4	180	3	10	4	180
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	81	172	297	878	81	172	297	878
7	Marketing <sup>[4]</sup>	24	32	35	286	24	32	35	286
8	Program Delivery <sup>[5]</sup>	0	220	0	1,072	0	220	0	1,072
9	EDC Evaluation Costs	59		202		59		202	
10	SWE Audit Costs	21		96		21		96	
11	Program Overhead Costs (Sum of rows 5 through 10)	622		3,051		622		3,051	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	1,581		9,106		1,403		8,132	
14	Total NPV Lifetime Electric Energy Benefits	595		6,303		497		5,128	
15	Total NPV Lifetime Electric Capacity Benefits	508		3,062		419		2,392	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	11		576		9		450	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	1,114		3,089		813		2,382	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	2,228		13,030		1,739		10,353	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.41		1.43		1.24		1.27	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars.</p>									

**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 <sup>[1]</sup>	786		7,364		786		7,364	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	1,346		7,716		999		5,847	
4	Incremental Measure Costs (Sum of rows 1 through 3)	2,132		15,080		1,785		13,211	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	10	23	13	733	10	23	13	733
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	228	846	873	4,273	228	846	873	4,273
7	Marketing <sup>[4]</sup>	88	108	116	668	88	108	116	668
8	Program Delivery <sup>[5]</sup>	0	776	0	2,944	0	776	0	2,944
9	EDC Evaluation Costs	169		573		169		573	
10	SWE Audit Costs	63		295		63		295	
11	Program Overhead Costs (Sum of rows 5 through 10)	2,312		10,489		2,312		10,489	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	4,444		23,486		4,097		21,755	
14	Total NPV Lifetime Electric Energy Benefits	1,514		16,166		1,332		13,675	
15	Total NPV Lifetime Electric Capacity Benefits	1,004		6,521		846		5,254	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	74		617		69		504	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	3,936		9,232		3,562		7,791	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	6,528		32,535		5,811		27,224	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.47		1.39		1.42		1.25	

[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

No program components (other than BDR which is described in Section 3.8.6) were evaluated in PY11. Findings and recommendations from previous process evaluation efforts are available in the PY8 and PY9, and PY10 annual reports.

### 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 PY11 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	319,500	14,591	8,897	342,988
PYRTD MWh/yr	31,545	1,379	841	33,766
PYRTD MW/yr	3.98	0.16	0.10	4.24
PYTD Incentives (\$1000)	1,585.47	38.57	23.52	1,648

**Table 88: EEP Program Participation and Reported Impacts for Penelec**

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	304,436	14,110	8,604	327,150
PYRTD MWh/yr	32,877	1,483	904	35,263
PYRTD MW/yr	3.72	0.16	0.10	3.97
PYTD Incentives (\$1000)	1,240.31	36.76	22.41	1,299

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

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	118,299	5,361	3,269	126,929
PYRTD MWh/yr	14,766	660	403	15,828
PYRTD MW/yr	1.87	0.08	0.05	1.99
PYTD Incentives (\$1000)	562.52	14.80	9.03	586

**Table 90: EEP Program Participation and Reported Impacts for WPP**

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	331,647	14,970	9,128	355,744
PYRTD MWh/yr	37,597	1,651	1,007	40,255
PYRTD MW/yr	5.12	0.21	0.13	5.46
PYTD Incentives (\$1000)	1,716.72	41.11	25.07	1,783

### 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Upstream Lighting	35,308	4.49	113.5%	121.5%
Met-Ed	Upstream Electronics	207	0.02	118.2%	114.8%
Met-Ed	HVAC	2,156	0.43	174.5%	115.4%
Met-Ed	Appliances	1,760	0.22	140.0%	142.4%
<b>Met-Ed Total</b>		<b>39,431</b>	<b>5.17</b>	<b>117%</b>	<b>122%</b>
Penelec	Upstream Lighting	36,963	4.30	110.6%	122.1%
Penelec	Upstream Electronics	108	0.01	122.9%	118.1%
Penelec	HVAC	2,111	0.35	220.9%	108.3%
Penelec	Appliances	1,063	0.15	134.8%	133.7%
<b>Penelec Total</b>		<b>40,245</b>	<b>4.81</b>	<b>114%</b>	<b>121%</b>
Penn Power	Upstream Lighting	16,800	2.10	112.9%	121.5%
Penn Power	Upstream Electronics	76	0.01	115.4%	110.6%
Penn Power	HVAC	643	0.28	121.7%	139.2%
Penn Power	Appliances	484	0.08	139.0%	139.7%
<b>Penn Power Total</b>		<b>18,003</b>	<b>2.47</b>	<b>114%</b>	<b>124%</b>
WPP	Upstream Lighting	41,676	5.60	111.9%	117.2%
WPP	Upstream Electronics	313	0.04	116.5%	112.8%
WPP	HVAC	2,698	0.58	164.7%	116.4%
WPP	Appliances	1,552	0.21	138.7%	138.6%
<b>WPP Total</b>		<b>46,239</b>	<b>6.42</b>	<b>115%</b>	<b>118%</b>

The gross realization rates for energy savings were driven primarily by the realization rates of the upstream lighting programs, which account for most of the program impacts. The reported impacts for upstream lighting are somewhat conservative because reported impacts do not include additional savings contributions from cross sector sales. Reported impacts for HVAC, appliances, and electronics were also conservative and the realization rates reflect measure impacts as calculated with measure-specific attributes using corresponding protocols in the TRM.

### 3.3.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

Data to support evaluation, measurement, and verification of this program are collected with remote online and telephone surveys. As a result, the PY11 evaluation was not altered due to COVID-19 induced social distancing measures.

### 3.3.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for the HVAC and Appliances portion of this program in PY11, while all components were also evaluated in previous years. 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Upstream Lighting	35,308	29.0%	10,239
Met-Ed	Upstream Electronics	207	58.3%	121
Met-Ed	HVAC	2,156	50.7%	1,093
Met-Ed	Appliances	1,760	50.2%	883
<b>Met-Ed Total</b>		<b>39,431</b>	<b>31.3%</b>	<b>12,337</b>
Penelec	Upstream Lighting	36,963	31.0%	11,459
Penelec	Upstream Electronics	108	58.3%	63
Penelec	HVAC	2,111	52.3%	1,104
Penelec	Appliances	1,063	60.0%	638
<b>Penelec Total</b>		<b>40,245</b>	<b>33.0%</b>	<b>13,263</b>
Penn Power	Upstream Lighting	16,800	26.0%	4,368
Penn Power	Upstream Electronics	76	58.3%	44
Penn Power	HVAC	643	54.8%	352
Penn Power	Appliances	484	56.2%	272
<b>Penn Power Total</b>		<b>18,003</b>	<b>28.0%</b>	<b>5,037</b>
WPP	Upstream Lighting	41,676	23.0%	9,585
WPP	Upstream Electronics	313	58.3%	182
WPP	HVAC	2,698	52.0%	1,403
WPP	Appliances	1,552	64.7%	1,004
<b>WPP Total</b>		<b>46,239</b>	<b>26.3%</b>	<b>12,175</b>

**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 PY11. 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**

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)						
PYRTD	33,766	4.24	35,263	3.97	15,828	1.99	40,255	5.46
PYVTD Gross	39,431	5.17	40,245	4.81	18,003	2.47	46,239	6.42
PYVTD Net	12,337	1.65	13,263	1.61	5,037	0.75	12,175	1.75
RTD	112,368	14.27	125,077	14.12	44,302	5.49	130,150	17.77
VTD Gross	142,030	19.16	152,388	18.47	55,727	7.45	160,723	22.61
VTD Net	48,679	6.69	51,458	6.34	18,095	2.52	44,219	6.42

### 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. PY11 process evaluation activities focused on the HVAC and Appliances program components.

**Table 94: EEP Program Process Evaluation Sample Design**

EDC	Measure	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%
Met-Ed	Appliances and HVAC	Customer Surveys (PY11)	4,200	179	25.6%
Penelec	Appliances and HVAC		7,586	199	26.6%
Penn Power	Appliances and HVAC		4,379	165	27.0%
WPP	Appliances and HVAC		3,675	191	26.4%
Met-Ed	Appliances and HVAC	Appliance Retailer Surveys (PY11)	297	44	17.4%
Penelec	Appliances and HVAC		233	35	22.7%
Penn Power	Appliances and HVAC		79	7	17.9%
WPP	Appliances and HVAC		258	38	20.3%
All EDCs	Midstream Appliances	Retailer Interviews (PY11)	54	3	5.6%
All EDCs	HVAC and Water Heating	Participating Contractor Interviews (PY11)	894	6	9.4%
All EDCs	HVAC and Water Heating	Nonparticipating Contractor Interviews (PY11)	na	6	9.4%
<b>Program Total</b>			<b>1,214,936</b>	<b>2,534</b>	<b>25.3%</b>

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 in PY9 since they are both downstream delivery that provide incentives directly to customers. In PY11, the

two programs were again combined for evaluation, although since PY9 the Companies have added midstream offerings for dehumidifiers and heat pump water heaters.

The PY11 process evaluation kicked off with interviews of FirstEnergy and ICSP program staff. The evaluation followed up with a participant customer survey, a survey of participating appliance retailers, and interviews with midstream appliance retailers, HVAC and water heating contractors, and nonparticipating HVAC and water heating contractors. Researchable issues focused on program awareness and marketing, interactions with contractors and retailers, retailer perspectives on appliance attributes that are important to customers, barriers to participation, satisfaction, and participation in the low-income appliance component. The survey sample was randomly selected for each EDC. 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 2019 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 not to use the dual baselines, gross and net TRCs for the Energy Efficient Products program would increase by 64% and 55% respectively, 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**

EDC	Gross		Net	
	Dual Baseline	Without Dual Baseline	Dual Baseline	Without Dual Baseline
Met-Ed	1.27	2.10	0.87	1.38
Penelec	1.37	2.29	0.95	1.52
Penn Power	1.70	2.78	1.13	1.75
WPP	1.27	2.03	0.78	1.14
Average	1.40	2.30	0.93	1.45

**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 <sup>[1]</sup>	1,648		7,120		1,648		7,120	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	7,243		24,107		1,987		5,442	
4	Incremental Measure Costs (Sum of rows 1 through 3)	8,891		31,226		3,634		12,561	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	4	1	5	141	4	1	5	141
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	85	251	225	757	85	251	225	757
7	Marketing <sup>[4]</sup>	34	44	56	284	34	44	56	284
8	Program Delivery <sup>[5]</sup>	0	586	0	2,087	0	586	0	2,087
9	EDC Evaluation Costs	155		477		155		477	
10	SWE Audit Costs	27		129		27		129	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,188		4,162		1,188		4,162	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	10,079		31,891		4,822		15,088	
14	Total NPV Lifetime Electric Energy Benefits	6,195		27,908		2,140		10,058	
15	Total NPV Lifetime Electric Capacity Benefits	1,623		9,681		569		3,567	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	5,101		16,237		1,479		5,309	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-162		-1,833		19		-528	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	12,756		51,994		4,208		18,405	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.27		1.63		0.87		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

**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 <sup>[1]</sup>	1,299		6,193		1,299		6,193	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	6,280		20,503		1,922		4,609	
4	Incremental Measure Costs (Sum of rows 1 through 3)	7,579		26,697		3,221		10,802	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	4	2	5	152	4	2	5	152
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	88	243	239	757	88	243	239	757
7	Marketing <sup>[4]</sup>	35	30	57	239	35	30	57	239
8	Program Delivery <sup>[5]</sup>	0	566	0	2,113	0	566	0	2,113
9	EDC Evaluation Costs	150		459		150		459	
10	SWE Audit Costs	28		131		28		131	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,145		4,152		1,145		4,152	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	8,724		27,754		4,366		13,434	
14	Total NPV Lifetime Electric Energy Benefits	5,863		28,982		2,118		10,159	
15	Total NPV Lifetime Electric Capacity Benefits	1,415		9,598		517		3,382	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	5,087		17,240		1,577		5,594	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-391		-3,309		-68		-1,008	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	11,974		52,510		4,145		18,128	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.37		1.89		0.95		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

**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 <sup>[1]</sup>	586		2,192		586		2,192	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	2,177		7,126		474		1,557	
4	Incremental Measure Costs (Sum of rows 1 through 3)	2,764		9,319		1,061		3,749	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	1	0	1	33	1	0	1	33
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	21	85	25	220	21	85	25	220
7	Marketing <sup>[4]</sup>	8	7	13	44	8	7	13	44
8	Program Delivery <sup>[5]</sup>	0	199	0	589	0	199	0	589
9	EDC Evaluation Costs	32		99		32		99	
10	SWE Audit Costs	6		30		6		30	
11	Program Overhead Costs (Sum of rows 5 through 10)	360		1,053		360		1,053	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	3,124		9,262		1,421		4,301	
14	Total NPV Lifetime Electric Energy Benefits	2,527		10,048		780		3,499	
15	Total NPV Lifetime Electric Capacity Benefits	745		2,918		257		1,064	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	2,254		6,164		586		1,934	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-202		-921		-18		-256	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	5,324		18,209		1,605		6,240	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.70		1.97		1.13		1.45	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars.</p>									

**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 <sup>[1]</sup>	1,783		7,565		1,783		7,565	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	7,817		25,404		2,023		4,809	
4	Incremental Measure Costs (Sum of rows 1 through 3)	9,600		32,968		3,806		12,373	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	4	2	6	165	4	2	6	165
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	98	297	337	874	98	297	337	874
7	Marketing <sup>[4]</sup>	40	113	63	569	40	113	63	569
8	Program Delivery <sup>[5]</sup>	0	693	0	2,414	0	693	0	2,414
9	EDC Evaluation Costs	174		518		174		518	
10	SWE Audit Costs	28		135		28		135	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,449		5,081		1,449		5,081	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	11,050		34,273		5,255		15,702	
14	Total NPV Lifetime Electric Energy Benefits	6,818		28,724		2,119		8,536	
15	Total NPV Lifetime Electric Capacity Benefits	1,925		10,987		610		3,279	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	5,794		17,577		1,333		4,336	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-488		-3,599		21		-694	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	14,049		53,690		4,084		15,456	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.27		1.57		0.78		0.98	
<p>[1] Includes direct install equipment costs and costs for EE&amp;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</p>									

### 3.3.7 Status of Recommendations

The process evaluation activities in PY11 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, PY9, and PY10 annual reports.

### 3.3.7.1 HVAC and Water Heating Measures

The PY11 process evaluation resulted in the following findings and recommendations.

**Finding #1:** *The program is challenged by high incremental costs for efficient equipment. All interviewed contractors felt rebate levels were insufficient to cover the incremental cost of efficient HVAC and water heating equipment.*

**Recommendation #1:** *Consider increasing rebate amounts to cover a greater portion of the incremental cost.*

**EDC Status Report #1:** Recommendation under consideration.

**Finding #2:** *Contractors are having a difficult time obtaining AHRI numbers for HVAC units. Five of the six participating HVAC contractors that were interviewed found the AHRI website difficult to navigate and reported having to call manufacturers to obtain AHRI certificates.*

**Recommendation #2:** *Consider accepting alternate information in place of the AHRI number on the rebate application or find a way to make it easier for contractors to look them up. The program ICSP or EM&V vendor may provide support with the latter option.*

**EDC Status Report #2:** Recommendation under consideration for Phase IV.

### 3.3.7.2 Appliances Subprogram (Downstream and Midstream)

The PY11 process evaluation resulted in the following findings and recommendations.

**Finding #1:** *Twenty-two percent of retailers surveyed said they were not aware that FirstEnergy offers downstream rebates to customers for select energy-efficient appliances.*

**Recommendation #1:** *Look for ways to educate more retail stores on the rebates available from FirstEnergy to inform their customers.*

**EDC Status Report #1:** Recommendation accepted.

**Finding #2:** *Ten percent of retailers surveyed are located outside of FirstEnergy's service territories.*

**Recommendation #2:** *Consider expanding awareness of downstream rebates to retail stores in areas just outside FirstEnergy's service territories.*

**EDC Status Report #2:** Recommendation accepted.

**Finding #3:** *While program satisfaction is high with midstream retailers and the distributor, lack of signage and brochures was the reason for the somewhat satisfied response by one midstream retailer. All interviewed said the signage, stickers, and brochures help promote sales of more energy-efficient appliances.*

**Recommendation #3:** *Provide more marketing materials for midstream retailers.*

**EDC Status Report #3:** Recommendation accepted.

**Finding #4:** *A major distributor of heat pump water heaters said the midstream appliance program is a great approach to move volume in sales of equipment. It also creates more demand among plumbers and other trades.*

**Recommendation #4:** *Consider moving more appliances to the midstream or upstream approach*

**EDC Status Report #4:** Recommendation under consideration for Phase IV.

### 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 PY11 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	13,030	17,553	3,518	15,821
PYRTD MWh/yr	3,638	3,540	1,087	3,829
PYRTD MW/yr	0.51	0.43	0.15	0.57
PYTD Incentives (\$1000)	74.57	142.88	14.75	64.22

### 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliances	23	0.00	122.9%	115.6%
Met-Ed	Appliance Turn-In	527	0.08	104.6%	103.7%
Met-Ed	Direct Install	963	0.10	103.6%	105.1%
Met-Ed	Home Energy Reports	2,554	0.29	120.2%	87.7%
Met-Ed	Kits	16	0.00	120.9%	157.3%
Met-Ed	New Homes	39	0.01	78.1%	93.5%
<b>Met-Ed Total</b>		<b>4,121</b>	<b>0.48</b>	<b>113%</b>	<b>94%</b>
Penelec	Appliances	32	0.00	113.9%	106.2%
Penelec	Appliance Turn-In	662	0.09	93.9%	93.6%
Penelec	Direct Install	1,176	0.11	107.2%	108.8%
Penelec	Home Energy Reports	1,745	0.19	124.2%	97.0%
Penelec	Kits	0	0.00	0.0%	0.0%
Penelec	New Homes	277	0.03	90.7%	93.6%
<b>Penelec Total</b>		<b>3,892</b>	<b>0.43</b>	<b>110%</b>	<b>99%</b>
Penn Power	Appliances	10	0.00	125.8%	119.7%
Penn Power	Appliance Turn-In	129	0.02	95.8%	97.8%
Penn Power	Direct Install	390	0.04	111.3%	108.5%
Penn Power	Home Energy Reports	560	0.06	94.3%	70.5%
Penn Power	Kits	0	0.00	100.0%	100.0%
Penn Power	New Homes	0	0.00	83.4%	92.8%
<b>Penn Power Total</b>		<b>1,089</b>	<b>0.12</b>	<b>100%</b>	<b>84%</b>
WPP	Appliances	27	0.00	119.9%	112.4%
WPP	Appliance Turn-In	604	0.09	100.3%	101.4%
WPP	Direct Install	1,352	0.14	101.7%	104.3%
WPP	Home Energy Reports	1,647	0.18	90.1%	53.5%
WPP	Kits	26	0.00	62.4%	67.6%
WPP	New Homes	5	0.00	70.7%	91.1%
<b>WPP Total</b>		<b>3,660</b>	<b>0.42</b>	<b>96%</b>	<b>74%</b>

The gross realization rates for energy savings were driven primarily by the two largest components, Home Energy Reports and Direct Install. The smaller program components: Appliances, Kits, and New Homes, had more variability in realization rates than the larger program components.

### 3.4.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

As discussed in previous sections, the evaluation effort for the Appliances, Appliance Turn-In, Home Energy Reports, Kits, and New Homes components were not impacted by the COVID-19 pandemic. Evaluation of the Direct Install component does require on-site inspections. Fortunately, on-site inspections are performed shortly after measure installation and an adequate number of inspections occurred during the first three quarters of the year. There were no inspections conducted in Q4 of PY11, but there were also relatively few measures installed in that quarter. The data collected in the first three quarters of the program year are representative of the installations that occurred in PY11.

### 3.4.3 Net Impact Evaluation

Net impact evaluation was not formally conducted for this program in PY11, in accordance with our evaluation 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 of 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 PY11. 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**

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)						
PYRTD	3,638	0.51	3,540	0.43	1,087	0.15	3,829	0.57
PYVTD Gross	4,121	0.48	3,892	0.43	1,089	0.12	3,660	0.42
PYVTD Net	4,121	0.48	3,892	0.43	1,089	0.12	3,660	0.42
RTD	34,119	4.25	35,144	4.10	11,000	1.38	33,719	4.53
VTD Gross	38,875	4.50	38,730	4.15	11,199	1.31	35,042	4.12
VTD Net	38,875	4.50	38,730	4.15	11,199	1.31	35,042	4.12

### 3.4.5 Process Evaluation

Tetra Tech conducted a process evaluation for this program in PY8, and again in PY11. The PY11 process evaluation for the Low-Income WARM and Multifamily components began with an interview of the program managers, followed by interviews with energy specialists (auditors and installers), and customer surveys.

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 for the WARM and Multifamily process evaluation is shown in Table 103. Please note that the population counts in the table are from PY8 and PY11 as indicated under the “Activity” column.

**Table 103: LIP Program Process Evaluation Sample Design**

EDC	Measure	Activity	Population Size	Achieved Sample Size	Response Rate
Met-Ed	Dired Install	Customer Surveys (PY8)	1,551	80	30.0%
Penn Power	Dired Install		2,433	85	38.0%
Penelec	Dired Install		842	73	36.0%
WPP	Dired Install		1,954	101	35.0%
Met-Ed	Dired Install	Customer Surveys (PY11)	818	105	25.0%
Penn Power	Dired Install		1,391	105	25.0%
Penelec	Dired Install		572	94	25.0%
WPP	Dired Install		1,117	105	25.0%
All EDCs	Dired Install	Energy Specialist Interviews (PY11)	30	9	30.0%

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 2019 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 <sup>[1]</sup>	75		352		75		352	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	23		77		23		77	
4	Incremental Measure Costs (Sum of rows 1 through 3)	97		429		97		429	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	8	3	10	203	8	3	10	203
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	135	101	598	1,187	135	101	598	1,187
7	Marketing <sup>[4]</sup>	64	124	78	496	64	124	78	496
8	Program Delivery <sup>[5]</sup>	108	835	429	8,194	108	835	429	8,194
9	EDC Evaluation Costs	115		432		115		432	
10	SWE Audit Costs	52		252		52		252	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,544		11,877		1,544		11,877	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	1,641		11,352		1,641		11,352	
14	Total NPV Lifetime Electric Energy Benefits	539		6,445		539		6,445	
15	Total NPV Lifetime Electric Capacity Benefits	121		1,823		121		1,823	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1		489		1		489	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	80		726		80		726	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	741		9,483		741		9,483	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.45		0.84		0.45		0.84	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	143		411		143		411	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	43		80		43		80	
4	Incremental Measure Costs (Sum of rows 1 through 3)	186		491		186		491	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	8	3	11	222	8	3	11	222
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	143	104	664	1,224	143	104	664	1,224
7	Marketing <sup>[4]</sup>	70	103	83	420	70	103	83	420
8	Program Delivery <sup>[5]</sup>	99	960	522	8,081	99	960	522	8,081
9	EDC Evaluation Costs	114		460		114		460	
10	SWE Audit Costs	56		265		56		265	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,659		11,951		1,659		11,951	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	1,845		11,447		1,845		11,447	
14	Total NPV Lifetime Electric Energy Benefits	690		6,952		690		6,952	
15	Total NPV Lifetime Electric Capacity Benefits	136		1,832		136		1,832	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		434		0		434	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	204		787		204		787	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	1,030		10,005		1,030		10,005	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.56		0.87		0.56		0.87	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	15		121		15		121	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	4		56		4		56	
4	Incremental Measure Costs (Sum of rows 1 through 3)	19		177		19		177	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	2	1	3	55	2	1	3	55
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	44	23	200	307	44	23	200	307
7	Marketing <sup>[4]</sup>	19	33	23	140	19	33	23	140
8	Program Delivery <sup>[5]</sup>	50	284	223	2,392	50	284	223	2,392
9	EDC Evaluation Costs	39		150		39		150	
10	SWE Audit Costs	16		76		16		76	
11	Program Overhead Costs (Sum of rows 5 through 10)	512		3,570		512		3,570	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	530		3,447		530		3,447	
14	Total NPV Lifetime Electric Energy Benefits	162		2,072		162		2,072	
15	Total NPV Lifetime Electric Capacity Benefits	32		517		32		517	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		140		0		140	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	4		139		4		139	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	199		2,869		199		2,869	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.37		0.83		0.37		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.

**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 <sup>[1]</sup>	64		306		64		306	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	16		62		16		62	
4	Incremental Measure Costs (Sum of rows 1 through 3)	80		368		80		368	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	7	3	9	199	7	3	9	199
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	129	159	584	1,126	129	159	584	1,126
7	Marketing <sup>[4]</sup>	60	126	72	529	60	126	72	529
8	Program Delivery <sup>[5]</sup>	119	2,738	469	9,636	119	2,738	469	9,636
9	EDC Evaluation Costs	120		458		120		458	
10	SWE Audit Costs	44		213		44		213	
11	Program Overhead Costs (Sum of rows 5 through 10)	3,504		13,295		3,504		13,295	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	3,584		12,428		3,584		12,428	
14	Total NPV Lifetime Electric Energy Benefits	596		6,027		596		6,027	
15	Total NPV Lifetime Electric Capacity Benefits	130		1,560		130		1,560	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	5		387		5		387	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	49		570		49		570	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	779		8,544		779		8,544	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.22		0.69		0.22		0.69	

[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

The process evaluation activities in PY11 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. Earlier recommendations from the PY8 evaluation are available in the PY8 report.

**Finding #1:** *Overall, most participants learn about the program through word-of-mouth, but results vary by subprogram.* Word-of-mouth was the most effective method for multifamily participants. Single-family participants were more likely to become aware of the program through bill inserts or direct mailing.

**Finding #2:** *The program influences participants' energy-saving behaviors.* Over 80 percent attributed the energy-saving actions they took after participating in the program to what they learned from the energy assessment.

**Finding #3:** *Most equipment received through the program is still installed.* Less than 10 percent of participants removed the equipment that was installed through the program. The most common equipment removed was LED bulbs due to the bulbs being broken or burned out.

**Finding #4:** *Energy specialists provide respondents with clear explanations of the actions they are taking in the participant's home.* Almost 90 percent of participants said that their energy specialist explained what they were doing in their home, and of those, all but three said that they were able to understand the explanation they were given.

**Finding #5:** *Participants and energy specialists are very satisfied with the program.* Three-fourths of participants rated their overall satisfaction with the program as a 10 on a scale of 1 to 10, where 1 was "very dissatisfied," and 10 was "very satisfied." The highest-rated aspects of the program were interactions with program staff, the quality of the items received through the program, and interactions with the energy specialist. All but one energy specialist rated their satisfaction with the program as "very satisfied."

**Finding #6:** *Participants are interested in receiving additional types of equipment through the program.* When asked if there was anything FirstEnergy could do to improve the program, the most common response was to offer additional types of equipment.

**Finding #7:** *Energy specialists are very satisfied with the LEEN tracking data system.* All but one rated the ease of use of the LEEN tracking system as a 5, on a scale of 1 to 5 where 1 was "very difficult," and 5 was "very easy."

**Finding #8:** *Some energy specialists experienced difficulties completing projects with customers who express interest in the program.* The main barriers for energy specialists were scheduling visits with the customer and being able to complete the necessary work in customer homes because multiple visits may be needed.

**Finding #9:** *Some energy specialists reported difficulties with the transition of program goals from participation to savings.* These difficulties centered around being able to track project savings to adhere to quarterly goals. Energy specialists now have to rely on the TRM to calculate project savings, although certain measures such as insulation cannot be estimated until a project is complete.

**Recommendation #1:** *Continue using bill inserts and direct mailings to market the program to customers.* Bill inserts were the most effective source of program awareness among single-family participants. Word-of-mouth was most effective for multifamily participants.

