Final Annual Report
to the
Pennsylvania Public Utility Commission

For the Period
June 2012 through May 2013
Program Year 4

For Pennsylvania Act 129 of 2008
Energy Efficiency and Conservation Plan

Prepared by ADM Associates, Tetra Tech, NMR Group, and Metropolitan Edison Company

For

Metropolitan Edison Company
Docket No. M-2009-2092222

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Acronyms

C&I	Commercial and Industrial
CATI	Computer-Aided Telephone Interview
CFL	Compact Fluorescent Lamp
CPITD	Cumulative Program/Portfolio Inception to Date
CPITD-Q	Cumulative Program/Portfolio Inception through Current Quarter
CSP	Conservation Service Provider or Curtailment Service Provider
CVR	Conservation Voltage Reduction
CVRf	Conservation Voltage Reduction factor
DLC	Direct Load Control
DR	Demand Response
EDC	Electric Distribution Company
EE&C	Energy Efficiency and Conservation
EM&V	Evaluation, Measurement, and Verification
GNI	Government, Non-Profit, Institutional
HVAC	Heating, Ventilating, and Air Conditioning
IQ	Incremental Quarter
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light Emitting Diode
LEEP	Low-Income Energy Efficiency Program
LIURP	Low-Income Usage Reduction Program
M&V	Measurement and Verification
MW	Megawatt
MWh	Megawatt-hour
NTG	Net-to-Gross
PA PUC	Pennsylvania Public Utility Commission
PY1	Program Year 2009, from June 1, 2009 to May 31, 2010
PY2	Program Year 2010, from June 1, 2010 to May 31, 2011
PY3	Program Year 2011, from June 1, 2011 to May 31, 2012
PY4	Program Year 2012, from June 1, 2012 to May 31, 2013
PYX QX	Program Year X, Quarter X
PYTD	Program Year to Date
SEER	Seasonal Energy Efficiency Rating
SWE	Statewide Evaluator
T&R	Tracking & Reporting
TRC	Total Resource Cost
TRM	Technical Reference Manual

Report Definitions

Note: Definitions provided in this section are limited to terms critical to understanding values presented in this report. For other definitions, please refer to the Act 129 glossary.

REPORTING PERIODS

Cumulative Program Inception to Date (CPITD)
Refers to the period of time since the start of the Act 129 programs. CPITD is calculated by totaling all program year results, including the current program year to date results. For example, CPTID results for PY4 Q3 is the sum of PY1, PY2, PY3, PY4 Q1, PY4 Q2, and PY4 Q3 results.

Incremental Quarter (IQ)
Refers to the current reporting quarter only. Activities occurring during previous quarters are not included. For example, IQ results for PY4 Q3 will only include results that occurred during PY4 Q3 and not PY4 Q2.

Program Year to Date (PYTD)
Refers to the current reporting program year only. Activities occurring during previous program years are not included. For example, PYTD results for PY4 Q3 will only include results that occurred during PY4 Q1, PY4 Q2, and PY4 Q3. It will not include results from PY1, PY2 and PY3.

SAVINGS TYPES

Preliminary
Qualifier used in all reports except the final annual report to signify that evaluations are still in progress and that results have not been finalized. Most often used with “realization rate” or “verified gross savings”.

Reported Gross
Refers to results of the program or portfolio determined by the program administrator (e.g., the EDC or the program implementer). Also known as *ex-ante*, or “before the fact” (using the annual evaluation activities as the reference point).

Verified Gross
Refers to results of the program or portfolio determined by the evaluation activities. Also known as *ex-post*, or “after the fact” (using the annual evaluation activities as the reference point).

TRC COMPONENTS[1]

Administration Costs
Includes the administrative CSP (rebate processing), tracking and reporting system ("T&R" or tracking system), and general administration and clerical costs.

EDC Costs
Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenditures only.

Management Costs
Includes the EDC program management, CSP program management, general management oversight and major accounts.

Participant Costs
Per the 2011 Total Resource Cost Test Order, the net participant costs are the costs for the end use customer.

Total TRC Costs
Total TRC Costs includes EDC Evaluation Costs, Total EDC Costs and Participant Costs.