**EDC Status Report #1:** Recommendation accepted.

**Recommendation #2:** *Consider expanding the types of equipment offered through the program.* Participants expressed interest in receiving additional types of equipment, including doors, windows, insulation, weatherstripping, water heaters, and freezers.

**EDC Status Report #2:** Some measures such as doors or windows may not be cost effective in most situations. All of the other measures are offered, but only on an as-needed basis per appliance kWh monitoring, energy audit findings and based on whether the customer has electric heat or electric water heat.

**Recommendation #3:** *Provide additional support to energy specialists for understanding the TRM and tracking savings for the program.* One of the difficulties reported by energy specialists was keeping track of savings goals, so providing additional assistance would facilitate their participation.

**EDC Status Report #3:** The Companies will explore methods to simplify tracking of impacts and provide more training in this area for energy specialists.

**Recommendation #4:** *Continue supporting energy specialists for their time working through customer scheduling difficulties.* Trade allies appreciate that FirstEnergy reimbursed them for no-show appointments and provided guidance when there were issues with the customer. Continuing to provide this support will be beneficial to the energy specialists participating in the program.

**EDC Status Report #4:** Recommendation accepted.

### 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 was implemented jointly by Sodexo and ARCA for PY11; FirstEnergy’s relationship with Sodexo ended April 24, 2020 with FirstEnergy managing those C&I programs for the remainder of PY11. 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 PY11 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	375	57	432	603	104	707
PYRTD MWh/yr	20,812	1,161	21,973	22,057	4,291	26,348
PYRTD MW/yr	3.17	0.18	3.35	3.09	0.65	3.75
PYTD Incentives (\$1000)	921.74	59.89	981.63	1,054.05	229.20	1,283.26

**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	233	32	265	665	100	765
PYRTD MWh/yr	15,280	869	16,149	26,827	4,560	31,387
PYRTD MW/yr	2.00	0.14	2.14	3.74	0.64	4.38
PYTD Incentives (\$1000)	715.43	44.95	760.38	1,320.28	227.03	1,547.31

#### 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Lighting	18,365	2.65	93%	87%
Met-Ed	Custom	1,756	0.22	99%	102%
Met-Ed	Prescriptive	133	0.04	100%	81%
Met-Ed	Appliance Turn-In	62	0.01	109%	101%
Met-Ed	Direct Install	241	0.02	109%	109%
<b>Met-Ed Total</b>		<b>20,557</b>	<b>2.95</b>	<b>94%</b>	<b>88%</b>
Penelec	Lighting	23,120	3.23	101%	95%
Penelec	Custom	3,063	0.28	101%	98%
Penelec	Prescriptive	90	0.02	101%	88%
Penelec	Appliance Turn-In	57	0.01	85%	86%
Penelec	Direct Install	334	0.03	104%	104%
<b>Penelec Total</b>		<b>26,663</b>	<b>3.57</b>	<b>101%</b>	<b>95%</b>
Penn Power	Lighting	14,884	1.95	100%	99%
Penn Power	Custom	1,259	0.16	105%	106%
Penn Power	Prescriptive	82	0.01	112%	121%
Penn Power	Appliance Turn-In	10	0.00	108%	96%
Penn Power	Direct Install	31	0.00	95%	95%
<b>Penn Power Total</b>		<b>16,267</b>	<b>2.12</b>	<b>101%</b>	<b>99%</b>
WPP	Lighting	23,563	3.93	98%	113%
WPP	Custom	7,294	0.44	108%	54%
WPP	Prescriptive	422	0.06	102%	96%
WPP	Appliance Turn-In	59	0.01	90%	90%
WPP	Direct Install	4	0.00	86%	94%
<b>WPP Total</b>		<b>31,342</b>	<b>4.45</b>	<b>100%</b>	<b>102%</b>

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.

### 3.5.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

This program's gross impact evaluation typically involves on-site visits, with occasional metering of equipment and monitoring lighting hours of use. ADM evaluates all lighting projects with expected savings above 750 MWh and all custom projects with expected savings above 500 MWh prior to rebate approval. Therefore, all of the large lighting and custom projects for PY11 were evaluated prior to the COVID-related shutdowns. ADM stopped conducting on-site visits in March 2020. After this time, ADM replaced in-person visits with telephone interviews or virtual on-site visits with two-way video conferences. In some cases, ADM sent data loggers to customers, who then installed, removed, and sent them back to ADM for analysis. To the extent possible ADM relied on trending data from energy management systems and customer billing data, however billing analyses were conducted only if ADM could determine that facility operations were not impacted by COVID during the periods of interest.

### 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Lighting	18,365	63.6%	11,673
Met-Ed	Custom	1,756	55.4%	973
Met-Ed	Prescriptive	133	73.7%	98
Met-Ed	Appliance Turn-In	62	45.0%	28
Met-Ed	Direct Install	241	63.6%	153
<b>Met-Ed Total</b>		<b>20,557</b>	<b>62.9%</b>	<b>12,925</b>
Penelec	Lighting	23,120	77.5%	17,915
Penelec	Custom	3,063	83.6%	2,561
Penelec	Prescriptive	90	46.8%	42
Penelec	Appliance Turn-In	57	47.0%	27
Penelec	Direct Install	334	77.5%	259
<b>Penelec Total</b>		<b>26,663</b>	<b>78.0%</b>	<b>20,804</b>
Penn Power	Lighting	14,884	79.5%	11,832
Penn Power	Custom	1,259	52.5%	660
Penn Power	Prescriptive	82	40.2%	33
Penn Power	Appliance Turn-In	10	51.0%	5
Penn Power	Direct Install	31	79.5%	24
<b>Penn Power Total</b>		<b>16,267</b>	<b>77.2%</b>	<b>12,556</b>
WPP	Lighting	23,563	66.1%	15,572
WPP	Custom	7,294	55.9%	4,076
WPP	Prescriptive	422	42.9%	181
WPP	Appliance Turn-In	59	48.0%	28
WPP	Direct Install	4	66.1%	2
<b>WPP Total</b>		<b>31,342</b>	<b>63.4%</b>	<b>19,859</b>

### 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 Initiatives 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 PY11. 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**

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)						
PYRTD	21,973	3.35	26,348	3.75	16,149	2.14	31,387	4.38
PYVTD Gross	20,557	2.95	26,663	3.57	16,267	2.12	31,342	4.45
PYVTD Net	12,925	1.86	20,804	2.78	12,556	1.64	19,859	2.88
RTD	98,131	14.74	104,101	15.60	52,452	7.51	108,748	15.65
VTD Gross	95,836	14.39	102,029	14.74	51,260	7.32	110,299	15.46
VTD Net	60,109	9.08	79,688	11.66	38,303	5.47	79,808	11.27

### 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 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%
<b>Program Total</b>	<b>3,045</b>	<b>728</b>	<b>43%</b>

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 2019 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 <sup>[1]</sup>	982		4,348		982		4,348	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	4,251		18,076		2,279		9,625	
4	Incremental Measure Costs (Sum of rows 1 through 3)	5,232		22,424		3,261		13,973	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	5	26	8	120	5	26	8	120
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	132	269	305	1,254	132	269	305	1,254
7	Marketing <sup>[4]</sup>	41	133	41	581	41	133	41	581
8	Program Delivery <sup>[5]</sup>	118	317	319	1,142	118	317	319	1,142
9	EDC Evaluation Costs	283		739		283		739	
10	SWE Audit Costs	34		166		34		166	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,359		4,675		1,359		4,675	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	6,591		24,413		4,620		16,801	
14	Total NPV Lifetime Electric Energy Benefits	8,757		35,429		5,509		22,254	
15	Total NPV Lifetime Electric Capacity Benefits	2,238		10,486		1,411		6,626	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,409		-4,253		-871		-2,697	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	9,586		41,662		6,049		26,183	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.45		1.71		1.31		1.56	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	1,283		5,480		1,283		5,480	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	8,919		29,794		6,664		22,229	
4	Incremental Measure Costs (Sum of rows 1 through 3)	10,203		35,274		7,947		27,709	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	5	29	9	125	5	29	9	125
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	121	275	325	1,287	121	275	325	1,287
7	Marketing <sup>[4]</sup>	46	129	46	559	46	129	46	559
8	Program Delivery <sup>[5]</sup>	114	425	355	1,271	114	425	355	1,271
9	EDC Evaluation Costs	295		774		295		774	
10	SWE Audit Costs	37		176		37		176	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,476		4,927		1,476		4,927	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	11,678		36,035		9,423		29,290	
14	Total NPV Lifetime Electric Energy Benefits	10,720		35,588		8,366		27,904	
15	Total NPV Lifetime Electric Capacity Benefits	2,581		10,485		2,007		8,348	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,108		-4,292		-858		-3,414	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	12,193		41,781		9,515		32,838	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.04		1.16		1.01		1.12	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	760		2,701		760		2,701	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	4,300		12,210		3,103		8,287	
4	Incremental Measure Costs (Sum of rows 1 through 3)	5,061		14,911		3,864		10,987	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	1	19	2	59	1	19	2	59
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	49	191	111	629	49	191	111	629
7	Marketing <sup>[4]</sup>	11	26	11	113	11	26	11	113
8	Program Delivery <sup>[5]</sup>	41	165	111	507	41	165	111	507
9	EDC Evaluation Costs	70		185		70		185	
10	SWE Audit Costs	10		44		10		44	
11	Program Overhead Costs (Sum of rows 5 through 10)	583		1,774		583		1,774	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	5,643		14,802		4,446		11,300	
14	Total NPV Lifetime Electric Energy Benefits	6,536		17,873		5,054		13,373	
15	Total NPV Lifetime Electric Capacity Benefits	1,499		5,158		1,161		3,843	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,183		-2,390		-940		-1,853	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	6,852		20,641		5,275		15,364	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.21		1.39		1.19		1.36	

[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 <sup>[1]</sup>	1,547		5,630		1,547		5,630	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	9,482		33,026		5,258		22,577	
4	Incremental Measure Costs (Sum of rows 1 through 3)	11,029		38,656		6,806		28,207	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	6	111	11	278	6	111	11	278
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	143	485	351	1,698	143	485	351	1,698
7	Marketing <sup>[4]</sup>	48	188	48	816	48	188	48	816
8	Program Delivery <sup>[5]</sup>	129	551	342	1,643	129	551	342	1,643
9	EDC Evaluation Costs	336		837		336		837	
10	SWE Audit Costs	36		167		36		167	
11	Program Overhead Costs (Sum of rows 5 through 10)	2,034		6,192		2,034		6,192	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	13,063		40,377		8,839		31,169	
14	Total NPV Lifetime Electric Energy Benefits	12,715		38,696		8,072		28,171	
15	Total NPV Lifetime Electric Capacity Benefits	3,274		10,999		2,120		8,132	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,969		-5,143		-1,301		-3,816	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	14,021		44,552		8,891		32,486	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.07		1.10		1.01		1.04	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

### 3.5.7 Status of Recommendations

The most recent process evaluation for this program occurred in PY10. Findings and recommendations from that process evaluation effort are available in the PY10 annual report.

### 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 was implemented by Sodexo for PY11; FirstEnergy’s relationship with Sodexo ended April 24, 2020 with FirstEnergy managing those C&I programs for the remainder of PY11. 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 PY11 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	118	56	174	107	33	140
PYRTD MWh/yr	35,639	3,843	39,482	31,893	2,864	34,757
PYRTD MW/yr	4.86	0.74	5.60	3.87	0.38	4.25
PYTD Incentives (\$1000)	1,448.81	187.15	1,635.96	1,554.29	127.71	1,682.00

**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	19	7	26	78	25	103
PYRTD MWh/yr	5,149	227	5,376	22,022	4,228	26,250
PYRTD MW/yr	0.59	0.03	0.61	2.96	0.58	3.53
PYTD Incentives (\$1000)	249.73	11.37	261.10	1,058.98	210.86	1,269.84

#### 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 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Lighting	22,818	3.10	93%	87%
Met-Ed	Custom	14,698	2.06	99%	102%
Met-Ed	Prescriptive	10	0.00	100%	81%
<b>Met-Ed Total</b>		<b>37,526</b>	<b>5.17</b>	<b>95.0%</b>	<b>92.3%</b>
Penelec	Lighting	22,087	2.56	101%	95%
Penelec	Custom	13,016	1.51	101%	98%
Penelec	Prescriptive	63	0.02	101%	88%
<b>Penelec Total</b>		<b>35,166</b>	<b>4.08</b>	<b>101.2%</b>	<b>96.1%</b>
Penn Power	Lighting	3,930	0.42	100%	99%
Penn Power	Custom	1,528	0.19	105%	106%
Penn Power	Prescriptive	0	0.00	112%	121%
<b>Penn Power Total</b>		<b>5,459</b>	<b>0.62</b>	<b>101.5%</b>	<b>100.8%</b>
WPP	Lighting	22,449	3.38	98%	113%
WPP	Custom	3,402	0.27	108%	54%
WPP	Prescriptive	97	0.03	102%	96%
<b>WPP Total</b>		<b>25,948</b>	<b>3.69</b>	<b>98.8%</b>	<b>104.3%</b>

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.

### 3.6.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

This program's gross impact evaluation typically involves on-site visits, with occasional metering of equipment and monitoring lighting hours of use. ADM evaluates all lighting projects with expected savings above 750 MWh and all custom projects with expected savings above 500 MWh prior to rebate approval. Therefore, all of the large lighting and custom projects for PY11 were evaluated prior to the COVID-related shutdowns. ADM stopped conducting on-site visits in March 2020. After this time, ADM replaced in-person visits with telephone interviews or virtual

on-site visits with two-way video conferences. In some cases, ADM sent data loggers to customers, who then installed, removed, and sent them back to ADM for analysis. To the extent possible ADM relied on trending data from energy management systems and customer billing data, however billing analyses were conducted only if ADM could determine that facility operations were not impacted by COVID during the periods of interest.

### 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	22,818	63.6%	14,503
Met-Ed	Custom	14,698	55.4%	8,146
Met-Ed	Prescriptive	10	73.7%	7
<b>Met-Ed Total</b>		<b>37,526</b>	<b>60.4%</b>	<b>22,656</b>
Penelec	Lighting	22,087	77.5%	17,114
Penelec	Custom	13,016	83.6%	10,885
Penelec	Prescriptive	63	46.8%	29
<b>Penelec Total</b>		<b>35,166</b>	<b>79.7%</b>	<b>28,029</b>
Penn Power	Lighting	3,930	79.5%	3,125
Penn Power	Custom	1,528	52.5%	802
Penn Power	Prescriptive	0	40.2%	0
<b>Penn Power Total</b>		<b>5,459</b>	<b>71.9%</b>	<b>3,926</b>
WPP	Lighting	22,449	66.1%	14,835
WPP	Custom	3,402	55.9%	1,901
WPP	Prescriptive	97	42.9%	42
<b>WPP Total</b>		<b>25,948</b>	<b>64.7%</b>	<b>16,778</b>

#### 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 Initiatives 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 PY11. 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**

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)						
PYRTD	39,482	5.60	34,757	4.25	5,376	0.61	26,250	3.53
PYVTD Gross	37,526	5.17	35,166	4.08	5,459	0.62	25,948	3.69
PYVTD Net	22,656	3.12	28,029	3.25	3,926	0.44	16,778	2.40
RTD	142,226	19.44	146,493	17.92	28,576	3.31	103,622	12.74
VTD Gross	138,949	18.93	141,341	16.45	28,046	3.13	102,199	12.13
VTD Net	81,698	11.05	111,824	13.13	19,352	2.16	66,847	8.26

### 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 2019 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 <sup>[1]</sup>	1,636		6,461		1,636		6,461	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	10,710		34,339		5,639		16,791	
4	Incremental Measure Costs (Sum of rows 1 through 3)	12,346		40,800		7,275		23,253	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	4	44	5	169	4	44	5	169
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	123	294	259	1,271	123	294	259	1,271
7	Marketing <sup>[4]</sup>	32	88	32	379	32	88	32	379
8	Program Delivery <sup>[5]</sup>	62	473	155	1,817	62	473	155	1,817
9	EDC Evaluation Costs	315		812		315		812	
10	SWE Audit Costs	26		127		26		127	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,462		5,025		1,462		5,025	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	2,827		2,332		2,364		1,950	
13	Total NPV TRC Costs <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	16,635		43,664		11,102		27,364	
14	Total NPV Lifetime Electric Energy Benefits	15,946		51,396		9,636		30,198	
15	Total NPV Lifetime Electric Capacity Benefits	3,905		13,920		2,358		8,061	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,149		-4,294		43		-2,119	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	18,703		61,023		12,037		36,140	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.12		1.40		1.08		1.32	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	1,682		6,707		1,682		6,707	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	10,651		42,901		8,085		32,361	
4	Incremental Measure Costs (Sum of rows 1 through 3)	12,333		49,609		9,767		39,068	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	4	36	5	164	4	36	5	164
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	98	255	256	1,263	98	255	256	1,263
7	Marketing <sup>[4]</sup>	30	59	30	253	30	59	30	253
8	Program Delivery <sup>[5]</sup>	48	380	140	1,765	48	380	140	1,765
9	EDC Evaluation Costs	275		713		275		713	
10	SWE Audit Costs	24		113		24		113	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,206		4,703		1,206		4,703	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		2,288		0		1,914	
13	Total NPV TRC Costs <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	13,539		51,117		10,973		39,181	
14	Total NPV Lifetime Electric Energy Benefits	14,155		48,938		11,280		38,789	
15	Total NPV Lifetime Electric Capacity Benefits	2,965		11,321		2,361		9,058	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,149		-3,763		-890		-2,939	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	15,970		56,495		12,750		44,909	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.18		1.11		1.16		1.15	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	261		1,314		261		1,314	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	1,616		7,845		1,042		4,861	
4	Incremental Measure Costs (Sum of rows 1 through 3)	1,877		9,159		1,303		6,175	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	1	5	1	33	1	5	1	33
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	35	41	88	255	35	41	88	255
7	Marketing <sup>[4]</sup>	6	7	6	32	6	7	6	32
8	Program Delivery <sup>[5]</sup>	18	57	45	351	18	57	45	351
9	EDC Evaluation Costs	59		154		59		154	
10	SWE Audit Costs	6		26		6		26	
11	Program Overhead Costs (Sum of rows 5 through 10)	236		992		236		992	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	2,113		9,134		1,539		6,430	
14	Total NPV Lifetime Electric Energy Benefits	2,174		9,727		1,570		6,729	
15	Total NPV Lifetime Electric Capacity Benefits	432		2,142		308		1,479	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-314		-876		-250		-707	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	2,292		10,992		1,628		7,501	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.08		1.20		1.06		1.17	

[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 <sup>[1]</sup>	1,270		4,772		1,270		4,772	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	6,975		28,572		3,959		17,368	
4	Incremental Measure Costs (Sum of rows 1 through 3)	8,245		33,345		5,229		22,140	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	3	30	4	131	3	30	4	131
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	93	234	217	1,022	93	234	217	1,022
7	Marketing <sup>[4]</sup>	26	69	26	299	26	69	26	299
8	Program Delivery <sup>[5]</sup>	46	322	119	1,405	46	322	119	1,405
9	EDC Evaluation Costs	254		655		254		655	
10	SWE Audit Costs	19		94		19		94	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,098		3,972		1,098		3,972	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		192		0		160	
13	Total NPV TRC Costs <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	9,343		34,167		6,327		23,883	
14	Total NPV Lifetime Electric Energy Benefits	10,595		35,881		6,857		23,524	
15	Total NPV Lifetime Electric Capacity Benefits	2,718		8,453		1,771		5,812	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,876		-3,165		-1,240		-2,440	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	11,436		41,169		7,388		26,896	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.22		1.20		1.17		1.13	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

### 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 was implemented jointly by Sodexo and ARCA for PY11; FirstEnergy's relationship with Sodexo ended April 24, 2020 with FirstEnergy managing those C&I programs for the remainder of PY11. 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 PY11 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	13	91	1	84
PYRTD MWh/yr	202	623	2	865
PYRTD MW/yr	0.02	0.01	0.00	0.02
PYTD Incentives (\$1000)	7.93	31.10	0.12	14.66

#### 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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Lighting	187	0.01	93%	87%
Met-Ed	Prescriptive	0	0.00	100%	81%
Met-Ed	Appliance Turn-In	1	0.00	109%	101%
<b>Met-Ed Total</b>		<b>188</b>	<b>0.01</b>	<b>92.9%</b>	<b>86.8%</b>
Penelec	Lighting	617	0.01	101%	95%
Penelec	Prescriptive	12	0.00	101%	88%
Penelec	Appliance Turn-In	1	0.00	85%	86%
<b>PenelecTotal</b>		<b>630</b>	<b>0.01</b>	<b>101.2%</b>	<b>93.9%</b>
Penn Power	Lighting	2	0.00	100%	99%
Penn Power	Prescriptive	0	0.00	112%	121%
Penn Power	Appliance Turn-In	0	0.00	108%	96%
<b>Penn PowerTotal</b>		<b>2</b>	<b>0.00</b>	<b>100.4%</b>	<b>98.6%</b>
WPP	Lighting	842	0.02	98%	113%
WPP	Prescriptive	0	0.00	102%	96%
WPP	Appliance Turn-In	2	0.00	90%	90%
<b>WPP Total</b>		<b>844</b>	<b>0.02</b>	<b>97.6%</b>	<b>112.6%</b>

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 PY11**

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Lighting	187	63.6%	119
Met-Ed	Prescriptive	0	73.7%	0
Met-Ed	Appliance Turn-In	1	45.0%	0
<b>Met-Ed Total</b>		<b>188</b>	<b>63.5%</b>	<b>119</b>
Penelec	Lighting	617	77.5%	478
Penelec	Prescriptive	12	46.8%	6
Penelec	Appliance Turn-In	1	47.0%	0
<b>Penelec</b>		<b>630</b>	<b>76.8%</b>	<b>484</b>
Penn Power	Lighting	2	79.5%	2
Penn Power	Prescriptive	0	40.2%	0
Penn Power	Appliance Turn-In	0	51.0%	0
<b>Penn Power</b>		<b>2</b>	<b>79.5%</b>	<b>2</b>
WPP	Lighting	842	66.1%	557
WPP	Prescriptive	0	42.9%	0
WPP	Appliance Turn-In	2	48.0%	1
<b>WPP</b>		<b>844</b>	<b>66.0%</b>	<b>558</b>

**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 PY11. 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**

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)						
PYRTD	202	0.02	623	0.01	2	0.00	865	0.02
PYVTD Gross	188	0.01	630	0.01	2	0.00	844	0.02
PYVTD Net	119	0.01	484	0.01	2	0.00	558	0.01
RTD	2,061	0.04	3,427	0.07	2,034	0.07	20,467	0.20
VTD Gross	2,020	0.03	3,291	0.06	1,948	0.07	21,623	0.21
VTD Net	1,292	0.02	2,648	0.05	1,464	0.05	17,130	0.17

**3.7.4.1 Evaluation Adjustments in Response to the COVID-19 Pandemic**

This program's gross impact evaluation typically involves on-site visits, with occasional metering of equipment and monitoring lighting hours of use. ADM stopped conducting on-site visits in March 2020. After this time, ADM replaced in-person visits with telephone interviews or virtual

on-site visits with two-way video conferences. In some cases, ADM sent data loggers to customers, who then installed, removed, and send them back to ADM for analysis. To the extent possible ADM relied on trending data from energy management systems and customer billing data, however billing analyses were conducted only if ADM could determine that facility operations were not impacted by COVID during the periods of interest.

### **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 2019 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 <sup>[1]</sup>	8		105		8		105	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	36		393		20		214	
4	Incremental Measure Costs (Sum of rows 1 through 3)	43		498		28		319	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	0	1	0	3	0	1	0	3
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	10	8	11	61	10	8	11	61
7	Marketing <sup>[4]</sup>	3	10	3	42	3	10	3	42
8	Program Delivery <sup>[5]</sup>	5	5	12	24	5	5	12	24
9	EDC Evaluation Costs	16		50		16		50	
10	SWE Audit Costs	2		10		2		10	
11	Program Overhead Costs (Sum of rows 5 through 10)	58		215		58		215	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	101		645		86		484	
14	Total NPV Lifetime Electric Energy Benefits	80		752		51		482	
15	Total NPV Lifetime Electric Capacity Benefits	11		25		7		16	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-12		-91		-8		-58	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	80		687		50		439	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.78		1.06		0.59		0.91	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	31		172		31		172	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	218		985		161		760	
4	Incremental Measure Costs (Sum of rows 1 through 3)	249		1,157		192		932	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	0	2	1	8	0	2	1	8
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	13	21	30	130	13	21	30	130
7	Marketing <sup>[4]</sup>	4	13	4	55	4	13	4	55
8	Program Delivery <sup>[5]</sup>	6	14	17	60	6	14	17	60
9	EDC Evaluation Costs	22		75		22		75	
10	SWE Audit Costs	3		14		3		14	
11	Program Overhead Costs (Sum of rows 5 through 10)	98		395		98		395	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	347		1,413		290		1,211	
14	Total NPV Lifetime Electric Energy Benefits	255		1,173		196		946	
15	Total NPV Lifetime Electric Capacity Benefits	5		46		4		36	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-32		-150		-25		-121	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	228		1,068		175		861	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.66		0.76		0.60		0.71	
<p>[1] Includes direct install equipment costs and costs for EE&amp;C kits.</p> <p>[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.</p> <p>[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.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[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.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[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.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

**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 <sup>[1]</sup>	0		110		0		110	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	1		275		0		179	
4	Incremental Measure Costs (Sum of rows 1 through 3)	1		384		1		289	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	0	0	0	1	0	0	0	1
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	5	3	9	64	5	3	9	64
7	Marketing <sup>[4]</sup>	1	3	1	13	1	3	1	13
8	Program Delivery <sup>[5]</sup>	2	2	6	12	2	2	6	12
9	EDC Evaluation Costs	5		17		5		17	
10	SWE Audit Costs	1		4		1		4	
11	Program Overhead Costs (Sum of rows 5 through 10)	23		127		23		127	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	24		491		23		398	
14	Total NPV Lifetime Electric Energy Benefits	1		735		1		553	
15	Total NPV Lifetime Electric Capacity Benefits	0		63		0		48	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	1		704		1		529	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.05		1.43		0.04		1.33	

[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 <sup>[1]</sup>	15		934		15		934	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	215		6,934		137		5,390	
4	Incremental Measure Costs (Sum of rows 1 through 3)	230		7,868		152		6,324	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	0	1	1	5	0	1	1	5
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	12	16	25	445	12	16	25	445
7	Marketing <sup>[4]</sup>	3	10	3	42	3	10	3	42
8	Program Delivery <sup>[5]</sup>	5	9	14	41	5	9	14	41
9	EDC Evaluation Costs	20		64		20		64	
10	SWE Audit Costs	2		12		2		12	
11	Program Overhead Costs (Sum of rows 5 through 10)	79		653		79		653	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	309		8,019		231		6,581	
14	Total NPV Lifetime Electric Energy Benefits	347		7,842		229		6,225	
15	Total NPV Lifetime Electric Capacity Benefits	16		182		11		148	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-70		-1,076		-47		-851	
18	Total NPV TRC Benefits <sup>[7]</sup> (Sum of rows 14 through 17)	293		6,948		193		5,521	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.95		0.87		0.84		0.84	
<p>[1] Includes direct install equipment costs and costs for EE&amp;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</p>									

### 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 PY11. 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 PY11 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	186,677	29,150	55,686
PYVTD MW/yr	9.62	1.78	3.14
PYTD Incentives (\$1000)	0.00	0.00	0.00
Evaluation Approach	Interval Meter Analysis with Randomized Control Trial		

#### 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 PY11**

Event Date	Verified MW and Relative Precision @ 90% C.L.		
	Met-Ed	Penn Power	WPP
7/17/2019	12.57 ± 3.08	1.41 ± 0.79	3.37 ± 1.41
7/18/2019	7.19 ± 2.93	2.05 ± 0.93	2.96 ± 1.5
7/19/2019	11 ± 3.19	2.26 ± 0.93	3.57 ± 1.54
8/19/2019	7.73 ± 3.04	1.39 ± 0.9	2.65 ± 1.52
<b>Total</b>	9.62 ± 1.53	1.78 ± 0.44	3.14 ± 0.75

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.

### 3.8.2.1 Evaluation Adjustments in Response to the COVID-19 Pandemic

This program was not impacted by COVID in PY11 since all events occurred during the summer of 2019.

### 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. 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.

This PY11 evaluation is limited in focus. Activities in PY11 focused on reviewing program progress with FirstEnergy program managers and representatives of Oracle, the Conservation Service Provider (CSP). We also analyzed data from FirstEnergy and Oracle on customer notifications during PY11. Findings and Recommendations from the PY11 study are discussed in Section 3.8.6.

### 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 2019 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 <sup>[1]</sup>	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 <sup>[2]</sup>	1	61	1	119	1	61	1	119
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	29	121	46	237	29	121	46	237
7	Marketing <sup>[4]</sup>	13	0	13	4	13	0	13	4
8	Program Delivery <sup>[5]</sup>	0	425	0	829	0	425	0	829
9	EDC Evaluation Costs	48		74		48		74	
10	SWE Audit Costs	5		10		5		10	
11	Program Overhead Costs (Sum of rows 5 through 10)	702		1,332		702		1,332	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	702		3,033		702		3,033	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	677		1,080		677		1,080	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	677		1,080		677		1,080	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.96		0.36		0.96		0.36	

[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 <sup>[1]</sup>	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 <sup>[2]</sup>	0	9	0	41	0	9	0	41
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	23	18	52	81	23	18	52	81
7	Marketing <sup>[4]</sup>	3	0	3	0	3	0	3	0
8	Program Delivery <sup>[5]</sup>	0	64	0	284	0	64	0	284
9	EDC Evaluation Costs	21		50		21		50	
10	SWE Audit Costs	2		11		2		11	
11	Program Overhead Costs (Sum of rows 5 through 10)	142		524		142		524	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	142		17,442		142		17,442	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	125		454		125		454	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	125		454		125		454	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.88		0.03		0.88		0.03	

[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 <sup>[1]</sup>	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 <sup>[2]</sup>	1	20	1	44	1	20	1	44
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	23	39	38	88	23	39	38	88
7	Marketing <sup>[4]</sup>	6	0	6	0	6	0	6	0
8	Program Delivery <sup>[5]</sup>	0	138	0	308	0	138	0	308
9	EDC Evaluation Costs	44		68		44		68	
10	SWE Audit Costs	4		8		4		8	
11	Program Overhead Costs (Sum of rows 5 through 10)	275		562		275		562	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	275		2,508		275		2,508	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	221		440		221		440	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	221		440		221		440	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.80		0.18		0.80		0.18	

[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. Earlier recommendations from the PY10 evaluation are available in the PY10 report.

**Finding #1:** *Both FirstEnergy and Oracle report that the program is running well.*

Communication between the two entities is effective, and the program is generally meeting energy reduction goals. Both FirstEnergy and Oracle acknowledge challenges presented by consecutive day events and Monday events. FirstEnergy initiates day-ahead notifications to treatment group customers through Facebook, and these have been especially useful in reaching customers for Monday events because they can be provided on Sunday, whereas the Oracle-led notifications can only be provided Monday morning.

**Finding #2:** *Pre-event notifications via telephone are more likely to reach customers than email messages.* Almost all customers (94 percent) receive telephone messages from the interactive voice recording (IVR) *pre-event* notifications, while about 30 percent of the email notifications that are sent are confirmed as *received* (defined as *opened and/or clicked* in our analysis). *Post-event* notifications sent by email are *received* (defined as *opened and/or clicked* in our analysis) by a larger proportion of customers across all EDCs.

**Finding #3:** *Opt-out rates are very low, but requests to leave the program are concentrated around the events themselves.* About one to two percent of treatment customers opted out in PY11. Most opt-out requests occur near the events themselves since customers use the event notifications to initiate the request—i.e., using the *unsubscribe* hyperlink in the email or the *select 9* option on the IVR message.

**Finding #4:** *The disposition of email notifications is more difficult to track than the IVR notices, and the delivery status of many email notifications cannot be confirmed (i.e., is “unknown”).* The disposition of nearly all IVR notifications can be accounted for in the data provided by Oracle. Only about five percent of IVR notifications are not *received* (defined as answered by a person or by voicemail in our analysis). Those notifications are tracked as *busy* or *no answer*. In contrast, email notifications, are not as straightforward as those for IVR, and it is more complicated to track the status of emails. In the data provided by Oracle, more than one-half of email messages sent for the pre- and post-event notices do not fit in any of the existing disposition categories (*delivered, opened, clicked, bounced, other not delivered*) and have an unknown delivery status.

**Recommendation #1:** *Continue to use Facebook messages to alert treatment customers of event days.* Sending notifications in advance of Monday events is a challenge. Facebook messages have generally been effective in reaching customers, and they offer useful day-ahead notice of a Monday event.

**EDC Status Report #1:** Recommendation accepted.

**Recommendation #2:** *Consider working with the CSP to improve the tracking of email notifications.* The data are insufficiently detailed to account for emails that are not clearly identified as *confirmed undeliverable* or *confirmed received*. Emails that are not opened, clicked,

or undeliverable could be coded as *no answer* or *unknown*. Tracking the remaining email messages—that are essentially equivalent to a telephone call that is not answered—will provide more insight into how many customers can be contacted effectively by email and how contact rates may vary by EDCs.

**EDC Status Report #2:** Recommendation accepted.

**Recommendation #3:** *Consider working with the CSP to improve documentation of the pre- and post-event notification reporting.* The initial data from Oracle did not include definitions of the disposition metrics used to track pre- and post-event notifications and how the disposition metrics compare to the treatment group. As a supplement to the definitions, it would be helpful to see a formula for IVR and email metrics and how they add up to *delivered* and *sent* to further understand communication effectiveness. Additionally, it is not possible to compute accurate opt-out rates. Opt-outs are tallied by channel (IVR, email), but the data do not specify the number of customers attempted by channel. The opt-out rates are computed conservatively as a proportion of all treatment customers. Improved documentation will add clarity and transparency to program reporting and help identify possible improvements.

**EDC Status Report #3:** The Companies considered this recommendation and ultimately determined that the associated cost could not be accommodated under the current agreement with the ICSP

### 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 PY11 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	38	7	45	0	0	0	13	2	15
PYVTD MW/yr	1.18	0.31	1.49	0.00	0.00	0.00	0.83	0.06	0.89
PYTD Incentives (\$1000)	26,184	6,888	33,072	0	0	0	6,647	481	7,128
Evaluation Approach	Apply weighted average of three lowest-RRMSE CBL algorithms, selected from 12 candidates.								

#### 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 PY11 impacts with 90% confidence intervals.

**Table 141: C&I Demand Response Program – Small, Verified PY11 Impacts**

Event Date	Verified MW and Precision @ 90% C.L.		
	Met-Ed	Penn Power	WPP
7/17/2019	1.5 ± 0.2	0.0 ± 0.0	0.7 ± 0.1
7/18/2019	1.7 ± 0.2	0.0 ± 0.0	1.0 ± 0.1
7/19/2019	1.4 ± 0.2	0.0 ± 0.0	1.0 ± 0.1
8/19/2019	1.4 ± 0.2	0.0 ± 0.0	0.8 ± 0.1
<b>Total</b>	<b>1.5 +/- 0.1</b>	<b>0.0 +/- 0.0</b>	<b>0.9 +/- 0.1</b>

### 3.9.2.3 Evaluation Adjustments in Response to the COVID-19 Pandemic

This program was not impacted by COVID in PY11 since all events occurred prior during the summer of 2019.

### 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 and PY11. 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 2019 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 <sup>[1]</sup>	33		68		33		68	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-8		-17		-8		-17	
4	Incremental Measure Costs (Sum of rows 1 through 3)	25		51		25		51	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	0	2	0	9	0	2	0	9
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	10	6	50	36	10	6	50	36
7	Marketing <sup>[4]</sup>	3	9	3	55	3	9	3	55
8	Program Delivery <sup>[5]</sup>	0	14	2	82	0	14	2	82
9	EDC Evaluation Costs	5		23		5		23	
10	SWE Audit Costs	3		12		3		12	
11	Program Overhead Costs (Sum of rows 5 through 10)	53		273		53		273	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	77		291		77		291	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	105		725		105		725	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	105		725		105		725	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.36		2.49		1.36		2.49	

[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 <sup>[1]</sup>	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 <sup>[2]</sup>	0	0	0	0	0	0	0	0
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	4	0	19	1	4	0	19	1
7	Marketing <sup>[4]</sup>	1	0	1	1	1	0	1	1
8	Program Delivery <sup>[5]</sup>	0	0	1	2	0	0	1	2
9	EDC Evaluation Costs	2		8		2		8	
10	SWE Audit Costs	1		4		1		4	
11	Program Overhead Costs (Sum of rows 5 through 10)	8		37		8		37	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	8		34		8		34	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	0		15		0		15	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	0.00		0.44		0.00		0.44	

[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 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 <sup>[1]</sup>	7		18		7		18	
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)	5		13		5		13	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	0	1	1	4	0	1	1	4
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	13	2	61	13	13	2	61	13
7	Marketing <sup>[4]</sup>	4	3	4	20	4	3	4	20
8	Program Delivery <sup>[5]</sup>	1	4	3	29	1	4	3	29
9	EDC Evaluation Costs	6		29		6		29	
10	SWE Audit Costs	3		14		3		14	
11	Program Overhead Costs (Sum of rows 5 through 10)	35		178		35		178	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	41		176		41		176	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	63		363		63		363	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	63		363		63		363	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.55		2.07		1.55		2.07	

[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 PY11 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	84	20	104	7	2	9	32	0	32
PYVTD MW/yr	41.67	4.11	45.78	33.36	0.07	33.42	91.78	0.30	92.08
PYTD Incentives (\$1000)	651,166	64,193	715,359	176,884	346	177,229	745,063	2,456	747,519
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<sup>10</sup>, (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*

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

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<sup>10</sup> This rule anticipates that all events will be called on non-holiday weekdays.

### *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 146 shows verified impacts by event and EDC, as well as overall PY11 impacts with 90% confidence intervals.

**Table 146: C&I Demand Response Program – Large, Verified PY11 Impacts**

Event Date	Verified MW and Relative Precision @ 90% C.L.		
	Met-Ed	Penn Power	WPP
7/17/2019	50.0 ± 3.0	15.4 ± 10.3	88.2 ± 38.8
7/18/2019	40.1 ± 3.1	38.6 ± 19.1	124.4 ± 41.1
7/19/2019	44.2 ± 3.0	31.0 ± 22.0	93.5 ± 36.0
8/19/2019	48.8 ± 2.9	48.6 ± 25.5	62.2 ± 20.8
<b>Total</b>	<b>45.8 +/- 1.2</b>	<b>33.4 +/- 11.0</b>	<b>92.1 +/- 28.9</b>

### 3.10.2.3 Evaluation Adjustments in Response to the COVID-19 Pandemic

This program was not impacted by COVID in PY11 since all events occurred during the summer of 2019.

### 3.10.3 Process Evaluation

Tetra Tech conducted a process evaluation of the Commercial and Industrial Demand Response Programs in PY9 and again in PY11. This PY11 process evaluation examined researchable questions related to participant satisfaction, response to events, and familiarity with PJM programs and rules, and other energy-related topics. The PY11 evaluation was a small, targeted study compared to the PY9 evaluation. The goal was to conduct in-depth interviews with three types of customers: full participants that curtailed load in each event, partial participants that did not participate in all events, and customers that were solicited but did not participate.

The evaluation consisted of the following activities:

- Program documentation and tracking data review, including review and preliminary analysis of actual 2019 event data;
- Interviews with Company staff (completed in late 2019 and early 2020);
- In-depth interviews with five participating customers and one nonparticipant.

Process evaluation activities were combined for the Large C&I, Small C&I programs given the combined program delivery. The Tetra Tech team interviewed the program manager to identify specific researchable issues that may help to improve program performance for PY12.

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. In PY11 there were 64 unique participants, and 45 of them were attempted to be contacted for interviews, but several could not be reached, possibly due to COVID-19 related shutdowns (the interviews took place in Q2 of 2020). The stratification design and response rates for the PY9 and PY11 evaluations 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**

EDC	Measure	Activity	Population Size	Achieved Sample Size	Response Rate
All	Demand Response	Customer Surveys in PY9	60	25	42%
All	Demand Response	Participant Interviews in PY11	64	6	13%
All	Demand Response	Nonparticipant Interviews in PY11	na	1	na

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 2019 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 PY11. This by itself does not bias TRC results in any way, but TRC measurements in PY11-12 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 2016 TRC Order specifies, for Demand Response, 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 2019, 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 20% 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 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 30% to 54% of total avoided costs associated with demand response in PY11, 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 30%, while the TRC for residential and Small C&I customers would decrease by 54%.

The combination of these alternative calculations would reduce TRC by 65% to 77% for Large C&I and residential/Small C&I customers respectively.

The 2021 TRC Order recognized the suggested recommendations and incorporated in some form these changes to use more accurate pricing and appropriate assumptions.

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 <sup>[1]</sup>	715		882		715		882	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-179		-221		-179		-221	
4	Incremental Measure Costs (Sum of rows 1 through 3)	537		662		537		662	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	3	36	4	128	3	36	4	128
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	92	138	445	499	92	138	445	499
7	Marketing <sup>[4]</sup>	28	207	28	749	28	207	28	749
8	Program Delivery <sup>[5]</sup>	4	311	21	1,123	4	311	21	1,123
9	EDC Evaluation Costs	41		210		41		210	
10	SWE Audit Costs	23		110		23		110	
11	Program Overhead Costs (Sum of rows 5 through 10)	884		3,317		884		3,317	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	1,420		3,502		1,420		3,502	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	2,016		7,726		2,016		7,726	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	2,016		7,726		2,016		7,726	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	1.42		2.21		1.42		2.21	

[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 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 <sup>[1]</sup>	177		860		177		860	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-44		-215		-44		-215	
4	Incremental Measure Costs (Sum of rows 1 through 3)	133		645		133		645	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	1	12	2	37	1	12	2	37
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	32	46	170	144	32	46	170	144
7	Marketing <sup>[4]</sup>	10	69	10	216	10	69	10	216
8	Program Delivery <sup>[5]</sup>	2	103	8	324	2	103	8	324
9	EDC Evaluation Costs	14		72		14		72	
10	SWE Audit Costs	9		40		9		40	
11	Program Overhead Costs (Sum of rows 5 through 10)	298		1,022		298		1,022	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	431		1,478		431		1,478	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	1,471		6,356		1,471		6,356	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	1,471		6,356		1,471		6,356	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	3.41		4.30		3.41		4.30	

[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 <sup>[1]</sup>	748		2,729		748		2,729	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-187		-682		-187		-682	
4	Incremental Measure Costs (Sum of rows 1 through 3)	561		2,047		561		2,047	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development <sup>[2]</sup>	4	41	5	144	4	41	5	144
6	Administration, Management, and Technical Assistance <sup>[3]</sup>	115	157	550	560	115	157	550	560
7	Marketing <sup>[4]</sup>	35	235	35	840	35	235	35	840
8	Program Delivery <sup>[5]</sup>	6	353	26	1,261	6	353	26	1,261
9	EDC Evaluation Costs	52		265		52		265	
10	SWE Audit Costs	26		126		26		126	
11	Program Overhead Costs (Sum of rows 5 through 10)	1,023		3,812		1,023		3,812	
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 <sup>[6]</sup> (Net present value of sum of rows 4, 11, and 12)	1,584		5,210		1,584		5,210	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	4,054		17,854		4,054		17,854	
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 <sup>[7]</sup> (Sum of rows 14 through 17)	4,054		17,854		4,054		17,854	
19	TRC Benefit-Cost Ratio <sup>[8]</sup>	2.56		3.43		2.56		3.43	

[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

This section shares findings from the targeted process evaluation effort in PY11. Findings and recommendations from previous process evaluation efforts are available in the PY8 and PY9 annual reports.

**Finding #1:** *Participants with detailed event plans reported less impact on their business. In the previous evaluation, some respondents noted that events affect their business longer than the exact hours of the event since they might need to shut down early or take time to restart equipment. Respondents in this evaluation noted that a detailed plan minimized this impact and allowed greater flexibility in responding to the event.*

**Recommendation #1:** *Work with CSPs and participants to develop detailed plans for responding to DR events to facilitate participation. Emphasize that these plans not only help respond to events but also minimize the impact on participants' business.*

**EDC Status Report #1:** Recommendation accepted.

**Finding #2:** *Partial participants met the targets they communicated with their CSPs, but did not participate in all events or event hours. These participants might be able to provide additional demand reduction since they have processes in place for the times they do participate.*

**Recommendation #2:** *Communicate to participants on their performance following events in context of the full event to encourage them to participate fully in further events. If FirstEnergy needs additional demand reduction, consider additional outreach to these participants.*

**EDC Status Report #2:** Recommendation accepted.

**Finding #3:** *Some Act 129 non-participants do participate in PJM's demand response programs and have confusion between the PJM and FirstEnergy demand response programs.*

**Recommendation #3:** *If FirstEnergy needs additional load reductions, CSPs should follow up with non-participants to ensure these customers understand the two programs and that the Act 129 program is different from other programs in which they participate. Explain how other participating customers navigate participating in both programs and how no new processes need to be implemented to reduce load between the two programs.*

**EDC Status Report #3:** Recommendation accepted.

**Finding #4:** *The evaluation had difficulty contacting some participants, even though FirstEnergy or their CSP provided the contact information. This issue may be unique to 2020 due to the effects of Coronavirus on staff working remotely or staff turnover.*

**Recommendation #4:** *Ensure the program has up-to-date contact information for participants to ensure that event notifications reach participants.*

**EDC Status Report #4:** Recommendation accepted.

## 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 PY11 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<sup>11</sup> 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.<sup>12</sup>

**Table 151: Met-Ed PY11 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	193	82	494	33	802
Energy Efficient Homes	2,291	327	2,034	187	4,839
Energy Efficient Products	1,648	123	882	155	2,808
Low Income Energy Efficiency	75	314	1,063	115	1,566
C&I Energy Solutions for Business - Small	982	296	745	283	2,306
C&I Energy Solutions for Business - Large	1,636	221	900	315	3,072
Governmental & Institutional Tariff	8	18	23	16	64
C&I Demand Response Program – Small	33	14	31	5	83
C&I Demand Response Program – Large	715	127	692	41	1,576
Common Portfolio Costs <sup>1</sup>				0	0
<b>Portfolio Total</b>	<b>7,580</b>	<b>1,523</b>	<b>6,864</b>	<b>1,149</b>	<b>17,116</b>
<b>SWE Costs<sup>2</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>256</b>
<b>Total</b>	<b>7,580</b>	<b>1,523</b>	<b>6,864</b>	<b>1,149</b>	<b>17,372</b>
1. Common portfolio 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.					

<sup>11</sup> <http://www.puc.pa.gov/pcdocs/1372426.doc> Section 10

<sup>12</sup> 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 PY11 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	166	90	440	35	731
Energy Efficient Homes	2,006	285	1,374	130	3,796
Energy Efficient Products	1,299	127	839	150	2,417
Low Income Energy Efficiency	143	320	1,170	114	1,746
C&I Energy Solutions for Business - Small	1,283	286	857	295	2,722
C&I Energy Solutions for Business - Large	1,682	179	729	275	2,864
Governmental & Institutional Tariff	31	23	50	22	126
<b>Common Portfolio Costs<sup>1</sup></b>				0	0
<b>Portfolio Total</b>	<b>6,611</b>	<b>1,310</b>	<b>5,459</b>	<b>1,022</b>	<b>14,402</b>
<b>SWE Costs<sup>2</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>232</b>
<b>Total</b>	<b>6,611</b>	<b>1,310</b>	<b>5,459</b>	<b>1,022</b>	<b>14,634</b>

1. Common portfolio 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 PY11 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	41	17	124	8	190
Energy Efficient Homes	296	108	434	59	898
Energy Efficient Products	586	29	293	32	940
Low Income Energy Efficiency	15	115	342	39	510
C&I Energy Solutions for Business - Small	760	103	400	70	1,334
C&I Energy Solutions for Business - Large	261	60	111	59	491
Governmental & Institutional Tariff	0	9	8	5	22
C&I Demand Response Program – Small	0	5	0	2	7
C&I Demand Response Program – Large	177	45	230	14	467
<b>Common Portfolio Costs<sup>1</sup></b>				0	0
<b>Portfolio Total</b>	<b>2,137</b>	<b>491</b>	<b>1,941</b>	<b>288</b>	<b>4,858</b>
<b>SWE Costs<sup>2</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>72</b>
<b>Total</b>	<b>2,137</b>	<b>491</b>	<b>1,941</b>	<b>288</b>	<b>4,930</b>

1. Common portfolio 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 PY11 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	201	82	514	33	831
Energy Efficient Homes	786	326	1,753	169	3,034
Energy Efficient Products	1,783	142	1,105	174	3,204
Low Income Energy Efficiency	64	315	3,025	120	3,524
C&I Energy Solutions for Business - Small	1,547	326	1,335	336	3,545
C&I Energy Solutions for Business - Large	1,270	169	656	254	2,348
Governmental & Institutional Tariff	15	21	36	20	91
C&I Demand Response Program – Small	7	18	9	6	39
C&I Demand Response Program – Large	748	160	785	52	1,745
<b>Common Portfolio Costs<sup>1</sup></b>				0	0
<b>Portfolio Total</b>	<b>6,421</b>	<b>1,560</b>	<b>9,219</b>	<b>1,163</b>	<b>18,362</b>
<b>SWE Costs<sup>2</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>240</b>
<b>Total</b>	<b>6,421</b>	<b>1,560</b>	<b>9,219</b>	<b>1,163</b>	<b>18,602</b>

1. Common portfolio 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	982	267	2,376	112	3,736
Energy Efficient Homes	12,103	945	9,078	615	22,741
Energy Efficient Products	7,120	287	3,269	477	11,153
Low Income Energy Efficiency	352	1,114	10,079	432	11,977
C&I Energy Solutions for Business - Small	4,348	673	3,097	739	8,857
C&I Energy Solutions for Business - Large	6,461	450	3,636	812	11,360
Governmental & Institutional Tariff	105	26	130	50	310
C&I Demand Response Program – Small	68	56	182	23	329
C&I Demand Response Program – Large	882	498	2,499	210	4,089
<b>Common Portfolio Costs<sup>1</sup></b>				0	0
<b>Portfolio Total</b>	<b>32,423</b>	<b>4,314</b>	<b>34,346</b>	<b>3,470</b>	<b>74,553</b>
<b>SWE Costs<sup>2</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>1,216</b>
<b>Total</b>	<b>32,423</b>	<b>4,314</b>	<b>34,346</b>	<b>3,470</b>	<b>75,769</b>

1. Common portfolio 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	853	287	2,165	121	3,425
Energy Efficient Homes	11,108	878	7,547	504	20,037
Energy Efficient Products	6,193	301	3,261	459	10,214
Low Income Energy Efficiency	411	1,280	9,946	460	12,098
C&I Energy Solutions for Business - Small	5,480	734	3,242	774	10,231
C&I Energy Solutions for Business - Large	6,707	431	3,445	713	11,296
Governmental & Institutional Tariff	172	52	253	75	552
<b>Common Portfolio Costs<sup>1</sup></b>				0	0
<b>Portfolio Total</b>	<b>30,924</b>	<b>3,963</b>	<b>29,859</b>	<b>3,107</b>	<b>67,853</b>
<b>SWE Costs<sup>2</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>1,102</b>
<b>Total</b>	<b>30,924</b>	<b>3,963</b>	<b>29,859</b>	<b>3,107</b>	<b>68,955</b>
1. Common portfolio 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	283	68	802	27	1,180
Energy Efficient Homes	3,380	335	2,417	202	6,334
Energy Efficient Products	2,192	40	886	99	3,216
Low Income Energy Efficiency	121	449	2,895	150	3,615
C&I Energy Solutions for Business - Small	2,701	236	1,308	185	4,430
C&I Energy Solutions for Business - Large	1,314	141	671	154	2,280
Governmental & Institutional Tariff	110	16	90	17	233
C&I Demand Response Program – Small	0	21	4	8	33
C&I Demand Response Program – Large	860	190	721	72	1,842
<b>Common Portfolio Costs<sup>1</sup></b>				0	0
<b>Portfolio Total</b>	<b>10,960</b>	<b>1,495</b>	<b>9,793</b>	<b>915</b>	<b>23,163</b>
<b>SWE Costs<sup>2</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>342</b>
<b>Total</b>	<b>10,960</b>	<b>1,495</b>	<b>9,793</b>	<b>915</b>	<b>23,505</b>
1. Common portfolio 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	1,086	273	2,661	112	4,131
Energy Efficient Homes	7,364	1,002	8,618	573	17,558
Energy Efficient Products	7,565	406	4,022	518	12,511
Low Income Energy Efficiency	306	1,134	11,490	458	13,388
C&I Energy Solutions for Business - Small	5,630	753	4,435	837	11,656
C&I Energy Solutions for Business - Large	4,772	366	2,857	655	8,650
Governmental & Institutional Tariff	934	43	534	64	1,576
C&I Demand Response Program – Small	18	68	66	29	182
C&I Demand Response Program – Large	2,729	616	2,805	265	6,415
<b>Common Portfolio Costs<sup>1</sup></b>				0	0
<b>Portfolio Total</b>	<b>30,405</b>	<b>4,661</b>	<b>37,489</b>	<b>3,512</b>	<b>76,066</b>
<b>SWE Costs<sup>2</sup></b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>N/A</b>	<b>1,140</b>
<b>Total</b>	<b>30,405</b>	<b>4,661</b>	<b>37,489</b>	<b>3,512</b>	<b>77,206</b>
1. Common portfolio 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<sup>13</sup> (\$1,000)**

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000) <sup>1</sup>	P3TD \$ Spending (\$1,000) <sup>1</sup>
Residential (incl Low Income)	Rate RS	\$10,085	\$50,300
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	\$2,524	\$9,496
Large C&I	Rate GS-Large, Rate GP and Rate TP	\$4,697	\$15,650
Street Lighting	Street Lighting Service, LED Street Lighting Service and Ornamental Street Lighting Service	\$14	\$144
Government & Non-Profit Tariff	Rate GS - Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate and Rate MS	\$52	\$179
<b>Portfolio Total</b>		<b>\$17,372</b>	<b>\$75,769</b>

**Table 160: Penelec EE&C Expenditures by Cost-Recovery Category<sup>14</sup> (\$1,000)**

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000) <sup>1</sup>	P3TD \$ Spending (\$1,000) <sup>1</sup>
Residential (incl Low Income)	Rate RS	\$8,773	\$46,484
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	\$2,845	\$10,494
Large C&I	Rate GS-Large, Rate GP, and Rate LP	\$2,888	\$11,410
Street Lighting	Street Lighting Service, LED Street Lighting Service, and Ornamental Street Lighting Service	\$18	\$192
Government & Non-Profit Tariff	Rate GS – Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate and Rate H	\$111	\$374
<b>Portfolio Total</b>		<b>\$14,634</b>	<b>\$68,955</b>

<sup>13</sup> Includes SWE costs

<sup>14</sup> Includes SWE costs

**Table 161: Penn Power EE&C Expenditures by Cost-Recovery Category<sup>15</sup> (\$1,000)**

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000) <sup>1</sup>	P3TD \$ Spending (\$1,000) <sup>1</sup>
Residential (incl Low Income)	Rate RS	\$2,551	\$14,535
Small C&I	Rate GS, GS Special Rider GSDS, Rate GM, Rate GS-Large and POL	\$1,383	\$4,565
Large C&I	Rate GP, and Rate GT	\$973	\$4,166
Street Lighting	Rate Schedules SV, SVD, SM and LED	\$3	\$167
Government & Non-Profit Tariff	Rate GS – Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate and Rate PNP	\$20	\$72
<b>Portfolio Total</b>		<b>\$4,930</b>	<b>\$23,505</b>

**Table 162: WPP EE&C Expenditures by Cost-Recovery Category<sup>16</sup> (\$1,000)**

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000) <sup>1</sup>	P3TD \$ Spending (\$1,000) <sup>1</sup>
Residential (incl Low Income)	Rate 10	\$10,661	\$48,229
Small C&I	Rate GS 20, Rate GS 30	\$3,709	\$12,143
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	\$4,139	\$15,243
Street Lighting	Rate Schedules 51 through 58, 71, 72	\$17	\$1,315
Government & Non-Profit Tariff	Rate GS 20 – Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate	\$77	\$276
<b>Portfolio Total</b>		<b>\$18,602</b>	<b>\$77,206</b>

<sup>15</sup> Includes SWE costs<sup>16</sup> 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	\$ 869,674	\$ 807,586	\$ 62,087.94
Penelec	\$ 828,794	\$ 769,625	\$ 59,169.44
Penn Power	\$ 333,771	\$ 309,942	\$ 23,828.62
West Penn	\$ 927,059	\$ 860,874	\$ 66,184.76

## Appendix B Site Inspection Summary

Table 164: PY11 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 (CAC, ASHP, Mini-Splits)	Honeywell	510	5	The most common discrepancies are incorrect addresses, account numbers, and model numbers; less common are incomplete installations, and lingering customer services issues.
Penelec		Honeywell	324	8	
Penn Power		Honeywell	47	1	
WPP		Honeywell	304	7	
Met-Ed	Energy Efficient Products Program - New Construction	PSD	43	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	0		
Penelec		PSD	3		
Penelec		ADM	5		
Penn Power		PSD	14		
Penn Power		ADM	9		
WPP		PSD	14		
WPP		ADM	1		
Met-Ed	Low Income Direct Install Programs	PSD, Action Housing, Pure Energy LLC	62	3	Measure count discrepancies involve aerators, furnace whistles, lamps, showerheads, and smart power strips.
Penelec			91	6	
Penn Power			65	4	
WPP			82	5	
Met-Ed	C/I Programs	ADM	56	Please refer to gross realization rates as a measure of consistency.	The main discrepancy is lamp fixture counts/types. Other measures are verified essentially 100% of the time.
Penelec	C/I Programs	ADM	63		
Penn Power	C/I Programs	ADM	44		
WPP	C/I Programs	ADM	57		
<b>TOTAL</b>	<b>TOTAL</b>		<b>1794</b>	<b>n/a</b>	

# 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 measures within the project are evaluated. 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 PY11, there were no measures associated with the Behavioral, or Conservation Kits Initiatives. The Conservation Kit program component is a part of the Companies’ EE&C plans, but was not implemented in PY11. Only West Penn Power ran a pilot Behavioral program in PY11 and PY12, but the program has not demonstrated measurable energy savings yet and unfortunately, COVID-19 related economic disruption in the small commercial sector have posed substantial challenges to program implementation and evaluation. West Penn Power did not report impacts toward Act 129 compliance for this pilot program.