Total TRC Benefits
Based upon verified gross kWh and kW savings. 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.

[1] All TRC definitions are subject to the 2011 Total Resource Cost Test Order.

1 Overview of Portfolio

Pennsylvania Act 129 of 2008 signed on October 15, 2008 mandated energy savings and coincident peak demand reduction goals for the largest electric distribution companies (EDCs) in Pennsylvania. Each EDC submitted energy efficiency and conservation (EE&C) plans (Plans)—which were approved by the Pennsylvania Public Utility Commission (PA PUC)—pursuant to these goals. This report documents the progress and effectiveness of the EE&C accomplishments for Metropolitan Edison Company (Met-Ed or Company) in the 4th quarter of Program Year 4 (PY4), defined as March 1, 2013 through May 31, 2013, Program Year 4 accomplishments, as well as the cumulative accomplishments of the programs since inception in Program Year 1 (PY1).

ADM Associates has evaluated the programs including measurement and verification of the savings. The final verified savings for PY4 and the cumulative verified savings of the programs since inception in Program Year 1 (PY1) are included in this final annual report.

This report is organized into two major sections. The first section provides an overview of activities the Company has undertaken in accordance with the Plan. This includes summary information and portfolio level details regarding the progress towards the Act 129 compliance goals, energy and demand impacts, net-to-gross ratios, finances, and cost-effectiveness. The following sections include program specific details, including program updates, impact evaluation findings, and process evaluation findings.

1.1 Summary of Progress toward Compliance Targets

Energy Savings

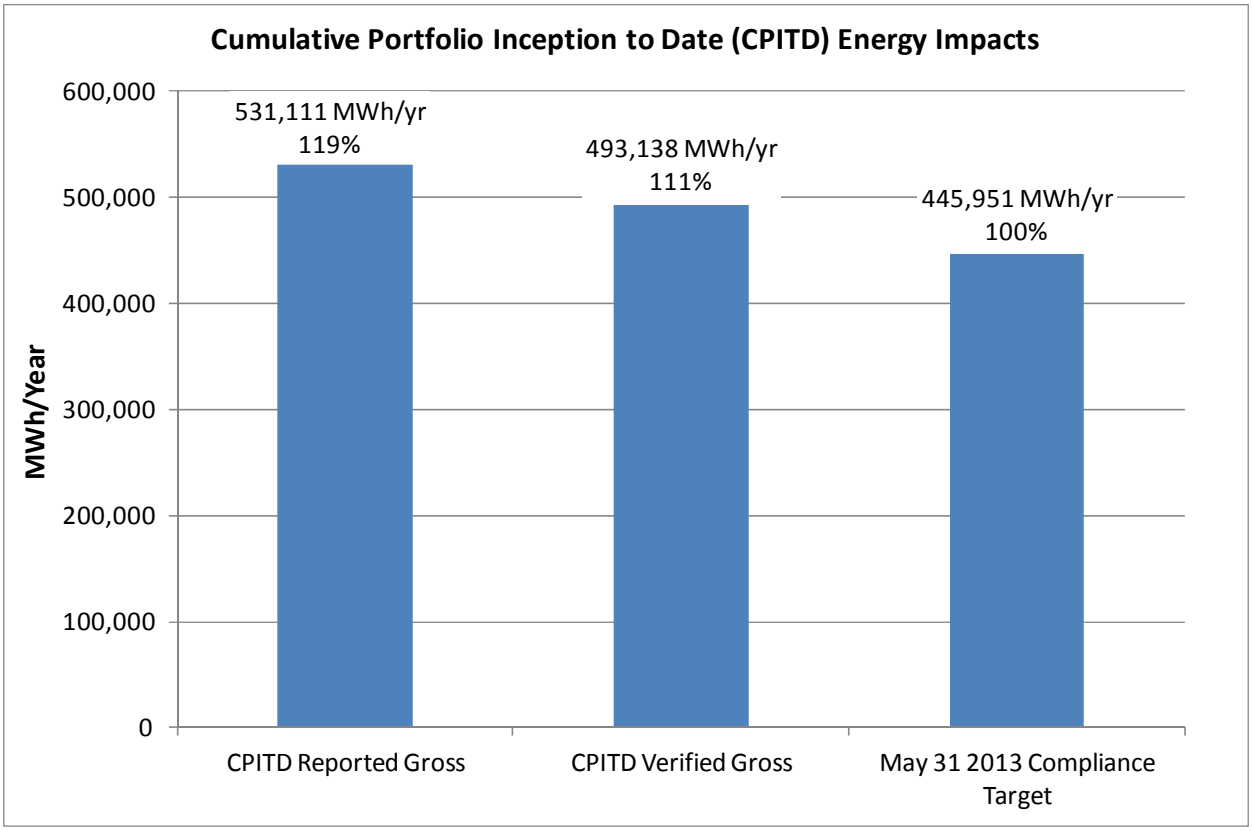
The energy savings[2] compliance target for Met-Ed was 445,951 MWh/yr which had to be achieved by May 31, 2013 per Act 129. Based on CPITD verified gross energy savings[3], Met-Ed has achieved 111 percent of