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 PY11. 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 Low-Speed 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

<b>Measure</b>	<b>TRM Section</b>	<b>Initiative</b>
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
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

<b>Measure</b>	<b>TRM Section</b>	<b>Initiative</b>
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
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

<b>Measure</b>	<b>TRM Section</b>	<b>Initiative</b>
Electric Chillers - Water Cooled - Reciprocating/Positive Displ $\geq 75 < 150$ 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
Heat Pumps - Air Source $\geq 135,000$ (11.25 tons) and $< 240,000$ Btu/h (20 tons)	3.2.1d	CI_Prescriptive
Heat Pumps - Air Source $\geq 240,000$ Btu/h (20 tons)	3.2.1d	CI_Prescriptive
Heat Pumps - Air Source $\geq 65,000$ (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 $\geq 135,000$ (11.25) and $< 240,000$ Btu/h (20 tons)	3.2.1a	CI_Prescriptive
Packaged/Split AC - Air Cooled $\geq 240,000$ (20) and $< 760,000$ Btu/h (63.33 tons)	3.2.1a	CI_Prescriptive
Packaged/Split AC - Air Cooled $\geq 65,000$ (5.4) and $< 135,000$ Btu/h (11.25 tons)	3.2.1a	CI_Prescriptive
Packaged/Split AC - Air Cooled $\geq 760,000$ 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 Btu/h (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 $\geq 240,000$ (20) and $< 760,000$ Btu/h (63.33 tons)	3.2.1b	CI_Prescriptive
Packaged/Split AC -Water Cooled $\geq 65,000$ (5.4) and $< 135,000$ Btu/h (11.25 tons)	3.2.1b	CI_Prescriptive
Packaged/Split AC Units - Air Cooled LT 65,000	3.2.1a	CI_Prescriptive

Measure	TRM Section	Initiative
Btu/h (5.4 tons) 16 SEER		
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 Btu/h (5.4 tons) 18 SEER	3.2.1b	CI_Prescriptive
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
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<b>Measure</b>	<b>TRM Section</b>	<b>Initiative</b>
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
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 Duplexes	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

<b>Measure</b>	<b>TRM Section</b>	<b>Initiative</b>
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
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

Measure	TRM Section	Initiative
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
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	2,880	355	Survey (online)
Freezers	680	99	
Dehumidifiers	228	28	
RACs	417	66	
<b>Program Total</b>	<b>4,205</b>	<b>548</b>	

**Table 170: ATI Initiative Gross Impact Sample Design for Penelec**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	2,491	346	Survey (online)
Freezers	585	87	
Dehumidifiers	220	47	
RACs	305	67	
<b>Program Total</b>	<b>3,601</b>	<b>547</b>	

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

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	627	78	Survey (online)
Freezers	154	24	
Dehumidifiers	51	9	
RACs	38	4	
<b>Program Total</b>	<b>870</b>	<b>115</b>	

**Table 172: ATI Initiative Gross Impact Sample Design for WPP**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	3,046	384	Survey (online)
Freezers	724	83	
Dehumidifiers	240	33	
RACs	289	47	
<b>Program Total</b>	<b>4,299</b>	<b>547</b>	

**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	2,718	101.8%	0.5	3.8%
Freezers	470	88.5%	0.5	7.2%
Dehumidifiers	114	98.2%	0.5	13.6%
RACs	48	106.9%	0.5	8.9%
<b>Program Total</b>	<b>3,350</b>	<b>99.9%</b>	<b>0.5</b>	<b>3.3%</b>

**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	2,639	95.5%	0.5	3.9%
Freezers	410	104.9%	0.5	7.7%
Dehumidifiers	99	130.7%	0.5	10.5%
RACs	35	92.3%	0.5	8.8%
<b>Program Total</b>	<b>3,183</b>	<b>97.8%</b>	<b>0.5</b>	<b>3.3%</b>

**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	677	93.8%	0.5	8.2%
Freezers	111	113.7%	0.5	14.7%
Dehumidifiers	22	109.1%	0.5	24.0%
RACs	4	80.3%	0.5	36.0%
<b>Program Total</b>	<b>815</b>	<b>96.8%</b>	<b>0.5</b>	<b>6.8%</b>

**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	3,123	99.1%	0.5	3.7%
Freezers	520	99.2%	0.5	7.9%
Dehumidifiers	112	111.8%	0.5	12.5%
RACs	33	96.7%	0.5	10.5%
<b>Program Total</b>	<b>3,787</b>	<b>99.4%</b>	<b>0.5</b>	<b>3.2%</b>

**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	0.30	101.9%	0.5	3.8%
Freezers	0.05	88.4%	0.5	7.2%
Dehumidifiers	0.02	100.5%	0.5	13.6%
RACs	0.11	86.7%	0.5	8.9%
<b>Program Total</b>	<b>0.49</b>	<b>97.0%</b>	<b>0.5</b>	<b>3.1%</b>

**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	0.30	95.5%	0.5	3.9%
Freezers	0.05	104.9%	0.5	7.7%
Dehumidifiers	0.02	139.2%	0.5	10.5%
RACs	0.08	92.8%	0.5	8.8%
<b>Program Total</b>	<b>0.44</b>	<b>98.2%</b>	<b>0.5</b>	<b>3.1%</b>

**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	0.08	93.8%	0.5	8.2%
Freezers	0.01	113.6%	0.5	14.7%
Dehumidifiers	0.01	106.1%	0.5	24.0%
RACs	0.01	80.0%	0.5	36.0%
<b>Program Total</b>	<b>0.10</b>	<b>95.5%</b>	<b>0.5</b>	<b>6.7%</b>

**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	0.35	99.1%	0.5	3.7%
Freezers	0.06	99.2%	0.5	7.9%
Dehumidifiers	0.02	118.9%	0.5	12.5%
RACs	0.08	93.9%	0.5	10.5%
<b>Program Total</b>	<b>0.51</b>	<b>99.3%</b>	<b>0.5</b>	<b>3.1%</b>

## 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	4,205	815	20.0%
<b>Program Total</b>	<b>4,205</b>	<b>815</b>	<b>20.0%</b>

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

Stratum	Population Size	Achieved Sample Size	Response Rate
Refrigerators	3,601	693	20.0%
<b>Program Total</b>	<b>3,601</b>	<b>693</b>	<b>20.0%</b>

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

Stratum	Population Size	Achieved Sample Size	Response Rate
Refrigerators	870	271	21.0%
<b>Program Total</b>	<b>870</b>	<b>271</b>	<b>21.0%</b>

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

Stratum	Population Size	Achieved Sample Size	Response Rate
Refrigerators	4,299	850	21.0%
<b>Program Total</b>	<b>4,299</b>	<b>850</b>	<b>21.0%</b>

### 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	3,347	55.0%	0.0%	45.0%	3.8%
<b>Program Total</b>	<b>3,347</b>	<b>55.0%</b>	<b>0.0%</b>	<b>45.0%</b>	<b>3.8%</b>

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

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Refrigerators	3,113	53.0%	0.0%	47.0%	4.1%
<b>Program Total</b>	<b>3,113</b>	<b>53.0%</b>	<b>0.0%</b>	<b>47.0%</b>	<b>4.1%</b>

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

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Refrigerators	789	49.0%	0.0%	51.0%	6.6%
<b>Program Total</b>	<b>789</b>	<b>49.0%</b>	<b>0.0%</b>	<b>51.0%</b>	<b>6.6%</b>

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

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Refrigerators	3,765	52.0%	0.0%	48.0%	3.7%
<b>Program Total</b>	<b>3,765</b>	<b>52.0%</b>	<b>0.0%</b>	<b>48.0%</b>	<b>3.7%</b>

# 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.

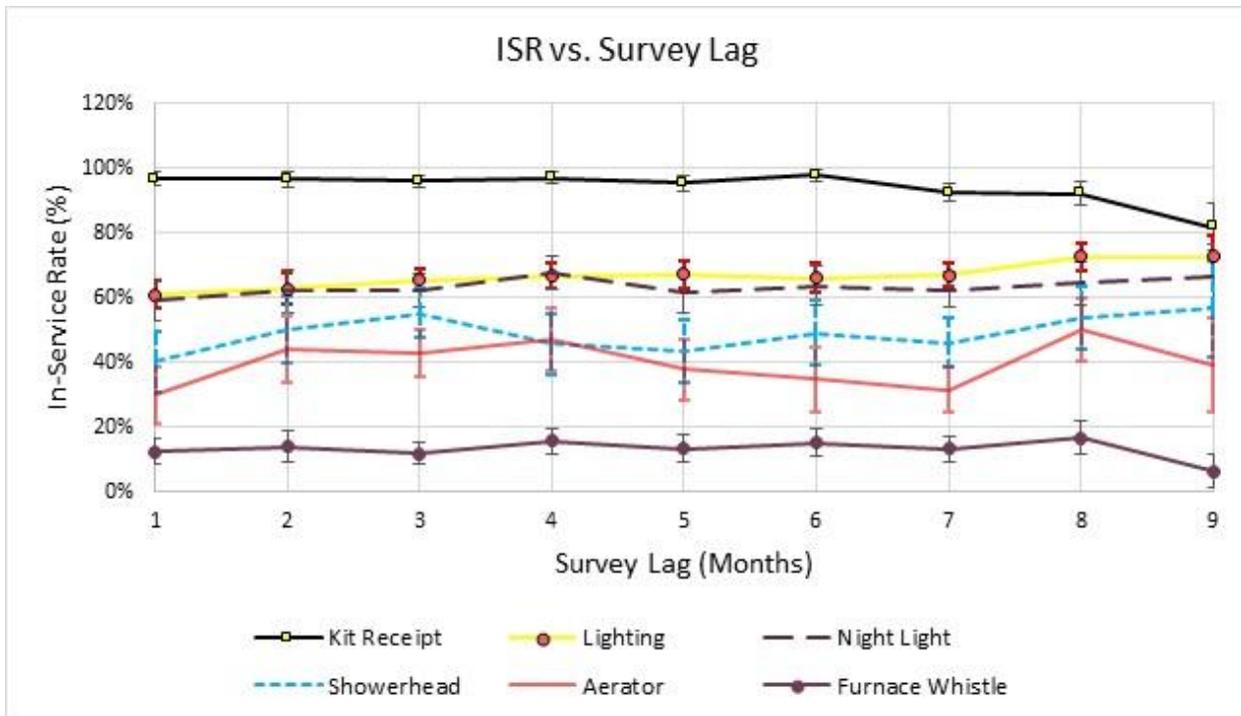
The final item, the delivery rate is determined through the online and phone survey instrument. Online and phone survey respondents are asked to indicate whether they received the conservation kit that was mailed to them. The reported in-service rates reflect the kit non-receipt rate as they are calculated 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  $\pm 10\%$  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<sup>17</sup>) 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.

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<sup>17</sup> 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	16,058	117	Survey (phone + online)
EE Kits - Standard	14,532	118	
Online Kits - Electric	390	8	
Online Kits - Standard	1,050	17	
School Education kits	392	28	
<b>Program Total</b>	<b>32,422</b>	<b>288</b>	

**Table 190: EE Kits Initiative Gross Impact Sample Design for Penelec**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	15,920	132	Survey (phone + online)
EE Kits - Standard	18,480	129	
Online Kits - Electric	718	21	
Online Kits - Standard	907	21	
School Education kits	404	20	
<b>Program Total</b>	<b>36,429</b>	<b>323</b>	

**Table 191: EE Kits Initiative Gross Impact Sample Design for Penn Power**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	36	6	Survey (phone + online)
EE Kits - Standard	29	3	
Online Kits - Electric	101	4	
Online Kits - Standard	125	4	
School Education kits	160	10	
<b>Program Total</b>	<b>451</b>	<b>27</b>	

**Table 192: EE Kits Initiative Gross Impact Sample Design for WPP**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	52	12	Survey (phone + online)
EE Kits - Standard	35	7	
Online Kits - Electric	882	41	
Online Kits - Standard	747	35	
School Education kits	1,260	29	
<b>Program Total</b>	<b>2,976</b>	<b>123</b>	

### 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	7,464	94.945%	0.5	6.6%
EE Kits - Standard	5,071	96.650%	0.5	6.6%
Online Kits - Electric	80	84.9%	0.5	25.2%
Online Kits - Standard	175	103.1%	0.5	17.3%
School Education kits	137	115.5%	0.5	13.1%
<b>Program Total</b>	<b>12,927</b>	<b>95.9%</b>	<b>0.5</b>	<b>4.6%</b>

**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	7,870	92.0%	0.5	6.2%
EE Kits - Standard	7,007	91.8%	0.5	6.3%
Online Kits - Electric	156	87.5%	0.5	15.7%
Online Kits - Standard	163	98.1%	0.5	15.5%
School Education kits	152	106.4%	0.5	15.7%
<b>Program Total</b>	<b>15,349</b>	<b>92.1%</b>	<b>0.5</b>	<b>4.3%</b>

**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	18	106.8%	0.5	26.8%
EE Kits - Standard	11	106.3%	0.5	39.4%
Online Kits - Electric	22	83.7%	0.5	37.8%
Online Kits - Standard	22	85.7%	0.5	35.4%
School Education kits	60	90.8%	0.5	22.0%
<b>Program Total</b>	<b>133</b>	<b>92.2%</b>	<b>0.5</b>	<b>13.8%</b>

**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	25	89.7%	0.5	18.2%
EE Kits - Standard	13	96.2%	0.5	24.3%
Online Kits - Electric	189	101.0%	0.5	11.1%
Online Kits - Standard	132	99.8%	0.5	12.0%
School Education kits	465	104.5%	0.5	13.2%
<b>Program Total</b>	<b>824</b>	<b>102.4%</b>	<b>0.5</b>	<b>8.3%</b>

### 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	0.82	97.1%	0.5	7%
EE Kits - Standard	0.58	104.7%	0.5	7%
Online Kits - Electric	0.01	86.2%	0.5	25%
Online Kits - Standard	0.02	116.9%	0.5	17%
School Education kits	0.02	127.6%	0.5	13%
<b>Program Total</b>	<b>1.44</b>	<b>100.7%</b>	<b>0.5</b>	<b>4.6%</b>

**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	0.78	94.9%	0.5	6%
EE Kits - Standard	0.70	99.1%	0.5	6%
Online Kits - Electric	0.02	86.6%	0.5	16%
Online Kits - Standard	0.02	104.5%	0.5	16%
School Education kits	0.02	118.4%	0.5	16%
<b>Program Total</b>	<b>1.53</b>	<b>97.1%</b>	<b>0.5</b>	<b>4.3%</b>

**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	0.00	103.6%	0.5	27%
EE Kits - Standard	0.00	97.2%	0.5	39%
Online Kits - Electric	0.00	95.5%	0.5	38%
Online Kits - Standard	0.00	95.7%	0.5	35%
School Education kits	0.01	90.1%	0.5	22%
<b>Program Total</b>	<b>0.01</b>	<b>94.3%</b>	<b>0.5</b>	<b>14.0%</b>

**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	0.00	103.5%	0.5	18%
EE Kits - Standard	0.00	96.5%	0.5	24%
Online Kits - Electric	0.02	111.9%	0.5	11%
Online Kits - Standard	0.02	113.6%	0.5	12%
School Education kits	0.06	108.2%	0.5	13%
<b>Program Total</b>	<b>0.10</b>	<b>109.6%</b>	<b>0.5</b>	<b>8.1%</b>

## 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 conducted 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 PY11 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  $98\% \times 150 + 2\% \times 100 = 149$ .

**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	32,422	172	97	170	13.9%
Penelec	36,429	171	71	169	13.8%
Penn Power	451	181	72	148	13.3%
WPP	2,976	193	90	154	13.0%

### 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	12,395	21.1%	3.1%	82.0%	5.5%
Penelec	14,132	20.2%	3.3%	83.1%	5.5%
Penn Power	123	22.1%	4.8%	82.6%	5.9%
WPP	843	21.1%	15.4%	94.2%	5.8%

# 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:

$$kWh_{imy} = \beta_0 + \sum_{m=1}^{12} \sum_{y=2011}^{2021} I_{my} * \beta_{mys} * (AvgPre_i + AvePreSummer_i + AvePreWinter_i) + \sum_{m=1}^{12} \sum_{y=2011}^{2021} I_{my} * \tau_{my} * treatment_{imy} + \epsilon_{imy}$$

**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 $y$ .
$\beta_0$	Intercept of the regression equation.
$I_{my}$	Equal to one for each monthly bill month $m$ , year $y$ , and zero otherwise.
$\beta_{mys}$	The coefficient on the bill month $m$ , year $y$ indicator variable interacted with season $s$ .
$AvgPre_i$	Average daily usage for customer $i$ in the pre-treatment period.
$AvePreSummer_i$	Average daily usage for customer $i$ in the pre-treatment period during June through September.
$AvePreWinter_i$	Average daily usage for customer $i$ in the pre-treatment period during December through March.
$treatment_{imy}$	The treatment indicator variable. Equal to one when the treatment is in effect for the treatment group. Zero otherwise. Always zero for the control group.
$\tau_{my}$	The estimated treatment effect in kWh per day per customer; the main parameter of interest.
$\varepsilon_{imy}$	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.

$$\begin{aligned}
 kWh\ savings_{my} &= \tau_{my} \times days_{my} \times number\ of\ participants_{my} \\
 &\quad \times upstream\ adjustment\ multiplier
 \end{aligned}$$

### 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
$\tau_{my}$	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.
<i>upstream adjustment multiplier</i>	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	26,200	27,205	1,005	PN-1	26,200	27,205	1,005
ME-1-LI	5,932	5,810	-122	PN-1-LI	5,932	5,810	-122
ME-2	11,082	12,004	922	PN-2	11,082	12,004	922
ME-2-LI	1,022	981	-41	PN-2-LI	1,022	981	-41
ME-3	1,843	2,055	213	PN-3	1,843	2,055	213
WP-1	18,769	19,817	1,048	PN-3-LI	18,769	19,817	1,048
WP-1-LI	2,646	2,611	-35	PP-1	2,646	2,611	-35
WP-2	2,122	2,257	135	PP-1-LI	2,122	2,257	135
WP-2-LI	852	918	66	PP-2	852	918	66
WP-3	1,737	2,107	370	PP-2-LI	1,737	2,107	370

#### 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:

$$\% \text{ savings}_{my} = \frac{kWh \text{ savings}_{my}}{kWh \text{ savings}_y}$$

## 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:

$$\% \text{ savings}_{my} = \beta_1 \text{end use}_{\text{heat pump}} + \beta_2 \text{end use}_{\text{interior lighting}} + \beta_3 \text{end use}_{\text{flat}}$$

## 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 – PY11 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	68,013	67,829	67,633	67,417	67,252	69,920	69,574	69,289	68,993	68,701	68,444	68,216
ME-1-LI	8,788	8,757	8,718	8,667	8,640	9,185	9,112	9,047	8,993	8,938	8,884	8,846
ME-2	43,876	43,740	43,588	43,424	43,317	45,398	45,132	44,883	44,658	44,419	44,199	44,033
ME-2-LI	1,776	1,764	1,756	1,743	1,732	1,880	1,858	1,845	1,830	1,812	1,798	1,788
ME-3	9,511	9,474	9,428	9,382	9,351	10,029	9,946	9,866	9,790	9,715	9,652	9,578
PN-1	44,762	44,657	44,571	44,452	44,351	45,772	45,605	45,443	45,281	45,103	44,957	44,867
PN-1-LI	5,628	5,614	5,587	5,564	5,548	5,861	5,824	5,785	5,753	5,707	5,677	5,651
PN-2	57,146	56,985	56,831	56,645	56,507	58,933	58,637	58,356	58,072	57,783	57,498	57,332
PN-2-LI	1,337	1,335	1,321	1,315	1,308	1,414	1,401	1,381	1,372	1,364	1,355	1,345
PN-3	23,796	23,708	23,610	23,491	23,409	24,870	24,663	24,511	24,323	24,135	23,999	23,903
PN-3-LI	6,991	6,954	6,908	6,855	6,825	7,484	7,396	7,317	7,238	7,158	7,086	7,040
PP-1	15,847	15,810	15,762	15,734	15,699	16,269	16,180	16,105	16,046	15,983	15,927	15,879
PP-1-LI	1,798	1,790	1,782	1,773	1,767	1,879	1,861	1,844	1,829	1,817	1,809	1,806
PP-2	6,402	6,379	6,367	6,353	6,341	6,573	6,536	6,514	6,494	6,460	6,440	6,420
PP-2-LI	692	687	683	682	680	729	722	717	712	708	700	697
WP-1	105,907	105,694	105,461	105,163	104,974	108,454	108,007	107,576	107,185	106,799	106,430	106,148
WP-1-LI	9,498	9,456	9,413	9,373	9,338	9,888	9,817	9,753	9,697	9,623	9,571	9,530
WP-2	16,162	16,114	16,075	16,029	15,990	16,635	16,538	16,461	16,382	16,312	16,248	16,205
WP-2-LI	3,236	3,216	3,194	3,172	3,161	3,438	3,398	3,356	3,317	3,289	3,266	3,253
WP-3	24,312	24,235	24,146	24,049	23,991	25,133	24,978	24,838	24,742	24,587	24,506	24,411

### 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	14,114	13,477	1.46%	0.16%
Met Ed	ME-2	8,249	7,877	1.32%	0.26%
Met Ed	ME-3	2,424	2,314	1.78%	0.61%
<b>Met Ed</b>	<b>Total for EEH Program</b>	<b>24,787</b>	<b>23,668</b>	<b>1.45%</b>	<b>0.14%</b>
Met Ed	ME-1-LI	1,855	2,230	1.80%	0.59%
Met Ed	ME-2-LI	269	324	1.12%	1.00%
<b>Met Ed</b>	<b>Total for LI Program</b>	<b>2,124</b>	<b>2,554</b>	<b>1.72%</b>	<b>0.53%</b>
Penelec	PN-1	7,527	6,260	1.15%	0.20%
Penelec	PN-2	7,030	5,846	1.15%	0.28%
Penelec	PN-3	506	421	0.24%	0.37%
<b>Penelec</b>	<b>Total for EEH Program</b>	<b>15,063</b>	<b>12,527</b>	<b>1.12%</b>	<b>0.17%</b>
Penelec	PN-1-LI	882	1,096	1.60%	0.59%
Penelec	PN-2-LI	392	487	2.76%	1.12%
Penelec	PN-3-LI	131	163	0.30%	0.64%
<b>Penelec</b>	<b>Total for LI Program</b>	<b>1,405</b>	<b>1,745</b>	<b>1.80%</b>	<b>0.58%</b>
Penn Power	PP-1	2,864	3,093	1.65%	0.27%
Penn Power	PP-2	2,345	2,532	2.34%	0.38%
<b>Penn Power</b>	<b>Total for EEH Program</b>	<b>5,209</b>	<b>5,625</b>	<b>1.96%</b>	<b>0.23%</b>
Penn Power	PP-1-LI	434	409	1.95%	0.93%
Penn Power	PP-2-LI	160	151	1.26%	1.17%
<b>Penn Power</b>	<b>Total for LI Program</b>	<b>594</b>	<b>560</b>	<b>1.76%</b>	<b>0.76%</b>
WPP	WP-1	12,861	10,064	0.65%	0.30%
WPP	WP-2	5,377	4,208	1.47%	0.36%
WPP	WP-3	4,477	3,503	1.07%	0.37%
<b>WPP</b>	<b>Total for EEH Program</b>	<b>22,715</b>	<b>17,774</b>	<b>0.92%</b>	<b>0.25%</b>
WPP	WP-1-LI	1,332	1,200	0.84%	1.24%
WPP	WP-2-LI	495	447	1.04%	0.82%
<b>WPP</b>	<b>Total for LI Program</b>	<b>1,827</b>	<b>1,647</b>	<b>0.90%</b>	<b>0.98%</b>

**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	3.80	2.67	70%
Met Ed	LI	0.33	0.29	88%
Penelec	Non-LI	2.14	1.40	66%
Penelec	LI	0.20	0.19	97%
Penn Power	Non-LI	0.79	0.63	80%
Penn Power	LI	0.09	0.06	70%
WPP	Non-LI	4.13	1.93	47%
WPP	LI	0.33	0.18	54%

## Appendix G Evaluation Detail – Residential Direct Install Initiative

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

The initial audit costs 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. Customers, who installed major measures, can receive an additional \$100 for achieving saving more than 2,000 kWh and \$150 for achieving 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 strata are stratified by total ex-ante savings at the site. High, medium, and low savings strata 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 strata. Many of the projects in the highest-saving strata included major measures, while most projects in the lower saving strata 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 customer 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	W_base	Varies	W	TRM Defaults Using Lamp Specification Sheets or PY11 Upstream Lighting Program
Lighting	W_ee	Varies	W	Specification Sheets or PY11 Upstream Lighting Program
Lighting, LED Night Lights	HOU	Varies	hours	TRM Default
Lighting, Attic Insulation	CF	Varies	fraction	TRM Default
Lighting	IE_kWh	Varies	percent	Based on EDC, Percent Inside Bulbs
Lighting	IE_kW	Varies	percent	Based on EDC, Percent Inside Bulbs
LED Night Light	W_ni	0.5	W	Specification Sheet Provided by FE
LED Night Light	W_base	7	W	TRM Default
Attic Insulation	R_base, R_ee	Varies	°F-ft <sup>2</sup> -h/Btu	Project Audit Forms
Wall Insulation	R_base	Varies	°F-ft <sup>2</sup> -h/Btu	TRM Default
Wall Insulation	R_ee	Varies	°F-ft <sup>2</sup> -h/Btu	TRM Default
Attic Insulation, Wall Insulation	HDD, CDD	Varies	Varies	TRM - Zip Code Lookup
Attic Insulation, Wall Insulation	Area	Varies	ft <sup>2</sup>	Project Audit Forms
Attic Insulation, Wall Insulation	EER, SEER, HSPF, COP, GSHPDF, GSER, AHF, DUA	Varies	Varies	TRM Defaults
Air Sealing	CFM50_base	Varies	cfm	Project Audit Forms
Air Sealing	CFM50_ee	Varies	cfm	Project Audit Forms
Air Sealing	UES_city-system	Varies	text	TRM - Zip Code Lookup
Air Sealing	UDS_city-system	Varies	text	TRM - Zip Code Lookup
Pipe Insulation, Aerators, Showerheads	Water heater type	Varies	text	GoodCents Database, Customer Tracking Data, Project Audit Forms
Pipe Insulation	Pipe Insulation Unit Energy Savings	9.43	kWh/ft	TRM Default
Pipe Insulation	Pipe Insulation Unit Peak Demand Reduction	0.000759	kW/ft	TRM Default
Smart Strip Plug Outlets	Number of Plugs	Varies	number	Customer Tracking Data
Smart Strip Plug Outlets	Percent Entertainment Center Smart Power Strip	Varies	text	Project Audit Forms
Aerators, Showerhead	Housing Type	Varies	text	Assumption of Single Family Housing
Aerators, Showerhead	Flow Rate (gpm)	1.5	gpm	TRM Defaults
Aerators	Faucet Location	Varies	text	Customer Tracking Data
Windows	E_sav	Varies	kWh/ft <sup>2</sup>	Based on Equipment Type
Windows	D_sav	Varies	kW/ft <sup>2</sup>	Based on Equipment Type

### 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
Prescriptive	na	85	15	Desk Review
Weatherization	na	9	9	
High-Impact	5	0	0	
<b>Program Total</b>		<b>94</b>	<b>24</b>	

**Table 214: Res DI Initiative Gross Impact Sample Design for Penelec**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive	na	236	19	Desk Review
Weatherization	na	1	1	
High-Impact	5	0	0	
<b>Program Total</b>		<b>237</b>	<b>20</b>	

**Table 215: Res DI Initiative Gross Impact Sample Design for Penn Power**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive	na	23	19	Desk Review
Weatherization	na	0	0	
High-Impact	5	0	0	
<b>Program Total</b>		<b>23</b>	<b>19</b>	

**Table 216: Res DI Initiative Gross Impact Sample Design for WPP**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive	na	235	20	Desk Review
Weatherization	na	6	6	
High-Impact	5	0	0	
<b>Program Total</b>		<b>241</b>	<b>26</b>	

### 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.
Prescriptive	na	58	97.2%	0.4	13%
Weatherization	na	21	91.2%	0.4	0%
High-Impact	5	0	0.0%	0.4	0%
<b>Program Total</b>		<b>79</b>	<b>95.6%</b>	<b>n/a</b>	<b>10.1%</b>

**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.
Prescriptive	na	214	98.8%	0.4	13%
Weatherization	na	1	11.1%	0.4	0%
High-Impact	5	0	0.0%	0.4	0%
<b>Program Total</b>		<b>215</b>	<b>98.4%</b>	<b>n/a</b>	<b>12.7%</b>

**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.
Prescriptive	na	16	103.2%	0.4	6%
Weatherization	na	0	0.0%	0.4	0%
High-Impact	5	0	0.0%	0.4	0%
<b>Program Total</b>		<b>16</b>	<b>103.2%</b>	<b>n/a</b>	<b>5.5%</b>

**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.
Prescriptive	na	231	98.0%	0.4	12%
Weatherization	na	13	98.4%	0.4	0%
High-Impact	5	0	0.0%	0.4	0%
<b>Program Total</b>		<b>244</b>	<b>98.0%</b>	<b>n/a</b>	<b>11.7%</b>

**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.
Prescriptive	na	0.01	96.6%	0.4	13%
Weatherization	na	0.00	93.5%	0.4	0%
High-Impact	5	0.00	0.0%	0.4	0%
<b>Program Total</b>		<b>0.01</b>	<b>96.0%</b>	<b>n/a</b>	<b>11.1%</b>

**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.
Prescriptive	na	0.02	90.6%	0.4	13%
Weatherization	na	0.00	27.8%	0.4	0%
High-Impact	5	0.00	0.0%	0.4	0%
<b>Program Total</b>		<b>0.02</b>	<b>90.5%</b>	<b>n/a</b>	<b>12.7%</b>

**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.
Prescriptive	na	0.00	101%	0.4	6%
Weatherization	na	0.00	0%	0.4	0%
High-Impact	5	0.00	0%	0.4	0%
<b>Program Total</b>		<b>0.00</b>	<b>100.7%</b>	<b>n/a</b>	<b>5.5%</b>

**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.
Prescriptive	na	0.03	105.9%	0.4	12%
Weatherization	na	0.00	127.6%	0.4	0%
High-Impact	5	0.00	0.0%	0.4	0%
<b>Program Total</b>		<b>0.03</b>	<b>106.6%</b>	<b>n/a</b>	<b>11.8%</b>

## 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	PYTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	75	19.0%	14.0%	95.0%	7.1%
Penelec	212	16.0%	19.0%	103.0%	5.7%
Penn Power	17	19.0%	20.0%	100.0%	6.6%
WPP	239	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, by 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	701	29	Model Review
<b>Program Total</b>	<b>701</b>	<b>29</b>	/ On-Site

**Table 228: RES NC Initiative Gross Impact Sample Design for Penelec**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	128	20	Model Review
<b>Program Total</b>	<b>128</b>	<b>20</b>	/ On-Site

**Table 229: RES NC Initiative Gross Impact Sample Design for Penn Power**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	419	22	Model Review
<b>Program Total</b>	<b>419</b>	<b>22</b>	/ On-Site

**Table 230: RES NC Initiative Gross Impact Sample Design for WPP**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	779	23	Model Review
<b>Program Total</b>	<b>779</b>	<b>23</b>	<b>/ On-Site</b>

**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	2,315	78.1%	0.5	13%
<b>Program Total</b>	<b>2,315</b>	<b>78.1%</b>	<b>0.5</b>	<b>13%</b>

**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	646	90.7%	0.5	15%
<b>Program Total</b>	<b>646</b>	<b>90.7%</b>	<b>0.5</b>	<b>15%</b>

**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	930	83.4%	0.5	15%
<b>Program Total</b>	<b>930</b>	<b>83.4%</b>	<b>0.5</b>	<b>15%</b>

**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	2,066	70.7%	0.5	15%
<b>Program Total</b>	<b>2,066</b>	<b>70.7%</b>	<b>0.5</b>	<b>15%</b>

**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	0.91	93.5%	0.5	13%
<b>Program Total</b>	<b>0.91</b>	<b>93.5%</b>	<b>0.5</b>	<b>13%</b>

**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	0.15	93.6%	0.5	15%
<b>Program Total</b>	<b>0.15</b>	<b>93.6%</b>	<b>0.5</b>	<b>15%</b>

**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	0.47	92.8%	0.5	15%
<b>Program Total</b>	<b>0.47</b>	<b>92.8%</b>	<b>0.5</b>	<b>15%</b>

**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	0.85	91.1%	0.5	15%
<b>Program Total</b>	<b>0.85</b>	<b>91.1%</b>	<b>0.5</b>	<b>15%</b>

## 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, the realization rate is adjusted to reflect invoiced quantities in the verified savings.

#### 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.1.1.3 Treatment of Non ENERGY 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.1.1.4 Determination of Cross Sector Sales

Since upstream program tracking data does 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%).

#### 1.1.1.5 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.

#### 1.1.1.6 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	328,999	Census	Database Review
		83	Invoice Review
		233	X-Sector Sales Survey
<b>Met-Ed Total</b>	<b>328,999</b>	<b>316</b>	
Penelec	318,155	Census	Database Review
		82	Invoice Review
		276	X-Sector Sales Survey
<b>Penelec Total</b>	<b>318,155</b>	<b>358</b>	
Penn Power	120,879	Census	Database Review
		78	Invoice Review
		255	X-Sector Sales Survey
<b>Penn Power Total</b>	<b>120,879</b>	<b>333</b>	
WPP	337,534	Census	Database Review
		81	Invoice Review
		237	X-Sector Sales Survey
<b>WPP Total</b>	<b>337,534</b>	<b>318</b>	

### 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	31,097	113.5%	0.5	7.9%
Penelec	33,432	110.6%	0.5	8.0%
Penn Power	14,886	112.9%	0.5	8.2%
WPP	37,229	111.9%	0.5	8.0%

### 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	3.69	121.5%	0.5	7.9%
Penelec	3.52	122.1%	0.5	8.0%
Penn Power	1.73	121.5%	0.5	8.2%
WPP	4.78	117.2%	0.5	8.0%

## 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.<sup>18</sup> 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.

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<sup>18</sup> 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	328,999	233	19%
<b>Met-Ed Total</b>		<b>n/a</b>	<b>n/a</b>	<b>n/a</b>
Penelec	Retailers	116	67	58%
	Customers	318,155	276	22%
<b>Penelec Total</b>		<b>n/a</b>	<b>n/a</b>	<b>n/a</b>
Penn Power	Retailers	24	13	54%
	Customers	120,879	255	21%
<b>Penn Power Total</b>		<b>n/a</b>	<b>n/a</b>	<b>n/a</b>
WPP	Retailers	73	28	38%
	Customers	337,534	237	19%
<b>WPP Total</b>		<b>n/a</b>	<b>n/a</b>	<b>n/a</b>

### 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	35,308	71.0%	0.0%	29.0%	10.0%
Penelec	36,963	69.0%	0.0%	31.0%	7.2%
Penn Power	16,800	74.0%	0.0%	26.0%	14.2%
WPP	41,676	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	5,179	Census	Database Review
		Census	Invoice Review
<b>Met-Ed Total</b>	<b>5,179</b>	<b>5179</b>	
Penelec	2,633	Census	Database Review
		Census	Invoice Review
<b>Penelec Total</b>	<b>2,633</b>	<b>2633</b>	
Penn Power	2,012	Census	Database Review
		Census	Invoice Review
<b>Penn Power Total</b>	<b>2,012</b>	<b>2012</b>	
WPP	7,893	Census	Database Review
		Census	Invoice Review
<b>WPP Total</b>	<b>7,893</b>	<b>7,893</b>	

### 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	107	91.8%	0.5	0.0%
Imaging	23	275.6%	0.5	0.0%
Computer	18	100.0%	0.5	0.0%
Monitor	28	100.0%	0.5	0.0%
<b>Program Total</b>	<b>175</b>	<b>118.2%</b>	<b>0.5</b>	<b>0.0%</b>

**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	51	95.4%	0.5	0.0%
Imaging	13	272.7%	0.5	0.0%
Computer	10	100.0%	0.5	0.0%
Monitor	14	100.0%	0.5	0.0%
<b>Program Total</b>	<b>88</b>	<b>122.9%</b>	<b>0.5</b>	<b>0.0%</b>

**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	37	90.1%	0.5	0.0%
Imaging	10	241.0%	0.5	0.0%
Computer	7	100.0%	0.5	0.0%
Monitor	12	100.0%	0.5	0.0%
<b>Program Total</b>	<b>66</b>	<b>115.4%</b>	<b>0.5</b>	<b>0.0%</b>

**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	163	92.6%	0.5	0.0%
Imaging	35	261.8%	0.5	0.0%
Computer	28	100.0%	0.5	0.0%
Monitor	43	100.0%	0.5	0.0%
<b>Program Total</b>	<b>268</b>	<b>116.5%</b>	<b>0.5</b>	<b>0.0%</b>

**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	0.01	91.7%	0.5	0.0%
Imaging	0.00	182.3%	0.5	0.0%
Computer	0.00	100.0%	0.5	0.0%
Monitor	0.00	100.0%	0.5	0.0%
<b>Program Total</b>	<b>0.02</b>	<b>114.8%</b>	<b>0.5</b>	<b>0.0%</b>

**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	0.00	95.3%	0.5	0.0%
Imaging	0.00	180.4%	0.5	0.0%
Computer	0.00	100.0%	0.5	0.0%
Monitor	0.00	100.0%	0.5	0.0%
<b>Program Total</b>	<b>0.01</b>	<b>118.1%</b>	<b>0.5</b>	<b>0.0%</b>

**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	0.00	90.0%	0.5	0.0%
Imaging	0.00	159.4%	0.5	0.0%
Computer	0.00	100.0%	0.5	0.0%
Monitor	0.00	100.0%	0.5	0.0%
<b>Program Total</b>	<b>0.01</b>	<b>110.6%</b>	<b>0.5</b>	<b>0.0%</b>

**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	0.02	92.5%	0.5	0.0%
Imaging	0.01	173.1%	0.5	0.0%
Computer	0.00	100.0%	0.5	0.0%
Monitor	0.01	100.0%	0.5	0.0%
<b>Program Total</b>	<b>0.03</b>	<b>112.8%</b>	<b>0.5</b>	<b>0.0%</b>

## 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 SEER<sub>base</sub> = 14 and HSPF<sub>base</sub> = 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<sub>cool</sub> and ESF<sub>heat</sub>) 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<sup>19</sup>.

#### *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.

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<sup>19</sup> 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	428	38	24
Mini-Split HP	410	31	30
GSHP	85	8	16
CAC	187	7	23
Furnace Fan	683	51	29
Thermostat	922	54	56
HVAC Tune-Up	235	25	20
PTAC	2	0	0
PTHP	0	0	0
<b>Program Total</b>	<b>2,952</b>	<b>214</b>	<b>198</b>

**Table 259: Res HVAC Initiative Gross Impact Sample Design for Penelec**

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	130	10	22
Mini-Split HP	576	50	49
GSHP	30	5	10
CAC	19	0	9
Furnace Fan	489	35	43
Thermostat	547	43	66
HVAC Tune-Up	364	17	33
PTAC	0	0	0
PTHP	0	0	0
<b>Program Total</b>	<b>2,155</b>	<b>160</b>	<b>232</b>

**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	89	4	14
Mini-Split HP	68	8	6
GSHP	16	3	2
CAC	11	2	3
Furnace Fan	414	19	38
Thermostat	370	25	40
HVAC Tune-Up	967	51	90
PTAC	0	0	0
PTHP	0	0	0
<b>Program Total</b>	<b>1,935</b>	<b>112</b>	<b>193</b>

**Table 261: Res HVAC Initiative Gross Impact Sample Design for WPP**

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	506	44	33
Mini-Split HP	474	41	38
GSHP	71	8	17
CAC	89	5	18
Furnace Fan	1,038	49	56
Thermostat	1,319	78	81
HVAC Tune-Up	822	34	63
PTAC	1	0	0
PTHP	1	0	0
<b>Program Total</b>	<b>4,320</b>	<b>259</b>	<b>306</b>

**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	316	120.2%	0.5	14.3%
Mini-Split HP	342	264.2%	0.5	12.7%
GSHP	135	181.7%	0.5	16.2%
CAC	42	141.3%	0.5	14.1%
Furnace Fan	305	94.1%	0.5	13.1%
Thermostat	55	442.5%	0.5	9.3%
HVAC Tune-Up	40	90.9%	0.5	15.4%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	0.0%	0.5	0.0%
<b>Program Total</b>	<b>1,236</b>	<b>174.5%</b>	<b>0.5</b>	<b>6.49%</b>

**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	110	137.3%	0.5	14.0%
Mini-Split HP	480	316.8%	0.5	9.8%
GSHP	48	214.7%	0.5	18.6%
CAC	4	93.2%	0.5	24.6%
Furnace Fan	218	94.3%	0.5	10.5%
Thermostat	33	309.8%	0.5	8.3%
HVAC Tune-Up	63	41.7%	0.5	12.0%
PTAC	0	0.0%	0.5	0.0%
PTHP	0	0.0%	0.5	0.0%
<b>Program Total</b>	<b>956</b>	<b>220.9%</b>	<b>0.5</b>	<b>7.30%</b>

**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	70	130.9%	0.5	17.7%
Mini-Split HP	57	214.7%	0.5	28.1%
GSHP	25	202.0%	0.5	47.6%
CAC	3	121.2%	0.5	35.5%
Furnace Fan	185	100.0%	0.5	11.1%
Thermostat	22	317.9%	0.5	10.8%
HVAC Tune-Up	166	71.6%	0.5	7.2%
PTAC	0	0.0%	0.5	0.0%
PTHP	0	0.0%	0.5	0.0%
<b>Program Total</b>	<b>529</b>	<b>121.7%</b>	<b>0.5</b>	<b>7.91%</b>

**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	425	109.5%	0.5	12.1%
Mini-Split HP	395	294.0%	0.5	11.2%
GSHP	113	193.7%	0.5	15.2%
CAC	21	100.8%	0.5	15.2%
Furnace Fan	463	91.8%	0.5	9.4%
Thermostat	79	370.8%	0.5	7.8%
HVAC Tune-Up	142	79.6%	0.5	8.7%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
<b>Program Total</b>	<b>1,638</b>	<b>164.7%</b>	<b>0.5</b>	<b>5.67%</b>

**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	169.8%	0.5	14.3%
Mini-Split HP	0.14	33.2%	0.5	12.7%
GSHP	0.02	345.0%	0.5	16.2%
CAC	0.03	232.0%	0.5	14.1%
Furnace Fan	0.07	94.1%	0.5	13.1%
Thermostat	0.00	100.0%	0.5	9.3%
HVAC Tune-Up	0.03	106.6%	0.5	15.4%
PTAC	0.00	100.0%	0.5	0.0%
PTHP	0.00	100.0%	0.5	6.5%
<b>Program Total</b>	<b>0.37</b>	<b>115.4%</b>	<b>0.5</b>	<b>6.49%</b>

**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	232.2%	0.5	14.0%
Mini-Split HP	0.19	82.7%	0.5	9.8%
GSHP	0.01	452.6%	0.5	18.6%
CAC	0.00	219.6%	0.5	24.6%
Furnace Fan	0.05	94.3%	0.5	10.5%
Thermostat	0.00	100.0%	0.5	8.3%
HVAC Tune-Up	0.04	99.7%	0.5	12.0%
PTAC	0.00	100.0%	0.5	0.0%
PTHP	0.00	100.0%	0.5	7.3%
<b>Program Total</b>	<b>0.32</b>	<b>108.3%</b>	<b>0.5</b>	<b>5.78%</b>

**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	189.6%	0.5	17.7%
Mini-Split HP	0.02	292.2%	0.5	28.1%
GSHP	0.00	490.4%	0.5	47.6%
CAC	0.00	290.5%	0.5	35.5%
Furnace Fan	0.04	100.0%	0.5	11.1%
Thermostat	0.00	100.0%	0.5	10.8%
HVAC Tune-Up	0.11	99.9%	0.5	7.2%
PTAC	0.00	100.0%	0.5	0.0%
PTHP	0.00	100.0%	0.5	7.9%
<b>Program Total</b>	<b>0.20</b>	<b>139.2%</b>	<b>0.5</b>	<b>8.44%</b>

**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	0.10	173.2%	0.5	12.1%
Mini-Split HP	0.16	68.6%	0.5	11.2%
GSHP	0.02	384.3%	0.5	15.2%
CAC	0.02	200.8%	0.5	15.2%
Furnace Fan	0.11	91.8%	0.5	9.4%
Thermostat	0.00	100.0%	0.5	7.8%
HVAC Tune-Up	0.09	101.9%	0.5	8.7%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	5.7%
<b>Program Total</b>	<b>0.50</b>	<b>116.4%</b>	<b>0.5</b>	<b>5.11%</b>

## 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 and PY11, 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 PY11Q4. 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. The achieved sample sizes and response rates are from the PY11 NTG effort.

**Table 270: Res HVAC Initiative Net-to-Gross Sampling for Met-Ed**

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,952	72	26.2%
<b>Program Total</b>	<b>2,952</b>	<b>72</b>	<b>26.2%</b>

**Table 271: Res HVAC Initiative Net-to-Gross Sampling for Penelec**

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,155	79	28.4%
<b>Program Total</b>	<b>2,155</b>	<b>79</b>	<b>28.4%</b>

**Table 272: Res HVAC Initiative Net-to-Gross Sampling for Penn Power**

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,935	67	24.7%
<b>Program Total</b>	<b>1,935</b>	<b>67</b>	<b>24.7%</b>

**Table 273: Res HVAC Initiative Net-to-Gross Sampling for WPP**

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	4,320	62	2.2%
<b>Program Total</b>	<b>4,320</b>	<b>62</b>	<b>2.2%</b>

### 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	2,156	50.4%	1.1%	50.7%	12.7%
<b>Program Total</b>	<b>2,156</b>	<b>50.4%</b>	<b>1.1%</b>	<b>50.7%</b>	<b>12.7%</b>

**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	2,111	48.6%	0.9%	52.3%	12.2%
<b>Program Total</b>	<b>2,111</b>	<b>48.6%</b>	<b>0.9%</b>	<b>52.3%</b>	<b>12.2%</b>

**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	643	52.8%	7.6%	54.8%	13.0%
<b>Program Total</b>	<b>643</b>	<b>52.8%</b>	<b>7.6%</b>	<b>54.8%</b>	<b>13.0%</b>

**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	2,698	48.3%	0.3%	52.0%	13.7%
<b>Program Total</b>	<b>2,698</b>	<b>48.3%</b>	<b>0.3%</b>	<b>52.0%</b>	<b>13.7%</b>

# 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 PY11, 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 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	104	8	13
Heat Pump Water Heater - Midstream	427	0	427
Clothes Washer	1,153	89	52
Dehumidifier	557	45	23
Dehumidifier - Midstream	1,728	0	1,728
Refrigerator	1,125	68	29
Clothes Dryer	650	48	36
Freezer	114	12	12
<b>Program Total</b>	<b>5,858</b>	<b>270</b>	<b>2,320</b>

**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	19	4	6
Heat Pump Water Heater - Midstream	254	0	254
Clothes Washer	703	49	64
Dehumidifier	979	63	77
Dehumidifier - Midstream	1,036	0	1,036
Refrigerator	805	49	49
Clothes Dryer	310	17	43
Freezer	101	9	19
<b>Program Total</b>	<b>4,207</b>	<b>191</b>	<b>1,548</b>

**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	2	1	0
Heat Pump Water Heater - Midstream	90	0	90
Clothes Washer	310	26	36
Dehumidifier	214	21	23
Dehumidifier - Midstream	979	0	979
Refrigerator	317	30	25
Clothes Dryer	145	10	24
Freezer	46	3	10
<b>Program Total</b>	<b>2,103</b>	<b>91</b>	<b>1,187</b>

**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	48	6	17
Heat Pump Water Heater - Midstream	357	0	357
Clothes Washer	1,134	76	83
Dehumidifier	780	62	70
Dehumidifier - Midstream	1,780	0	1,780
Refrigerator	1,145	80	53
Clothes Dryer	628	39	60
Freezer	125	17	21
<b>Program Total</b>	<b>5,997</b>	<b>280</b>	<b>2,441</b>

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	99	7	13
Dehumidifier	23	3	7
Refrigerator	71	8	7
Clothes Dryer	43	1	11
Freezer	7	1	0
<b>Program Total</b>	<b>243</b>	<b>20</b>	<b>38</b>

**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	124	17	24
Dehumidifier	68	7	21
Refrigerator	86	15	16
Clothes Dryer	49	9	11
Freezer	10	1	7
<b>Program Total</b>	<b>337</b>	<b>49</b>	<b>79</b>

**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	28	2	9
Dehumidifier	23	1	6
Refrigerator	20	3	1
Clothes Dryer	15	1	6
Freezer	4	1	3
<b>Program Total</b>	<b>90</b>	<b>8</b>	<b>25</b>

**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	90	11	26
Dehumidifier	55	4	20
Refrigerator	77	8	13
Clothes Dryer	41	1	18
Freezer	12	1	6
<b>Program Total</b>	<b>275</b>	<b>25</b>	<b>83</b>

### 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	144	147.7%	0.5	0.0%
Heat Pump Water Heater - Midstream	593	148.6%	0.5	0.0%
Clothes Washer	107	148.0%	0.5	236.3%
Dehumidifier	78	92.8%	0.5	0.0%
Dehumidifier - Midstream	241	144.8%	0.5	0.0%
Refrigerator	75	83.2%	0.5	0.0%
Clothes Dryer	16	109.6%	0.5	0.0%
Freezer	3	202.4%	0.5	0.0%
<b>Program Total</b>	<b>1,257</b>	<b>140.0%</b>	<b>0.5</b>	<b>21.2%</b>

**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	26	148.3%	0.5	0.0%
Heat Pump Water Heater - Midstream	353	147.9%	0.5	0.0%
Clothes Washer	65	139.3%	0.5	219.8%
Dehumidifier	136	105.5%	0.5	0.0%
Dehumidifier - Midstream	144	143.5%	0.5	0.0%
Refrigerator	53	87.4%	0.5	0.0%
Clothes Dryer	8	108.6%	0.5	0.0%
Freezer	2	213.8%	0.5	0.0%
<b>Program Total</b>	<b>788</b>	<b>134.8%</b>	<b>0.5</b>	<b>18.8%</b>

**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	3	100.0%	0.5	0.0%
Heat Pump Water Heater - Midstream	125	148.6%	0.5	0.0%
Clothes Washer	29	148.1%	0.5	209.4%
Dehumidifier	30	97.5%	0.5	0.0%
Dehumidifier - Midstream	136	145.2%	0.5	0.0%
Refrigerator	21	94.1%	0.5	0.0%
Clothes Dryer	4	111.4%	0.5	0.0%
Freezer	1	221.5%	0.5	0.0%
<b>Program Total</b>	<b>348</b>	<b>139.0%</b>	<b>0.5</b>	<b>18.4%</b>

**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	67	148.6%	0.5	0.0%
Heat Pump Water Heater - Midstream	496	148.3%	0.5	0.0%
Clothes Washer	105	151.5%	0.5	214.3%
Dehumidifier	109	93.8%	0.5	0.0%
Dehumidifier - Midstream	248	144.7%	0.5	0.0%
Refrigerator	76	96.3%	0.5	0.0%
Clothes Dryer	16	111.6%	0.5	0.0%
Freezer	3	214.6%	0.5	0.0%
<b>Program Total</b>	<b>1,119</b>	<b>138.7%</b>	<b>0.5</b>	<b>22.0%</b>