[2] Herein, energy savings refers to annualized energy savings and is measured in kWh/year or MWh/year. Energy savings are reported at the meter.

[3] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated.

the energy savings compliance target. These energy savings are shown in Figure 1-1. The PUC will determine compliance using CPITD verified gross energy savings.

Figure 1-1: Portfolio CPITD Energy Savings



Line Loss Adjustments

Table 1-1 shows the line loss adjustment factor that was used to gross up demand savings from the meter level to the system level. This factor reflects the weighted average hourly marginal loss value (i.e. the change in MW losses vs. the change in MW of load) modeled during the top 100 hours, where weights are reflected by the hourly load reductions for energy efficiency and demand response programs. This represents the weighted average of marginal distribution and transmission system losses across the top 100 hours for Met-Ed.

Table 1-1: Line Loss Factor

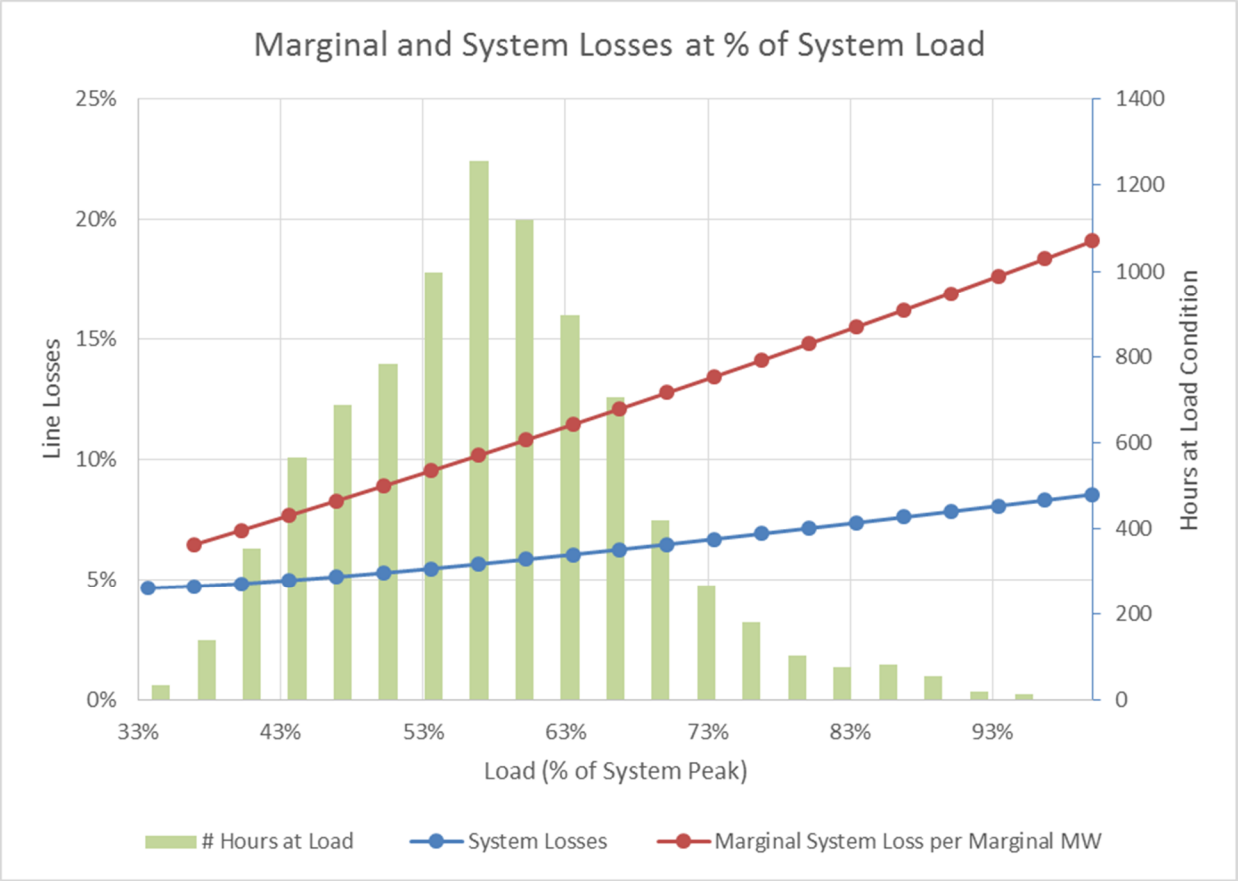
Application	Line Loss Factor
Utilized for all EE and DR Programs	16.6%