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	142.1%	0.5	213.1%
Dehumidifier	3	106.4%	0.5	0.0%
Refrigerator	5	99.0%	0.5	0.0%
Clothes Dryer	1	112.1%	0.5	0.0%
Freezer	0	100.0%	0.5	0.0%
<b>Program Total</b>	<b>18</b>	<b>122.9%</b>	<b>0.5</b>	<b>124.6%</b>

**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	12	135.7%	0.5	209.6%
Dehumidifier	9	99.3%	0.5	0.0%
Refrigerator	6	90.6%	0.5	0.0%
Clothes Dryer	1	111.8%	0.5	0.0%
Freezer	0	194.5%	0.5	0.0%
<b>Program Total</b>	<b>28</b>	<b>113.9%</b>	<b>0.5</b>	<b>103.1%</b>

**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	146.9%	0.5	123.3%
Dehumidifier	3	121.6%	0.5	0.0%
Refrigerator	1	91.6%	0.5	0.0%
Clothes Dryer	0	112.0%	0.5	0.0%
Freezer	0	216.5%	0.5	0.0%
<b>Program Total</b>	<b>8</b>	<b>125.8%</b>	<b>0.5</b>	<b>49.6%</b>

**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	8	141.9%	0.5	191.5%
Dehumidifier	8	107.4%	0.5	0.0%
Refrigerator	5	99.1%	0.5	0.0%
Clothes Dryer	1	111.4%	0.5	0.0%
Freezer	0	200.1%	0.5	0.0%
<b>Program Total</b>	<b>22</b>	<b>119.9%</b>	<b>0.5</b>	<b>85.2%</b>

### 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	170.7%	0.5	0.0%
Heat Pump Water Heater - Midstream	0.04	171.8%	0.5	0.0%
Clothes Washer	0.01	142.9%	0.5	236.3%
Dehumidifier	0.02	92.7%	0.5	0.0%
Dehumidifier - Midstream	0.06	144.8%	0.5	0.0%
Refrigerator	0.01	78.4%	0.5	0.0%
Clothes Dryer	0.00	100.7%	0.5	0.0%
Freezer	0.00	202.9%	0.5	0.0%
<b>Program Total</b>	<b>0.15</b>	<b>142.4%</b>	<b>0.5</b>	<b>18.1%</b>

**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	171.1%	0.5	0.0%
Heat Pump Water Heater - Midstream	0.02	171.0%	0.5	0.0%
Clothes Washer	0.01	136.5%	0.5	219.8%
Dehumidifier	0.03	104.6%	0.5	0.0%
Dehumidifier - Midstream	0.04	143.5%	0.5	0.0%
Refrigerator	0.01	81.2%	0.5	0.0%
Clothes Dryer	0.00	99.1%	0.5	0.0%
Freezer	0.00	201.9%	0.5	0.0%
<b>Program Total</b>	<b>0.11</b>	<b>133.7%</b>	<b>0.5</b>	<b>14.5%</b>

**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	100.0%	0.5	0.0%
Heat Pump Water Heater - Midstream	0.01	171.8%	0.5	0.0%
Clothes Washer	0.00	146.0%	0.5	209.4%
Dehumidifier	0.01	96.5%	0.5	0.0%
Dehumidifier - Midstream	0.03	145.2%	0.5	0.0%
Refrigerator	0.00	86.5%	0.5	0.0%
Clothes Dryer	0.00	99.7%	0.5	0.0%
Freezer	0.00	192.9%	0.5	0.0%
<b>Program Total</b>	<b>0.06</b>	<b>139.7%</b>	<b>0.5</b>	<b>12.3%</b>

**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	0.00	171.6%	0.5	0.0%
Heat Pump Water Heater - Midstream	0.03	171.5%	0.5	0.0%
Clothes Washer	0.01	148.4%	0.5	214.3%
Dehumidifier	0.03	93.1%	0.5	0.0%
Dehumidifier - Midstream	0.06	144.7%	0.5	0.0%
Refrigerator	0.01	89.1%	0.5	0.0%
Clothes Dryer	0.00	100.9%	0.5	0.0%
Freezer	0.00	203.6%	0.5	0.0%
<b>Program Total</b>	<b>0.15</b>	<b>138.6%</b>	<b>0.5</b>	<b>17.5%</b>

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	137.1%	0.5	213.1%
Dehumidifier	0.00	106.6%	0.5	0.0%
Refrigerator	0.00	93.5%	0.5	0.0%
Clothes Dryer	0.00	103.5%	0.5	0.0%
Freezer	0.00	100.0%	0.5	0.0%
<b>Program Total</b>	<b>0.00</b>	<b>115.6%</b>	<b>0.5</b>	<b>100.2%</b>

**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	129.6%	0.5	209.6%
Dehumidifier	0.00	98.9%	0.5	0.0%
Refrigerator	0.00	84.4%	0.5	0.0%
Clothes Dryer	0.00	103.0%	0.5	0.0%
Freezer	0.00	186.3%	0.5	0.0%
<b>Program Total</b>	<b>0.00</b>	<b>106.2%</b>	<b>0.5</b>	<b>72.5%</b>

**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	140.3%	0.5	123.3%
Dehumidifier	0.00	119.8%	0.5	0.0%
Refrigerator	0.00	83.2%	0.5	0.0%
Clothes Dryer	0.00	103.3%	0.5	0.0%
Freezer	0.00	185.8%	0.5	0.0%
<b>Program Total</b>	<b>0.00</b>	<b>119.7%</b>	<b>0.5</b>	<b>31.7%</b>

**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	136.0%	0.5	191.5%
Dehumidifier	0.00	106.9%	0.5	0.0%
Refrigerator	0.00	92.0%	0.5	0.0%
Clothes Dryer	0.00	102.7%	0.5	0.0%
Freezer	0.00	190.1%	0.5	0.0%
<b>Program Total</b>	<b>0.00</b>	<b>112.4%</b>	<b>0.5</b>	<b>59.2%</b>

## L.2 NET IMPACT EVALUATION

### L.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted net impact evaluation for appliances in PY8 and again in PY11. 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. The achieved sample sizes and response rates in the table below are from the PY11 net impact evaluation effort.

**Table 303: Res Appliances Initiative Net-to-Gross Sampling for Met-Ed**

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	5,858	72	26.6%
<b>Program Total</b>	<b>5,858</b>	<b>72</b>	<b>26.6%</b>

**Table 304: Res Appliances Initiative Net-to-Gross Sampling for Penelec**

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	4,207	70	26.3%
<b>Program Total</b>	<b>4,207</b>	<b>70</b>	<b>26.3%</b>

**Table 305: Res Appliances Initiative Net-to-Gross Sampling for Penn Power**

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,103	76	29.1%
<b>Program Total</b>	<b>2,103</b>	<b>76</b>	<b>29.1%</b>

**Table 306: Res Appliances Initiative Net-to-Gross Sampling for WPP**

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	5,997	74	26.9%
<b>Program Total</b>	<b>5,997</b>	<b>74</b>	<b>26.9%</b>

### 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.

**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	1,760	52.8%	3.0%	50.2%	12.7%
<b>Program Total</b>	<b>1,760</b>	<b>52.8%</b>	<b>3.0%</b>	<b>50.2%</b>	<b>12.7%</b>

**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	1,063	46.9%	6.9%	60.0%	12.9%
<b>Program Total</b>	<b>1,063</b>	<b>46.9%</b>	<b>6.9%</b>	<b>60.0%</b>	<b>12.9%</b>

**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	484	56.0%	12.2%	56.2%	12.4%
<b>Program Total</b>	<b>484</b>	<b>56.0%</b>	<b>12.2%</b>	<b>56.2%</b>	<b>12.4%</b>

**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	1,552	49.2%	13.9%	64.7%	12.6%
<b>Program Total</b>	<b>1,552</b>	<b>49.2%</b>	<b>13.9%</b>	<b>64.7%</b>	<b>12.6%</b>

## 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 for 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	447	65	Survey (phone + online)
Freezers	92	22	
Dehumidifiers	20	2	
RACs	77	19	
<b>Program Total</b>	<b>636</b>	<b>108</b>	

**Table 313: LI ATI Initiative Gross Impact Sample Design for Penelec**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	578	84	Survey (phone + online)
Freezers	105	17	
Dehumidifiers	21	7	
RACs	80	17	
<b>Program Total</b>	<b>784</b>	<b>125</b>	

**Table 314: LI ATI Initiative Gross Impact Sample Design for Penn Power**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	104	15	Survey (phone + online)
Freezers	23	4	
Dehumidifiers	7	1	
RACs	20	3	
<b>Program Total</b>	<b>154</b>	<b>23</b>	

**Table 315: LI ATI Initiative Gross Impact Sample Design for WPP**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	501	91	Survey (phone + online)
Freezers	94	16	
Dehumidifiers	28	5	
RACs	74	14	
<b>Program Total</b>	<b>697</b>	<b>126</b>	

**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	422	102.6%	0.5	8.9%
Freezers	64	107.2%	0.5	15.4%
Dehumidifiers	10	160.2%	0.5	50.9%
RACs	9	119.9%	0.5	16.5%
<b>Program Total</b>	<b>504</b>	<b>104.6%</b>	<b>0.5</b>	<b>8.1%</b>

**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	612	95.6%	0.5	7.9%
Freezers	74	75.6%	0.5	17.5%
Dehumidifiers	9	127.3%	0.5	27.2%
RACs	9	90.0%	0.5	17.5%
<b>Program Total</b>	<b>705</b>	<b>93.9%</b>	<b>0.5</b>	<b>6.7%</b>

**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	112	94.6%	0.5	18.6%
Freezers	17	90.1%	0.5	36.0%
Dehumidifiers	3	169.8%	0.5	72.0%
RACs	2	100.0%	0.5	41.6%
<b>Program Total</b>	<b>134</b>	<b>95.8%</b>	<b>0.5</b>	<b>15.5%</b>

**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	514	98.9%	0.5	7.5%
Freezers	67	100.7%	0.5	18.0%
Dehumidifiers	13	152.0%	0.5	32.2%
RACs	8	101.9%	0.5	19.2%
<b>Program Total</b>	<b>603</b>	<b>100.3%</b>	<b>0.5</b>	<b>6.8%</b>

**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	0.05	102.6%	0.5	8.9%
Freezers	0.01	107.1%	0.5	15.4%
Dehumidifiers	0.00	155.8%	0.5	50.9%
RACs	0.02	100.0%	0.5	16.5%
<b>Program Total</b>	<b>0.08</b>	<b>103.7%</b>	<b>0.5</b>	<b>7.6%</b>

**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	0.07	95.6%	0.5	7.9%
Freezers	0.01	75.5%	0.5	17.5%
Dehumidifiers	0.00	143.2%	0.5	27.2%
RACs	0.02	88.9%	0.5	17.5%
<b>Program Total</b>	<b>0.10</b>	<b>93.6%</b>	<b>0.5</b>	<b>6.2%</b>

**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	0.01	94.6%	0.5	18.6%
Freezers	0.00	90.1%	0.5	36.0%
Dehumidifiers	0.00	159.2%	0.5	72.0%
RACs	0.01	100.0%	0.5	41.6%
<b>Program Total</b>	<b>0.02</b>	<b>97.8%</b>	<b>0.5</b>	<b>16.0%</b>

**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	0.06	98.9%	0.5	7.5%
Freezers	0.01	100.7%	0.5	18.0%
Dehumidifiers	0.00	164.6%	0.5	32.2%
RACs	0.02	100.0%	0.5	19.2%
<b>Program Total</b>	<b>0.09</b>	<b>101.4%</b>	<b>0.5</b>	<b>6.9%</b>

## 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 2020 Federal Income Poverty Guideline (FPIG).

To join this program, new participants must submit their most recent Household Income Tax Return and pay stubs for the last 30 days to FirstEnergy contractors to verify their income. FirstEnergy also maintains a list of known Low-Income customers to verify 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<sup>20</sup>.

### 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	1,350	175	11	TRM
Medium Savings	900	345	11	Analysis + On-Site
Low Savings	0	641	41	
<b>Program Total</b>		<b>1,161</b>	<b>63</b>	Verification

**Table 325: LI DI Initiative Gross Impact Sample Design for Penelec**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,500	180	22	TRM
Medium Savings	850	329	18	Analysis + On-Site
Low Savings	0	1,218	50	
<b>Program Total</b>		<b>1,727</b>	<b>90</b>	Verification

<sup>20</sup> There are other measures with sparse implementation that are also not credited savings. One example is the installation of a clothesline. 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	1,100	74	8	TRM
Medium Savings	770	130	12	Analysis + On-Site
Low Savings	0	479	43	
<b>Program Total</b>		<b>683</b>	<b>63</b>	Verification

**Table 327: LI DI Initiative Gross Impact Sample Design for WPP**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,580	222	14	TRM
Medium Savings	1,180	324	14	Analysis + On-Site
Low Savings	0	986	53	
<b>Program Total</b>		<b>1,532</b>	<b>81</b>	Verification

### 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	1,350	298	102.7%	0.5	21%
Medium Savings	900	391	104.7%	0.5	21%
Low Savings	0	240	103.0%	0.5	11%
<b>Program Total</b>		<b>929</b>	<b>103.6%</b>	<b>0.5</b>	<b>11.6%</b>

**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	1,500	362	101.1%	0.5	14%
Medium Savings	850	368	103.8%	0.5	16%
Low Savings	0	367	116.7%	0.5	10%
<b>Program Total</b>		<b>1,097</b>	<b>107.2%</b>	<b>0.5</b>	<b>7.9%</b>

**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	1,100	111	112.8%	0.5	24%
Medium Savings	770	125	111.9%	0.5	20%
Low Savings	0	114	109.3%	0.5	10%
<b>Program Total</b>		<b>350</b>	<b>111.3%</b>	<b>0.5</b>	<b>11.0%</b>

**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	1,580	437	96.9%	0.5	19%
Medium Savings	1,180	438	101.8%	0.5	19%
Low Savings	0	453	106.3%	0.5	10%
<b>Program Total</b>		<b>1,328</b>	<b>101.7%</b>	<b>0.5</b>	<b>9.2%</b>

#### 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	1,350	0.03	102.4%	0.5	21%
Medium Savings	900	0.04	104.0%	0.5	21%
Low Savings	0	0.02	110.6%	0.5	11%
<b>Program Total</b>		<b>0.10</b>	<b>105.1%</b>	<b>0.5</b>	<b>11.7%</b>

**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	1,500	0.03	102.8%	0.5	14%
Medium Savings	850	0.04	103.8%	0.5	16%
Low Savings	0	0.03	122.1%	0.5	10%
<b>Program Total</b>		<b>0.10</b>	<b>108.8%</b>	<b>0.5</b>	<b>8.1%</b>

**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	1,100	0.01	108.3%	0.5	24%
Medium Savings	770	0.01	110.4%	0.5	20%
Low Savings	0	0.01	106.5%	0.5	10%
<b>Program Total</b>		<b>0.03</b>	<b>108.5%</b>	<b>0.5</b>	<b>11.1%</b>

**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	1,580	0.05	101.9%	0.5	19%
Medium Savings	1,180	0.05	102.1%	0.5	19%
Low Savings	0	0.04	109.0%	0.5	10%
<b>Program Total</b>		<b>0.14</b>	<b>104.3%</b>	<b>0.5</b>	<b>9.4%</b>

## 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	0	0	Survey (phone + online)
LI EE Kits - Standard	0	0	
LI School Education Kits	35	1	
<b>Program Total</b>	<b>35</b>	<b>1</b>	

**Table 337: LI EE Kits Initiative Gross Impact Sample Design for Penelec**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	0	0	Survey (phone + online)
LI EE Kits - Standard	0	0	
LI School Education Kits	0	0	
<b>Program Total</b>	<b>0</b>	<b>0</b>	

**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	0	0	Survey (phone + online)
LI EE Kits - Standard	0	0	
LI School Education Kits	1	0	
<b>Program Total</b>	<b>1</b>	<b>0</b>	

**Table 339: LI EE Kits Initiative Gross Impact Sample Design for WPP**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	0	0	Survey (phone + online)
LI EE Kits - Standard	0	0	
LI School Education Kits	109	5	
<b>Program Total</b>	<b>109</b>	<b>5</b>	

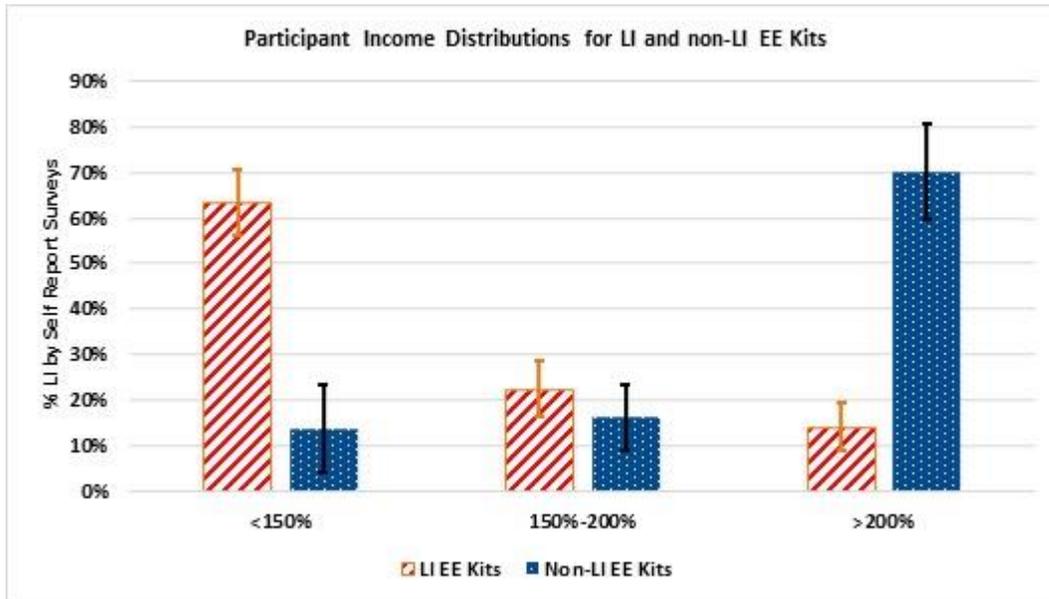
### O.1.3 Determination of Low-Income Eligibility

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. PY9 survey results for the EE Kits and LI EE Kits are shown in Figure 28 below<sup>21</sup>. 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

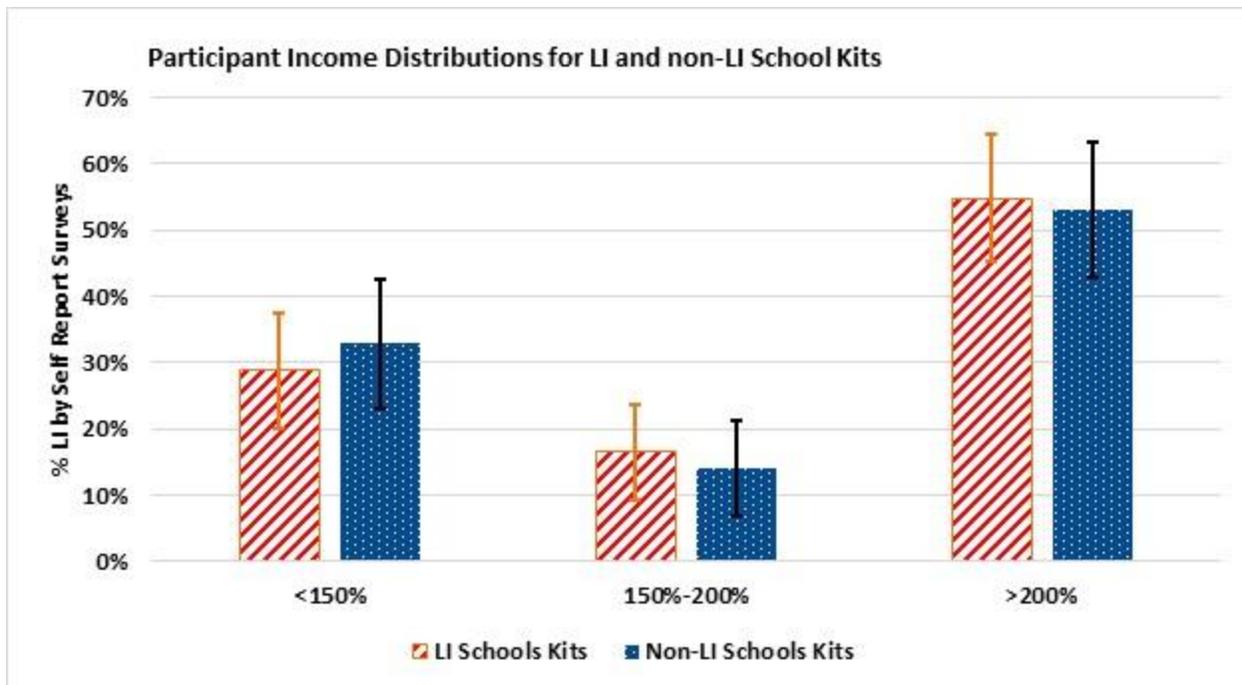
<sup>21</sup> The figure is not updated for later years since it served to identify and issue which has been resolved through the adjustment process discussed herein.

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<sup>22</sup>. 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.

<sup>22</sup> 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](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	31.43%
Met-Ed	Res	30.70%
Penelec	Res LI	0.00%
Penelec	Res	31.20%
Penn Power	Res LI	0.00%
Penn Power	Res	47.47%
WPP	Res LI	50.46%
WPP	Res	31.40%

A detailed breakdown of reported and verified impacts for the School Education Kits program component is provided in Table 341 below.

**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	Reported kWh	Reported kW	Verified kWh	Verified kW
Met-Ed	1	0	24	8,824	1.0	10,667	1.6
Met-Ed	1	1	11	4,044	0.5	4,889	0.7
Met-Ed	0	0	272	95,248	11.0	110,034	14.1
Met-Ed	0	1	120	42,187	4.9	48,736	6.2
Penelec	1	0	0	0	0.0	0	0.0
Penelec	1	1	0	0	0.0	0	0.0
Penelec	0	0	278	104,860	10.8	111,545	12.7
Penelec	0	1	126	47,553	4.9	50,584	5.8
Penn Power	1	0	1	394	0.0	394	0.0
Penn Power	1	1	0	0	0.0	0	0.0
Penn Power	0	0	84	31,535	3.6	28,646	3.2
Penn Power	0	1	76	28,495	3.2	25,885	2.9
WPP	1	0	54	20,909	2.6	13,051	1.7
WPP	1	1	55	21,296	2.6	13,292	1.8
WPP	0	0	864	318,941	39.4	333,290	42.6
WPP	0	1	396	146,016	18.0	152,585	19.5

### 0.1.4 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	0	0.0%	0.5	0%
LI EE Kits - Standard	0	0.0%	0.5	0%
LI School Education Kits	13	120.9%	0.5	71%
<b>Program Total</b>	<b>13</b>	<b>120.9%</b>	<b>0.5</b>	<b>71.0%</b>

**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	0	0.0%	0.5	0%
LI EE Kits - Standard	0	0.0%	0.5	0%
LI School Education Kits	0	0.0%	0.5	0%
<b>Program Total</b>	<b>0</b>	<b>0.0%</b>	<b>0.5</b>	<b>0.0%</b>

**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	0	0.0%	0.5	0%
LI EE Kits - Standard	0	0.0%	0.5	0%
LI School Education Kits	0	100.0%	0.5	0%
<b>Program Total</b>	<b>0</b>	<b>100.0%</b>	<b>0.5</b>	<b>0.0%</b>

**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	0	0.0%	0.5	0%
LI EE Kits - Standard	0	0.0%	0.5	0%
LI School Education Kits	42	62.4%	0.5	31%
<b>Program Total</b>	<b>42</b>	<b>62.4%</b>	<b>0.5</b>	<b>31.5%</b>

### 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	0.00	0.0%	0.5	0%
LI EE Kits - Standard	0.00	0.0%	0.5	0%
LI School Education Kits	0.00	157.3%	0.5	71%
<b>Program Total</b>	<b>0.00</b>	<b>157.3%</b>	<b>0.5</b>	<b>71.0%</b>

**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	0.00	0.0%	0.5	0%
LI EE Kits - Standard	0.00	0.0%	0.5	0%
LI School Education Kits	0.00	0.0%	0.5	0%
<b>Program Total</b>	<b>0.00</b>	<b>0.0%</b>	<b>0.5</b>	<b>0.0%</b>

**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	0.00	0.0%	0.5	0%
LI EE Kits - Standard	0.00	0.0%	0.5	0%
LI School Education Kits	0.00	100.0%	0.5	0%
<b>Program Total</b>	<b>0.00</b>	<b>100.0%</b>	<b>0.5</b>	<b>0.0%</b>

**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	0.00	0.0%	0.5	0%
LI EE Kits - Standard	0.00	0.0%	0.5	0%
LI School Education Kits	0.01	67.6%	0.5	31%
<b>Program Total</b>	<b>0.01</b>	<b>67.6%</b>	<b>0.5</b>	<b>31.5%</b>

## 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

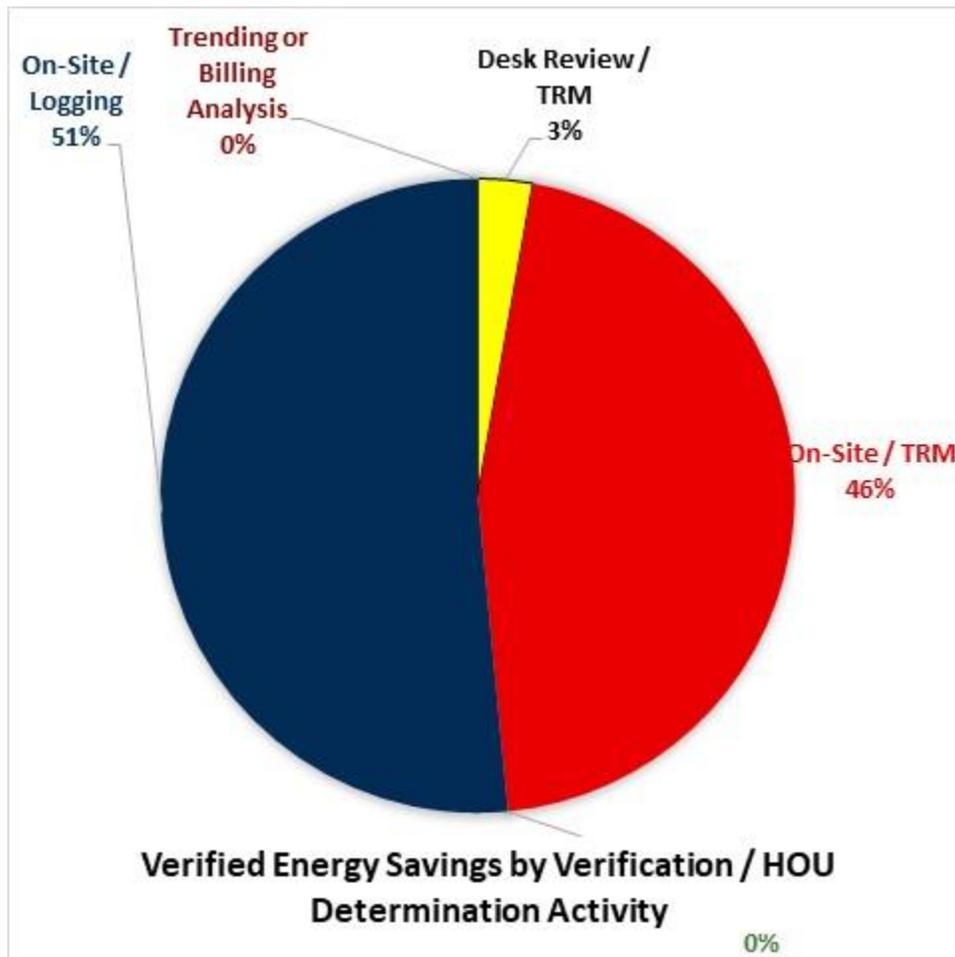
As a first step, projects are placed into one of four sampling strata as described in the next section. Each sampled lighting project first undergoes a desk review. The desk review includes reconciliation of invoices, fixture specification sheets (cut sheets), and re-calculating reported savings using 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 the Companies' implementation vendor 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	9	9	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	43	7	
Lighting-2	25	180	6	
Lighting-1	0	231	9	
<b>Program Total</b>	<b>n/a</b>	<b>463</b>	<b>31</b>	

**Table 351: CI Lighting Initiative Gross Impact Sample Design for Penelec**

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	41	9	
Lighting-2	25	258	8	
Lighting-1	0	407	6	
<b>Program Total</b>	<b>n/a</b>	<b>709</b>	<b>26</b>	

**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	5	5	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	19	6	
Lighting-2	25	76	7	
Lighting-1	0	137	8	
<b>Program Total</b>	<b>n/a</b>	<b>237</b>	<b>26</b>	

**Table 353: CI Lighting Initiative Gross Impact Sample Design for WPP**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Lighting-Certainty	750	9	9	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	52	14	
Lighting-2	25	227	5	
Lighting-1	0	419	7	
Program Total	n/a	707	35	

**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.

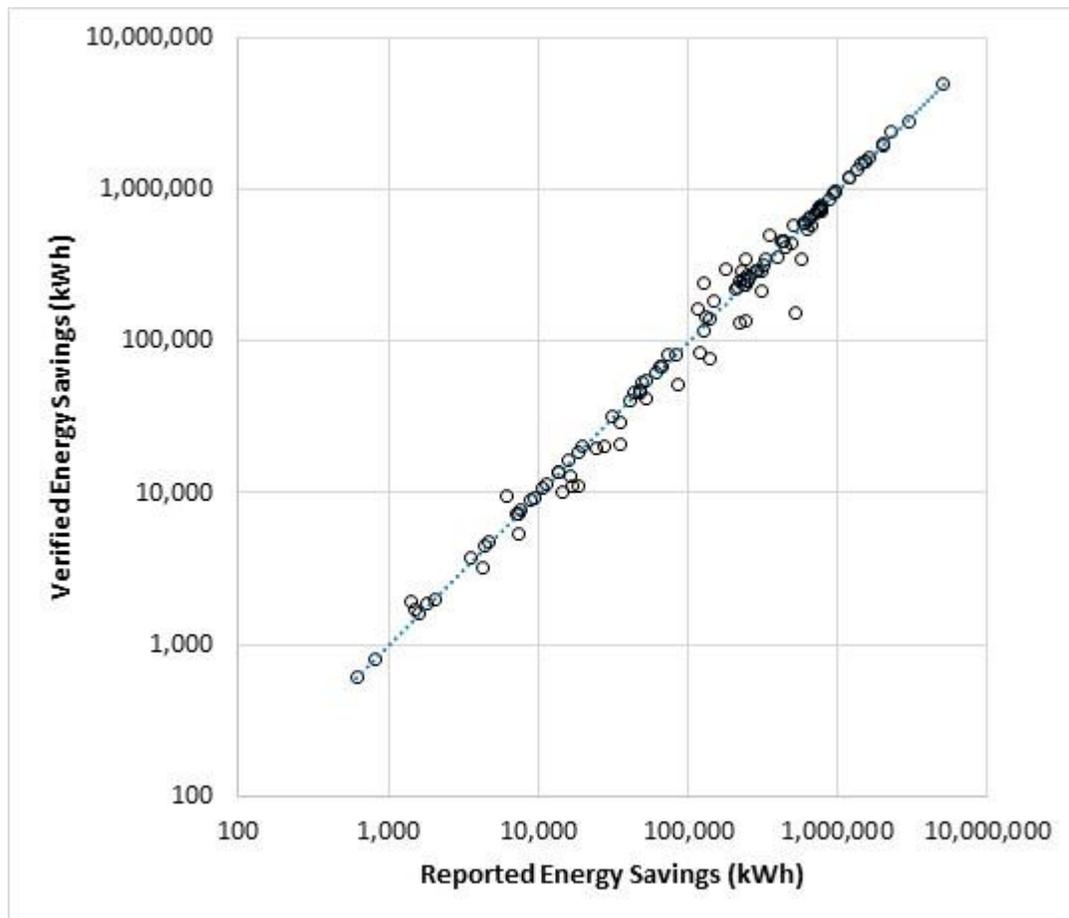


Figure 31: Verified vs. Reported Energy Savings for Sampled Lighting Projects.

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	11,550	99.9%	0.5	0%
Lighting-3	250	18,006	85.4%	0.5	25%
Lighting-2	25	12,737	97.7%	0.5	29%
Lighting-1	0	2,270	88.2%	0.5	24%
Program Total	n/a	44,563	92.8%	0.5	11.8%

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	10,345	96.7%	0.5	0%
Lighting-3	250	13,492	97.0%	0.5	21%
Lighting-2	25	17,835	108.7%	0.5	25%
Lighting-1	0	3,601	93.1%	0.5	29%
Program Total	n/a	45,273	101.2%	0.5	12.5%

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	4,625	100.0%	0.5	0%
Lighting-3	250	7,664	87.0%	0.5	24%
Lighting-2	25	5,251	120.4%	0.5	26%
Lighting-1	0	1,209	99.5%	0.5	25%
Program Total	n/a	18,750	100.4%	0.5	12.4%

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	8,830	98.9%	0.5	0%
Lighting-3	250	20,339	102.9%	0.5	16%
Lighting-2	25	15,605	91.8%	0.5	32%
Lighting-1	0	3,240	88.3%	0.5	27%
Program Total	n/a	48,014	97.6%	0.5	12.0%

### 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	1.84	100.6%	0.5	0%
Lighting-3	250	2.84	83.9%	0.5	25%
Lighting-2	25	1.69	77.3%	0.5	29%
Lighting-1	0	0.28	81.9%	0.5	24%
Program Total	n/a	6.65	86.8%	0.5	10.6%

**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	1.23	96.6%	0.5	0%
Lighting-3	250	1.76	100.3%	0.5	21%
Lighting-2	25	2.65	95.8%	0.5	25%
Lighting-1	0	0.45	68.9%	0.5	29%
Program Total	n/a	6.09	95.2%	0.5	12.2%

**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	0.66	100.0%	0.5	0%
Lighting-3	250	0.97	93.5%	0.5	24%
Lighting-2	25	0.63	104.4%	0.5	26%
Lighting-1	0	0.15	100.5%	0.5	25%
Program Total	n/a	2.41	98.6%	0.5	11.7%

**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	1.18	98.4%	0.5	0%
Lighting-3	250	2.67	110.2%	0.5	16%
Lighting-2	25	2.28	129.0%	0.5	32%
Lighting-1	0	0.37	78.4%	0.5	27%
Program Total	n/a	6.50	112.8%	0.5	16.2%

## 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. Please note that the population counts shown are from PY10, when the NTG study was conducted.

**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%
<b>Program Total</b>	<b>682</b>	<b>146</b>	<b>21.4%</b>

**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%
<b>Program Total</b>	<b>1,053</b>	<b>180</b>	<b>17.1%</b>

**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%
<b>Program Total</b>	<b>320</b>	<b>86</b>	<b>26.9%</b>

**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%
<b>Program Total</b>	<b>987</b>	<b>152</b>	<b>15.4%</b>

### 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-Gross Results for Met-Ed**

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Lighting-3	26,926	40.5%	1.1%	60.6%	11.3%
Lighting-2	12,442	28.4%	0.1%	71.7%	7.0%
Lighting-1	2,002	48.0%	0.1%	52.1%	10.1%
<b>Program Total</b>	<b>41,370</b>	<b>37.2%</b>	<b>0.7%</b>	<b>63.6%</b>	<b>7.4%</b>

**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	23,089	15.5%	3.6%	88.0%	12.1%
Lighting-2	19,381	35.7%	3.2%	67.5%	6.5%
Lighting-1	3,354	39.9%	2.6%	62.7%	8.4%
<b>Program Total</b>	<b>45,824</b>	<b>25.8%</b>	<b>3.3%</b>	<b>77.5%</b>	<b>7.4%</b>

**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	11,291	11.4%	0.0%	88.6%	12.3%
Lighting-2	6,323	35.0%	1.9%	66.9%	8.6%
Lighting-1	1,203	42.7%	2.4%	59.7%	12.9%
<b>Program Total</b>	<b>18,817</b>	<b>21.3%</b>	<b>0.8%</b>	<b>79.5%</b>	<b>8.6%</b>

**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	29,669	35.5%	0.0%	64.5%	12.7%
Lighting-2	14,323	32.8%	1.4%	68.7%	7.4%
Lighting-1	2,862	30.2%	0.0%	69.9%	9.1%
<b>Program Total</b>	<b>46,855</b>	<b>34.4%</b>	<b>0.4%</b>	<b>66.1%</b>	<b>8.2%</b>

# 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 placed into one of three sampling strata as described in the next section. As with lighting projects, each sampled custom project undergoes a desk review prior to M&V plan construction. The desk review includes a full documentation review and if needed, additional topical research. Evaluation of most projects requires an M&V plan. The first step in the M&V planning process is to check that the project is sufficiently documented, and that the evaluation engineer can articulate the mechanism or process that will yield the expected energy savings. ADM engineers are encouraged to contact the applicant early on in the M&V planning process to ask for additional documentation, clarification, or even to seek feedback on the feasibility of the proposed data acquisition and analysis methodology. The desk review and M&V plan will depend on the opportunities and constraints posed by each project. However, some defaults or “modes” are discussed for certain categories of projects below:

Air Compressor Projects: In many cases, vendors perform a baseline metering study prior to air compressor upgrades. The data collected from such studies are very useful, provided that they appear to be consistent with the overall project documentation. In many cases it is possible to use metered flow data or power data along with compressor curves to establish the facility’s compressed air load profile. The energy usage of the proposed air compressor may then be derived from application of compressor curves to the compressed air load profile. Additional activities such as post-installation metering or a billing analysis may be recommended, depending on project specifics. In some cases, baseline meter data are not available. In these cases, ADM will meter the new air compressor and use compressor curves to establish the underlying compressed air load profile, and then determine the baseline usage through application of the baseline compressor curves and (if needed) compressor staging practices.

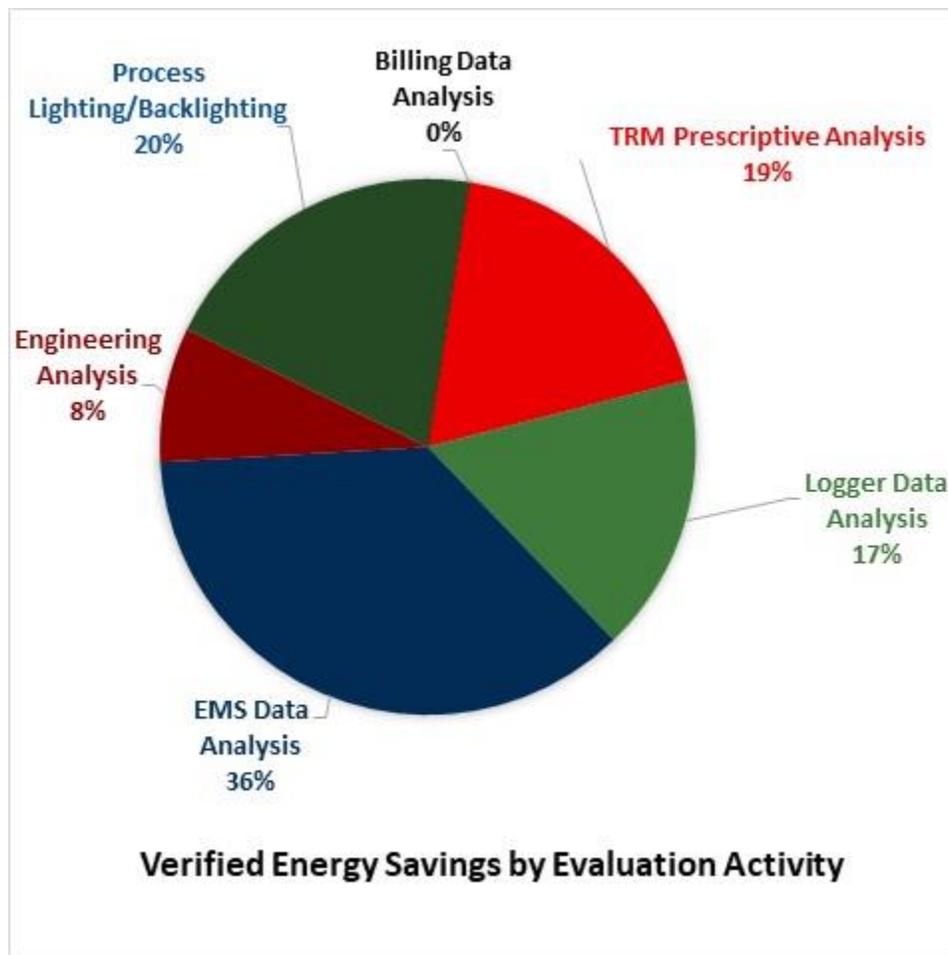
Water Pumping Projects: Pumping projects are typically evaluated through billing analysis, using water throughput as the normalizing variable.

Combined Heat and Power (CHP): CHP projects are typically evaluated through trending data analysis. The generator output is typically modeled as a function of explanatory variables that may include weather-related information, calendar day types (especially for universities), and availability of biofuels, if applicable. Parasitic loads are estimated through inspection of trending data, monitoring, or an inspection equipment specifications and operating schedules.

General Process Improvements: For general process improvements, the evaluation determines the change in the energy usage intensity associated with the creation or maintenance of one production unit.

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	2	2	On-Site Verification, Metering
Custom-2	250	6	4	
Custom-1	0	65	14	
<b>Program Total</b>	n/a	73	20	

**Table 371: CI Custom Initiative Gross Impact Sample Design for Penelec**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	3	3	On-Site Verification, Metering
Custom-2	250	4	1	
Custom-1	0	120	18	
<b>Program Total</b>	n/a	127	22	

**Table 372: CI Custom Initiative Gross Impact Sample Design for Penn Power**

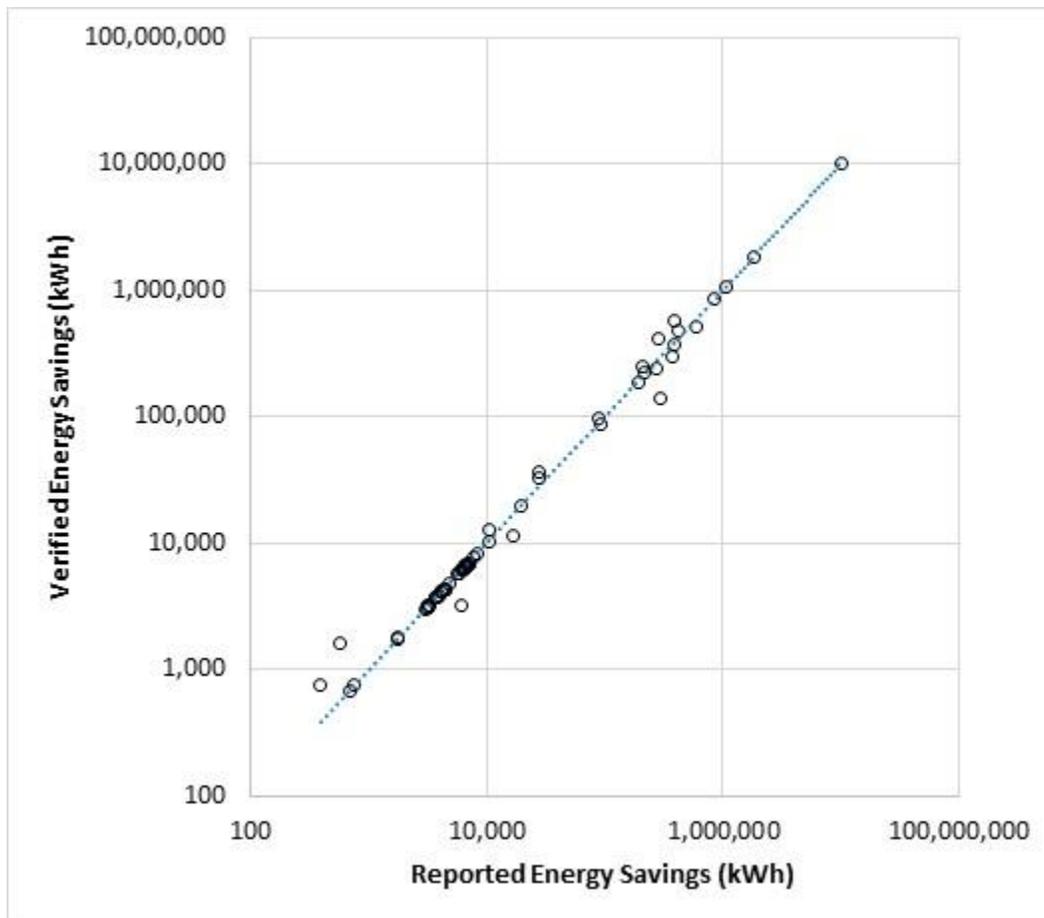
Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	1	1	On-Site Verification, Metering
Custom-2	250	1	1	
Custom-1	0	38	15	
<b>Program Total</b>	n/a	40	17	

**Table 373: CI Custom Initiative Gross Impact Sample Design for WPP**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	4	4	On-Site Verification, Metering
Custom-2	250	2	1	
Custom-1	0	131	14	
Program Total	n/a	137	19	

**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	11,400	100.0%	0.5	0%
Custom-2	250	2,004	88.3%	0.5	21%
Custom-1	0	3,269	100.5%	0.5	17%
<b>Program Total</b>	<b>n/a</b>	<b>16,673</b>	<b>98.7%</b>		<b>4.0%</b>

**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	10,940	100.0%	0.5	0%
Custom-2	250	1,349	86.4%	0.5	62%
Custom-1	0	3,614	109.9%	0.5	16%
<b>Program Total</b>	<b>n/a</b>	<b>15,903</b>	<b>101.1%</b>		<b>6.0%</b>

**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	286	147.1%	0.5	0%
Custom-2	250	588	87.9%	0.5	0%
Custom-1	0	1,789	103.4%	0.5	14%
<b>Program Total</b>	<b>n/a</b>	<b>2,663</b>	<b>104.7%</b>		<b>10.0%</b>

**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	3,072	100.0%	0.5	0%
Custom-2	250	689	152.5%	0.5	51%
Custom-1	0	6,146	107.0%	0.5	18%
<b>Program Total</b>	<b>n/a</b>	<b>9,906</b>	<b>108.0%</b>		<b>13.2%</b>

**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	1.53	100.0%	0.5	0%
Custom-2	250	0.20	104.9%	0.5	21%
Custom-1	0	0.51	106.9%	0.5	17%
<b>Program Total</b>	<b>n/a</b>	<b>2.24</b>	<b>102.0%</b>		<b>4.6%</b>

**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	1.29	106.0%	0.5	0%
Custom-2	250	0.10	85.4%	0.5	62%
Custom-1	0	0.44	75.9%	0.5	16%
<b>Program Total</b>	<b>n/a</b>	<b>1.83</b>	<b>97.7%</b>		<b>4.1%</b>

**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	0.03	149.2%	0.5	0%
Custom-2	250	0.09	97.3%	0.5	0%
Custom-1	0	0.21	103.2%	0.5	14%
<b>Program Total</b>	<b>n/a</b>	<b>0.33</b>	<b>106.0%</b>		<b>9.5%</b>

**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	0.31	100.1%	0.5	0%
Custom-2	250	0.14	65.2%	0.5	51%
Custom-1	0	0.88	36.2%	0.5	18%
<b>Program Total</b>	<b>n/a</b>	<b>1.33</b>	<b>54.1%</b>		<b>5.7%</b>

## 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. Please note that the population counts shown are from PY10, when the NTG study was conducted.

**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%
<b>Program Total</b>	<b>50</b>	<b>26</b>	<b>52.0%</b>

**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%
<b>Program Total</b>	<b>119</b>	<b>34</b>	<b>28.6%</b>

**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%
<b>Program Total</b>	<b>22</b>	<b>11</b>	<b>50.0%</b>

**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%
<b>Program Total</b>	<b>52</b>	<b>21</b>	<b>40.4%</b>

### 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	13,169	43.6%	0.0%	56.4%	8.5%
Custom-1	3,285	48.3%	0.0%	51.7%	12.7%
<b>Program Total</b>	<b>16,454</b>	<b>44.6%</b>	<b>0.0%</b>	<b>55.4%</b>	<b>7.3%</b>

**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	12,106	8.4%	0.5%	92.1%	10.2%
Custom-1	3,973	42.2%	0.0%	57.8%	12.6%
<b>Program Total</b>	<b>16,079</b>	<b>16.7%</b>	<b>0.4%</b>	<b>83.6%</b>	<b>8.8%</b>

**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	938	36.5%	0.0%	63.5%	0.0%
Custom-1	1,850	53.1%	0.0%	46.9%	21.3%
<b>Program Total</b>	<b>2,787</b>	<b>47.5%</b>	<b>0.0%</b>	<b>52.5%</b>	<b>12.6%</b>

**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	4,122	50.0%	0.0%	50.0%	39.4%
Custom-1	6,574	40.4%	0.0%	59.6%	12.7%
<b>Program Total</b>	<b>10,696</b>	<b>44.1%</b>	<b>0.0%</b>	<b>55.9%</b>	<b>16.0%</b>

# 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	0	0	Desk Review, On-Site Verification
Prescriptive-1	0	27	15	
<b>Program Total</b>	<b>n/a</b>	<b>27</b>	<b>15</b>	

**Table 391: CI Prescriptive Initiative Gross Impact Sample Design for Penelec**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	1	1	Desk Review, On-Site Verification
Prescriptive-1	0	36	19	
<b>Program Total</b>	<b>n/a</b>	<b>37</b>	<b>20</b>	

**Table 392: CI Prescriptive Initiative Gross Impact Sample Design for Penn Power**

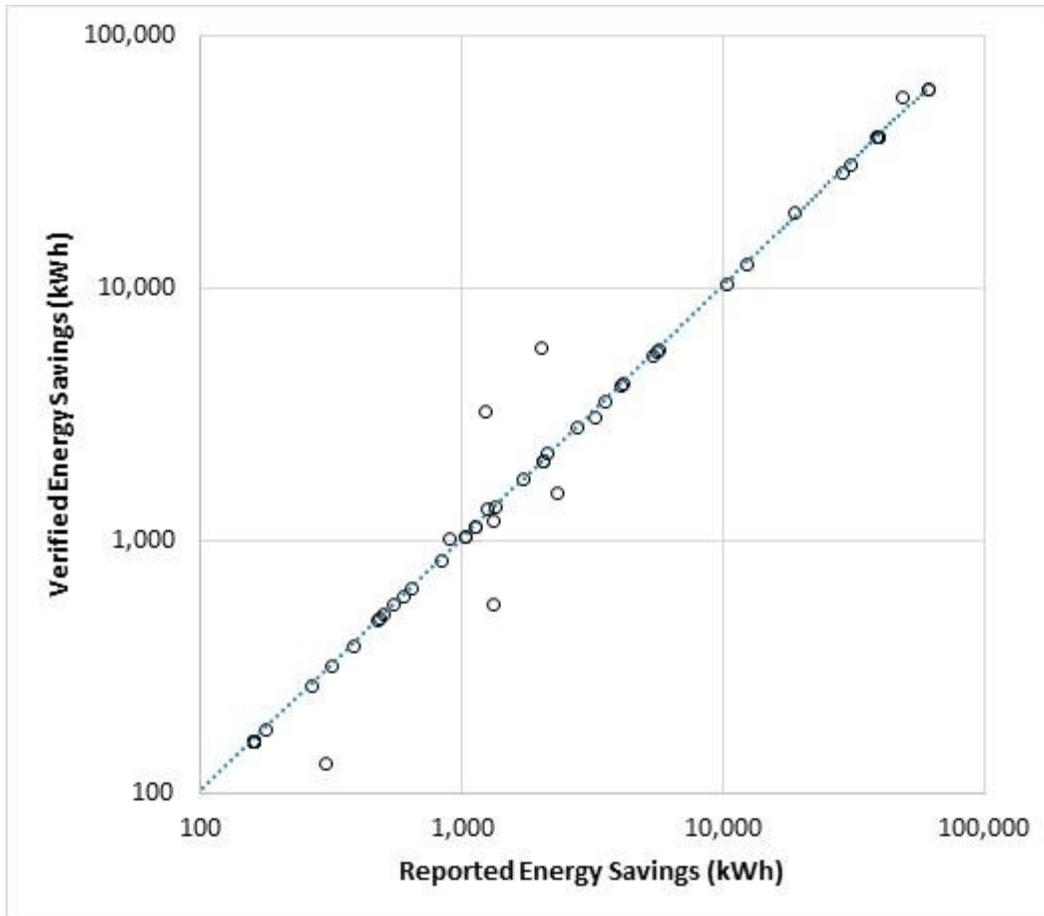
Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	1	1	Desk Review, On-Site Verification
Prescriptive-1	0	5	4	
<b>Program Total</b>	n/a	6	5	

**Table 393: CI Prescriptive Initiative Gross Impact Sample Design for WPP**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	2	1	Desk Review, On-Site Verification
Prescriptive-1	0	44	18	
<b>Program Total</b>	n/a	46	19	

### 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	0	0.0%	0.4	0%
Prescriptive-1	0	142	100.1%	0.4	10%
Program Total	n/a	142	100.1%		9.9%

**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	61	100.0%	0.4	0%
Prescriptive-1	0	103	101.2%	0.4	9%
Program Total	n/a	164	100.8%		5.8%

**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	49	116.1%	0.4	0%
Prescriptive-1	0	25	104.9%	0.4	13%
Program Total	n/a	73	112.4%		4.5%

**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	111	100.0%	0.4	41%
Prescriptive-1	0	400	102.1%	0.4	10%
Program Total	n/a	511	101.7%		12.2%

#### 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	0.00	0.0%	0.4	0%
Prescriptive-1	0	0.05	81.4%	0.4	10%
Program Total	n/a	0.05	81.4%		8.1%

**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	0.02	100.1%	0.4	0%
Prescriptive-1	0	0.02	77.3%	0.4	9%
Program Total	n/a	0.04	87.7%		3.8%

**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	121.2%	0.4	0%
Prescriptive-1	0	0.00	121.5%	0.4	13%
Program Total	n/a	0.01	121.5%		13.5%

**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	0.04	100.0%	0.4	41%
Prescriptive-1	0	0.06	93.6%	0.4	10%
Program Total	n/a	0.10	96.0%		16.6%

## 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. Please note that the population counts shown are from PY10, when the NTG study was conducted.

**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%
<b>Program Total</b>	<b>43</b>	<b>15</b>	<b>34.9%</b>

**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%
<b>Program Total</b>	<b>61</b>	<b>40</b>	<b>65.6%</b>

**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%
<b>Program Total</b>	<b>15</b>	<b>10</b>	<b>66.7%</b>

**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%
<b>Program Total</b>	<b>57</b>	<b>30</b>	<b>52.6%</b>

### 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	0	50.0%	0.0%	50.0%	23.6%
Prescriptive-1	142	26.3%	0.0%	73.7%	18.1%
<b>Program Total</b>	<b>142</b>	<b>26.3%</b>	<b>0.0%</b>	<b>73.7%</b>	<b>18.1%</b>

**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	61	44.8%	0.0%	55.2%	9.6%
Prescriptive-1	104	58.1%	0.0%	41.9%	7.7%
<b>Program Total</b>	<b>165</b>	<b>53.2%</b>	<b>0.0%</b>	<b>46.8%</b>	<b>6.0%</b>

**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	57	62.5%	0.0%	37.5%	0.0%
Prescriptive-1	26	53.8%	0.0%	46.2%	14.3%
<b>Program Total</b>	<b>82</b>	<b>59.8%</b>	<b>0.0%</b>	<b>40.2%</b>	<b>5.2%</b>

**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	111	50.8%	0.0%	49.2%	16.1%
Prescriptive-1	409	58.8%	0.0%	41.2%	10.0%
<b>Program Total</b>	<b>519</b>	<b>57.1%</b>	<b>0.0%</b>	<b>42.9%</b>	<b>8.5%</b>

# 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	55	22 / 55	Phone Surveys / Desk Review
Freezers	7	2 / 7	
Dehumidifiers	0	0 / 0	
RACs	10	8 / 10	
<b>Program Total</b>	<b>72</b>	<b>32 / 72</b>	

**Table 411: C&I ATI Initiative Gross Impact Sample Design for Penelec**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	58	23 / 58	Phone Surveys / Desk Review
Freezers	7	3 / 7	
Dehumidifiers	0	0 / 0	
RACs	11	8 / 11	
<b>Program Total</b>	<b>76</b>	<b>34 / 76</b>	

**Table 412: C&I ATI Initiative Gross Impact Sample Design for Penn Power**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	4	2 / 4	Phone Surveys / Desk Review
Freezers	7	3 / 7	
Dehumidifiers	0	0 / 0	
RACs	3	3 / 3	
<b>Program Total</b>	<b>14</b>	<b>8 / 14</b>	

**Table 413: C&I ATI Initiative Gross Impact Sample Design for WPP**

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	53	21 / 53	Phone Surveys / Desk Review
Freezers	17	3 / 17	
Dehumidifiers	0	0 / 0	
RACs	5	2 / 5	
<b>Program Total</b>	<b>75</b>	<b>26 / 75</b>	

**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	52	108.0%	0.5	11.9%
Freezers	5	120.7%	0.5	43.0%
Dehumidifiers	0	0.0%	0.5	0.0%
RACs	1	99.8%	0.5	11.4%
<b>Program Total</b>	<b>58</b>	<b>108.9%</b>	<b>0.5</b>	<b>12.3%</b>

**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	61	79.8%	0.5	11.7%
Freezers	5	154.0%	0.5	31.4%
Dehumidifiers	0	0.0%	0.5	0.0%
RACs	1	88.0%	0.5	13.3%
<b>Program Total</b>	<b>68</b>	<b>85.3%</b>	<b>0.5</b>	<b>9.2%</b>

**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	4	96.3%	0.5	36.0%
Freezers	5	118.9%	0.5	31.4%
Dehumidifiers	0	0.0%	0.5	0.0%
RACs	0	80.3%	0.5	0.0%
<b>Program Total</b>	<b>10</b>	<b>107.5%</b>	<b>0.5</b>	<b>24.8%</b>

**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	54	84.3%	0.5	12.2%
Freezers	12	115.0%	0.5	37.7%
Dehumidifiers	0	0.0%	0.5	0.0%
RACs	1	96.4%	0.5	39.4%
<b>Program Total</b>	<b>67</b>	<b>89.9%</b>	<b>0.5</b>	<b>11.5%</b>

#### 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	108.0%	0.5	11.9%
Freezers	0.00	120.7%	0.5	43.0%
Dehumidifiers	0.00	0.0%	0.5	0.0%
RACs	0.00	80.9%	0.5	11.4%
<b>Program Total</b>	<b>0.01</b>	<b>100.9%</b>	<b>0.5</b>	<b>9.3%</b>

**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	79.8%	0.5	11.7%
Freezers	0.00	154.0%	0.5	31.4%
Dehumidifiers	0.00	0.0%	0.5	0.0%
RACs	0.00	88.4%	0.5	13.3%
<b>Program Total</b>	<b>0.01</b>	<b>86.1%</b>	<b>0.5</b>	<b>7.5%</b>

**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	96.3%	0.5	36.0%
Freezers	0.00	118.9%	0.5	31.4%
Dehumidifiers	0.00	0.0%	0.5	0.0%
RACs	0.00	80.0%	0.5	0.0%
<b>Program Total</b>	<b>0.00</b>	<b>96.3%</b>	<b>0.5</b>	<b>14.7%</b>

**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	84.3%	0.5	12.2%
Freezers	0.00	115.0%	0.5	37.7%
Dehumidifiers	0.00	0.0%	0.5	0.0%
RACs	0.00	93.6%	0.5	39.4%
<b>Program Total</b>	<b>0.01</b>	<b>90.5%</b>	<b>0.5</b>	<b>11.3%</b>

## 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 PY11, there were 13 projects approved in the Commercial and Industrial Direct Install (C&I Direct Install) initiative. Gross impact evaluation for this initiative involved stratified sampling, on-site verifications, and project-specific data collection and calculations.

### T.1.1 Gross Impact Evaluation Methodology

As a first step, projects are spaced into one of two sampling strata as described in the next section. Each sampled project undergoes a desk review that includes a full documentation review and if needed, additional topical research.

In the Multifamily Direct Install Program, energy efficiency measures can be installed in the dwelling units and commons areas. The most common measures include lighting, refrigerators and freezers, and smart power strips. The PA (TRM) is applied to calculate measure level savings. When a measure is installed in a dwelling unit the residential section of the TRM is applied, and when a measure is installed in a common area the C&I section of the TRM is applied. In PY11, ADM conducted desk reviews for calculation validation and desk reviews. Gross realization rates for projects were generally close to 100%.

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.

### T.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 422: CI Direct Install Initiative Gross Impact Sample Design for Met-Ed**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Direct_Install-2	20	3	3	Desk Review
Direct_Install-1	0	0	0	
Program Total	n/a	3	3	

**Table 423: CI Direct Install Initiative Gross Impact Sample Design for Penelec**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Direct_Install-2	20	5	4	Desk Review
Direct_Install-1	0	2	2	
Program Total	n/a	7	6	

**Table 424: CI Direct Install Initiative Gross Impact Sample Design for Penn Power**

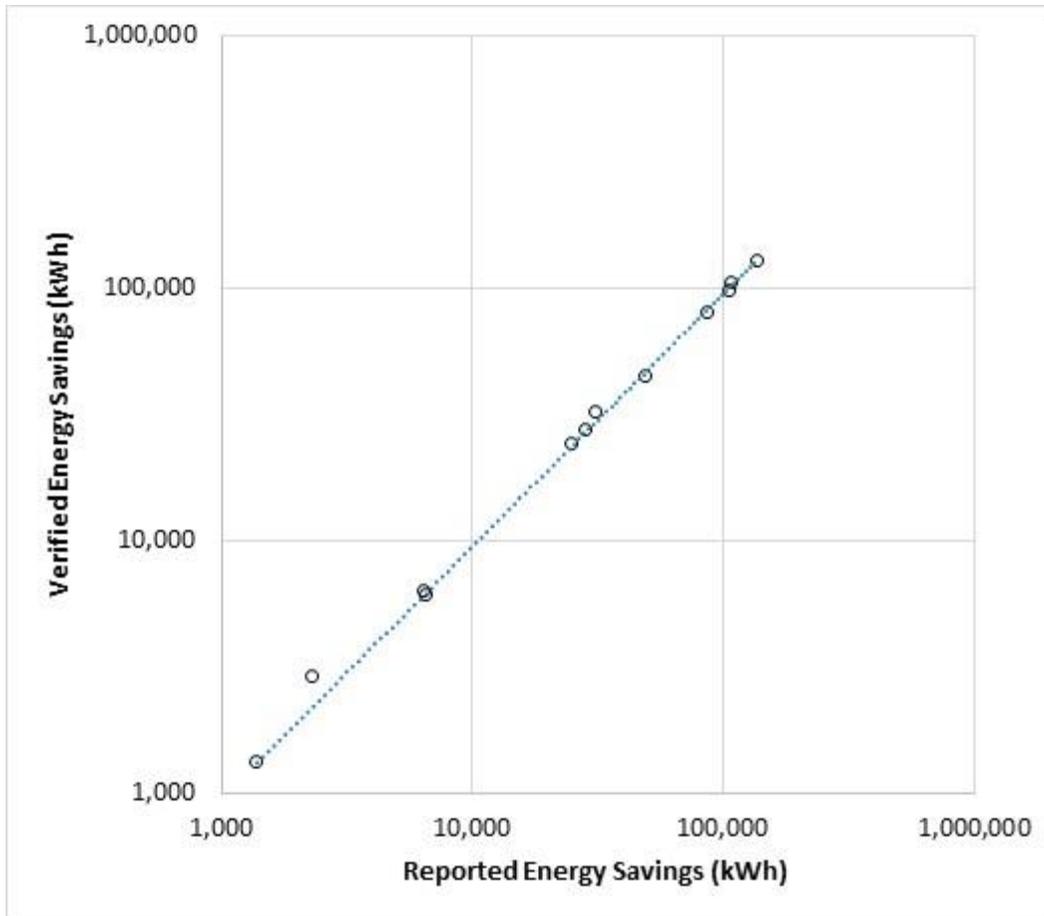
Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Direct_Install-2	20	1	1	Desk Review
Direct_Install-1	0	0	0	
Program Total	n/a	1	1	

**Table 425: CI Direct Install Initiative Gross Impact Sample Design for WPP**

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Direct_Install-2	20	0	0	Desk Review
Direct_Install-1	0	2	2	
Program Total	n/a	2	2	

### T.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 426, Table 427, Table 428, and Table 429 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 35: Verified vs. Reported Energy Savings for Sampled Direct Install Projects.**

**Table 426: CI Direct Install Initiative Energy Gross Realization Rates for Met-Ed**

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Direct_Install-2	20	221	108.7%	0.4	0%
Direct_Install-1	0	0	0.0%	0.4	0%
Program Total	n/a	221	108.7%	0.4	0.0%

**Table 427: CI Direct Install Initiative Energy Gross Realization Rates for Penelec**

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Direct_Install-2	20	309	104.0%	0.4	13%
Direct_Install-1	0	12	104.3%	0.4	0%
Program Total	n/a	321	104.0%	0.4	12.9%

**Table 428: CI Direct Install Initiative Energy Gross Realization Rates for Penn Power**

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Direct_Install-2	20	32	94.6%	0.4	0%
Direct_Install-1	0	0	0.0%	0.4	0%
Program Total	n/a	32	94.6%	0.4	0.0%

**Table 429: CI Direct Install Initiative Energy Gross Realization Rates for WPP**

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Direct_Install-2	20	0	100.0%	0.4	0%
Direct_Install-1	0	4	86.5%	0.4	0%
Program Total	n/a	4	86.5%	0.4	0.0%

#### T.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 430, Table 431, Table 432, and Table 433 for Met-Ed, Penelec, Penn Power, and WPP respectively.

**Table 430: CI Direct Install Initiative Demand Gross Realization Rates for Met-Ed**

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Direct_Install-2	20	0.02	108.7%	0.4	0%
Direct_Install-1	0	0.00	0.0%	0.4	0%
Program Total	n/a	0.02	108.7%	0.4	0.0%

**Table 431: CI Direct Install Initiative Demand Gross Realization Rates for Penelec**

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Direct_Install-2	20	0.03	104.0%	0.4	13%
Direct_Install-1	0	0.00	103.5%	0.4	0%
Program Total	n/a	0.03	103.9%	0.4	12.9%

**Table 432: CI Direct Install Initiative Gross Realization Rates for Penn Power**

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Direct_Install-2	20	0.00	94.6%	0.4	0%
Direct_Install-1	0	0.00	0.0%	0.4	0%
Program Total	n/a	0.00	94.6%	0.4	0.0%

**Table 433: CI Direct Install Initiative Demand Gross Realization Rates for WPP**

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Direct_Install-2	20	0.00	100.0%	0.4	0%
Direct_Install-1	0	0.00	93.9%	0.4	0%
Program Total	n/a	0.00	93.9%	0.4	0.0%

## T.2 NET IMPACT EVALUATION

An independent net impact evaluation was not conducted for this initiative because the initiative had very low participation throughout Phase III. The NTG of the Direct Install Initiative is taken to be the same as for the Lighting Initiative, as all rebated projects to date were found to be lighting retrofits.

# 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:

$$kW_{ieh} = \beta_0 + \beta_1 * (NoCooling_i + MediumCooling_i + HighCooling_i) + \beta_2 * datetime_{eh} + \tau_{eh} * datetime_{eh} * treatment_i + \varepsilon$$

The variables above are defined in Table 434 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 434: Definition of variables in the lagged seasonal regression model.**

Variable	Definition
$kW_{ieh}$	Customer i’s energy demand during each event hour.
$\beta_0$	Intercept of the regression equation.
$\beta_1$	A matrix of regression coefficients representing the impact of the pre-treatment baseline variables on the regression equation.
$\beta_1$	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.
$\tau_{eh}$	A matrix of regression coefficients representing the treatment effect in each of hour of each event day.
$\varepsilon$	The error term.

# Appendix V PYTD and P3TD Summary by Customer Segment and Carveout

## V.1 VERIFIED IMPACT SUMMARY TABLES

Table 435 and Table 436 present the verified energy savings and demand reduction respectively by program, customer sector, and carveout for PY11. Table 437 and Table 438 present the verified energy savings and demand reduction respectively by program, customer sector, and carveout for Phase III. 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 carveouts were defined by statute (66 Pa. C.S. § 2806.1).

**Table 435: PYTD Verified Energy Savings by Program, Customer Sector, and Carveout**

Utility	Program	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI
Met-Ed	Appliance Turn-in	3,347	0	0	0	0
	Energy Efficient Homes	37,870	38	0	0	0
	Energy Efficient Products	34,537	0	3,040	0	1,854
	Low Income Energy Efficiency	0	4,121	0	0	0
	C&I Energy Solutions for Business - Small	0	0	19,475	0	1,082
	C&I Demand Response - Small	0	0	0	0	0
	C&I Energy Solutions for Business - Large	0	0	0	33,917	3,608
	C&I Demand Response - Large	0	0	0	0	0
	Governmental & Institutional Tariff	0	0	0	0	188
<b>Portfolio Total</b>	<b>75,755</b>	<b>4,159</b>	<b>22,515</b>	<b>33,917</b>	<b>6,732</b>	
Penelec	Appliance Turn-in	3,113	0	0	0	0
	Energy Efficient Homes	27,129	51	0	0	0
	Energy Efficient Products	35,473	0	2,964	0	1,807
	Low Income Energy Efficiency	0	3,892	0	0	0
	C&I Energy Solutions for Business - Small	0	0	22,320	0	4,343
	C&I Demand Response - Small	0	0	0	0	0
	C&I Energy Solutions for Business - Large	0	0	0	32,267	2,899
	C&I Demand Response - Large	0	0	0	0	0
	Governmental & Institutional Tariff	0	0	0	0	630
<b>Portfolio Total</b>	<b>65,715</b>	<b>3,942</b>	<b>25,284</b>	<b>32,267</b>	<b>9,679</b>	
Penn Power	Appliance Turn-in	789	0	0	0	0
	Energy Efficient Homes	6,515	25	0	0	0
	Energy Efficient Products	15,817	0	1,358	0	828
	Low Income Energy Efficiency	0	1,089	0	0	0
	C&I Energy Solutions for Business - Small	0	0	15,393	0	873
	C&I Demand Response - Small	0	0	0	0	0
	C&I Energy Solutions for Business - Large	0	0	0	5,230	228
	C&I Demand Response - Large	0	0	0	0	0
	Governmental & Institutional Tariff	0	0	0	0	2
<b>Portfolio Total</b>	<b>23,121</b>	<b>1,114</b>	<b>16,751</b>	<b>5,230</b>	<b>1,932</b>	
West Penn Power	Appliance Turn-in	3,765	0	0	0	0
	Energy Efficient Homes	20,172	140	0	0	0
	Energy Efficient Products	40,731	0	3,421	0	2,086
	Low Income Energy Efficiency	0	3,660	0	0	0
	C&I Energy Solutions for Business - Small	0	0	26,806	0	4,536
	C&I Demand Response - Small	0	0	0	0	0
	C&I Energy Solutions for Business - Large	0	0	0	21,745	4,202
	C&I Demand Response - Large	0	0	0	0	0
	Governmental & Institutional Tariff	0	0	0	0	844
<b>Portfolio Total</b>	<b>64,669</b>	<b>3,800</b>	<b>30,227</b>	<b>21,745</b>	<b>11,669</b>	

**Table 436: PYTD Demand Reductions by Program, Customer Sector, and Carveout**

Utility	Program	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI
Met-Ed	Appliance Turn-in	0.47	0.00	0.00	0.00	0.00
	Energy Efficient Homes	4.97	0.00	0.00	0.00	0.00
	EEH: Behavioral Demand Response	9.62	0.00	0.00	0.00	0.00
	Energy Efficient Products	4.20	0.00	0.60	0.00	0.36
	Low Income Energy Efficiency	0.00	0.48	0.00	0.00	0.00
	C&I Energy Solutions for Business - Small	0.00	0.00	2.79	0.00	0.16
	C&I Demand Response - Small	0.00	0.00	1.18	0.00	0.31
	C&I Energy Solutions for Business - Large	0.00	0.00	0.00	4.48	0.69
	C&I Demand Response - Large	0.00	0.00	0.00	41.67	4.11
	Governmental & Institutional Tariff	0.00	0.00	0.00	0.00	0.01
	Portfolio Total	19.26	0.49	4.57	46.15	5.65
Penelec	Appliance Turn-in	0.43	0.00	0.00	0.00	0.00
	Energy Efficient Homes	3.01	0.01	0.00	0.00	0.00
	EEH: Behavioral Demand Response	0.00	0.00	0.00	0.00	0.00
	Energy Efficient Products	3.87	0.00	0.58	0.00	0.36
	Low Income Energy Efficiency	0.00	0.43	0.00	0.00	0.00
	C&I Energy Solutions for Business - Small	0.00	0.00	2.95	0.00	0.62
	C&I Demand Response - Small	0.00	0.00	0.00	0.00	0.00
	C&I Energy Solutions for Business - Large	0.00	0.00	0.00	3.72	0.36
	C&I Demand Response - Large	0.00	0.00	0.00	0.00	0.00
	Governmental & Institutional Tariff	0.00	0.00	0.00	0.00	0.01
	Portfolio Total	7.32	0.43	3.54	3.72	1.35
Penn Power	Appliance Turn-in	0.10	0.00	0.00	0.00	0.00
	Energy Efficient Homes	1.08	0.00	0.00	0.00	0.00
	EEH: Behavioral Demand Response	1.78	0.00	0.00	0.00	0.00
	Energy Efficient Products	2.04	0.00	0.27	0.00	0.16
	Low Income Energy Efficiency	0.00	0.12	0.00	0.00	0.00
	C&I Energy Solutions for Business - Small	0.00	0.00	1.98	0.00	0.14
	C&I Demand Response - Small	0.00	0.00	0.00	0.00	0.00
	C&I Energy Solutions for Business - Large	0.00	0.00	0.00	0.59	0.03
	C&I Demand Response - Large	0.00	0.00	0.00	33.36	0.07
	Governmental & Institutional Tariff	0.00	0.00	0.00	0.00	0.00
	Portfolio Total	4.99	0.13	2.25	33.95	0.39
West Penn Power	Appliance Turn-in	0.50	0.00	0.00	0.00	0.00
	Energy Efficient Homes	2.82	0.02	0.00	0.00	0.00
	EEH: Behavioral Demand Response	3.14	0.00	0.00	0.00	0.00
	Energy Efficient Products	5.34	0.00	0.67	0.00	0.41
	Low Income Energy Efficiency	0.00	0.42	0.00	0.00	0.00
	C&I Energy Solutions for Business - Small	0.00	0.00	3.81	0.00	0.63
	C&I Demand Response - Small	0.00	0.00	0.83	0.00	0.06
	C&I Energy Solutions for Business - Large	0.00	0.00	0.00	3.13	0.56
	C&I Demand Response - Large	0.00	0.00	0.00	91.78	0.30
	Governmental & Institutional Tariff	0.00	0.00	0.00	0.00	0.02
	Portfolio Total	11.80	0.44	5.32	94.91	1.98

**Table 437: VTD Verified Energy Savings by Program, Customer Sector, and Carveout**

Utility	Program	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI
Met-Ed	Appliance Turn-in	16,909	0	0	0	0
	Energy Efficient Homes	208,896	183	0	0	0
	Energy Efficient Products	124,236	0	13,308	0	4,486
	Low Income Energy Efficiency	0	38,875	0	0	0
	C&I Energy Solutions for Business - Small	0	0	89,632	0	6,203
	C&I Demand Response - Small	0	0	0	0	0
	C&I Energy Solutions for Business - Large	0	0	0	122,844	16,104
	C&I Demand Response - Large	0	0	0	0	0
	Governmental & Institutional Tariff	0	0	0	0	2,020
<b>Portfolio Total</b>	<b>350,041</b>	<b>39,058</b>	<b>102,940</b>	<b>122,844</b>	<b>28,814</b>	
Penelec	Appliance Turn-in	15,498	0	0	0	0
	Energy Efficient Homes	160,937	355	0	0	0
	Energy Efficient Products	134,107	0	13,860	0	4,422
	Low Income Energy Efficiency	0	38,730	0	0	0
	C&I Energy Solutions for Business - Small	0	0	83,898	0	18,132
	C&I Demand Response - Small	0	0	0	0	0
	C&I Energy Solutions for Business - Large	0	0	0	113,561	27,780
	C&I Demand Response - Large	0	0	0	0	0
	Governmental & Institutional Tariff	0	0	0	0	3,291
<b>Portfolio Total</b>	<b>310,542</b>	<b>39,085</b>	<b>97,757</b>	<b>113,561</b>	<b>53,624</b>	
Penn Power	Appliance Turn-in	4,890	0	0	0	0
	Energy Efficient Homes	47,073	206	0	0	0
	Energy Efficient Products	48,988	0	4,919	0	1,819
	Low Income Energy Efficiency	0	11,199	0	0	0
	C&I Energy Solutions for Business - Small	0	0	45,844	0	5,416
	C&I Demand Response - Small	0	0	0	0	0
	C&I Energy Solutions for Business - Large	0	0	0	27,009	1,037
	C&I Demand Response - Large	0	0	0	0	0
	Governmental & Institutional Tariff	0	0	0	0	1,948
<b>Portfolio Total</b>	<b>100,952</b>	<b>11,405</b>	<b>50,763</b>	<b>27,009</b>	<b>10,220</b>	
West Penn Power	Appliance Turn-in	20,188	0	0	0	0
	Energy Efficient Homes	153,825	577	0	0	0
	Energy Efficient Products	141,731	0	14,208	0	4,784
	Low Income Energy Efficiency	0	35,042	0	0	0
	C&I Energy Solutions for Business - Small	0	0	92,941	0	17,359
	C&I Demand Response - Small	0	0	0	0	0
	C&I Energy Solutions for Business - Large	0	0	0	71,830	30,368
	C&I Demand Response - Large	0	0	0	0	0
	Governmental & Institutional Tariff	0	0	0	0	21,623
<b>Portfolio Total</b>	<b>315,744</b>	<b>35,619</b>	<b>107,148</b>	<b>71,830</b>	<b>74,134</b>	

**Table 438: VTD Demand Reductions by Program, Customer Sector, and Carveout**

Utility	Program	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI
Met-Ed	Appliance Turn-in	2.33	0.00	0.00	0.00	0.00
	Energy Efficient Homes	25.37	0.03	0.00	0.00	0.00
	EEH: Behavioral Demand Response	5.82	0.00	0.00	0.00	0.00
	Energy Efficient Products	15.56	0.00	2.74	0.00	0.86
	Low Income Energy Efficiency	0.00	4.50	0.00	0.00	0.00
	C&I Energy Solutions for Business - Small	0.00	0.00	13.52	0.00	0.87
	C&I Demand Response - Small	0.00	0.00	1.28	0.00	2.13
	C&I Energy Solutions for Business - Large	0.00	0.00	0.00	16.21	2.72
	C&I Demand Response - Large	0.00	0.00	0.00	37.92	5.89
	Governmental & Institutional Tariff	0.00	0.00	0.00	0.00	0.03
<b>Portfolio Total</b>	<b>49.08</b>	<b>4.52</b>	<b>17.54</b>	<b>54.13</b>	<b>12.50</b>	
Penelec	Appliance Turn-in	2.07	0.00	0.00	0.00	0.00
	Energy Efficient Homes	17.51	0.04	0.00	0.00	0.00
	EEH: Behavioral Demand Response	0.00	0.00	0.00	0.00	0.00
	Energy Efficient Products	14.76	0.00	2.86	0.00	0.84
	Low Income Energy Efficiency	0.00	4.15	0.00	0.00	0.00
	C&I Energy Solutions for Business - Small	0.00	0.00	12.00	0.00	2.74
	C&I Demand Response - Small	0.00	0.00	0.00	0.00	0.00
	C&I Energy Solutions for Business - Large	0.00	0.00	0.00	13.41	3.04
	C&I Demand Response - Large	0.00	0.00	0.00	0.00	0.00
	Governmental & Institutional Tariff	0.00	0.00	0.00	0.00	0.06
<b>Portfolio Total</b>	<b>34.34</b>	<b>4.19</b>	<b>14.86</b>	<b>13.41</b>	<b>6.68</b>	
Penn Power	Appliance Turn-in	0.63	0.00	0.00	0.00	0.00
	Energy Efficient Homes	6.72	0.02	0.00	0.00	0.00
	EEH: Behavioral Demand Response	2.03	0.00	0.00	0.00	0.00
	Energy Efficient Products	6.09	0.00	1.01	0.00	0.35
	Low Income Energy Efficiency	0.00	1.31	0.00	0.00	0.00
	C&I Energy Solutions for Business - Small	0.00	0.00	6.50	0.00	0.82
	C&I Demand Response - Small	0.00	0.00	-0.01	0.00	0.05
	C&I Energy Solutions for Business - Large	0.00	0.00	0.00	3.08	0.05
	C&I Demand Response - Large	0.00	0.00	0.00	37.58	0.19
	Governmental & Institutional Tariff	0.00	0.00	0.00	0.00	0.07
<b>Portfolio Total</b>	<b>15.47</b>	<b>1.33</b>	<b>7.50</b>	<b>40.66</b>	<b>1.53</b>	
West Penn Power	Appliance Turn-in	2.62	0.00	0.00	0.00	0.00
	Energy Efficient Homes	19.88	0.08	0.00	0.00	0.00
	EEH: Behavioral Demand Response	2.38	0.00	0.00	0.00	0.00
	Energy Efficient Products	18.77	0.00	2.93	0.00	0.92
	Low Income Energy Efficiency	0.00	4.12	0.00	0.00	0.00
	C&I Energy Solutions for Business - Small	0.00	0.00	12.80	0.00	2.66
	C&I Demand Response - Small	0.00	0.00	1.43	0.00	0.00
	C&I Energy Solutions for Business - Large	0.00	0.00	0.00	8.83	3.29
	C&I Demand Response - Large	0.00	0.00	0.00	108.57	0.02
	Governmental & Institutional Tariff	0.00	0.00	0.00	0.00	0.21
<b>Portfolio Total</b>	<b>43.65</b>	<b>4.19</b>	<b>17.16</b>	<b>117.41</b>	<b>7.09</b>	

# Appendix W Report Validation

## W.1 LINKED IMAGES

Most tables and charts in this report are images that are generated within an excel file. The last image should reflect the time and date of report compilation.

**Table 439: Report Update Timestamp**

<b>Tables and Charts Updated on 01/29/21, at 15:17</b>
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