This line loss factor recognizes the fact that Transmission and Distribution systems experience exponential gains in line losses as system loading increases[4] due to increased thermal resistivity of system conductors and transformers, as was experienced during the top 100 summer hours of 2012. System reconstructed loads during the top 100 hours in 2012 were significantly greater than annual system average loads. Exhibit 1 below illustrates system and marginal line losses for Met Ed at various system loading conditions. "# Hours at Load" (shown in bars) reflects the distribution of 8760 annual hours at different loading conditions. Recognizing that the Demand Reduction compliance period is measured during the Top 100 Hours, the Line Loss Factor in Table 1-1 appropriately reflects the average marginal line losses occurring during maximum system loading conditions (i.e., the upper right hand portion of the marginal loss line in Exhibit 1 below).

Met-Ed's saving analysis incorporates line losses modeled at peak system load conditions, reflecting Met-Ed's sector sales reported via the FERC Form 1 and sector loss factors as defined in Met-Ed's Tariff. Hourly losses were modeled for each of the top 100 hours used to reconstruct system loads (i.e., reflecting add-backs as described in §4 of the 2012 TRM) and to compute the energy efficiency and demand response demand savings.

[4] *Valuing the Contribution of Energy Efficiency to Avoided Marginal Line Losses and Reserve Requirements*. Principal authors Jim Lazar and Xavier Baldwin Aug. 2011.

Exhibit 1 – Marginal and System Losses



Peak Demand Reduction during the Top 100 Hours

The system peak demand reduction[5] compliance target for Met-Ed was 119 MW per Act 129 which had to be achieved by May 31, 2013. When assessing performance against this target, the Company utilized specific evaluation results to measure the demand impacts of CFLs in addition to TRM protocols. Specifically, the Company's evaluator has adjusted the coincidence factor and included waste heat interactive effects to more accurately depict the demand reductions from residential CFLs during the Company's Top 100 Hours.

As requested by the SWE and TUS Staff, the Company's performance results are shown utilizing the 2012 TRM, hereafter referred to as "TRM Top 100 Hours MW Achieved" or "TRM". However, as has been

[5] Herein, demand reduction refers to the EDC's system peak demand reduction in the EDC's top 100 hours of highest demand, as defined by the PA PUC and is measured in kW or MW.

previously communicated to the SWE and TUS Staff through Joint Utility comments[6], the 2012 TRM contains an error in the demand coincidence factor for Residential CFLs[7]. As this error *significantly* understates the impact of these widely adopted measures during peak periods, it was corrected in the 2014 TRM[8]. As such, and consistent with Section 1.8 of the 2012 TRM which allows for the correction of results for discovered errors, the Company has calculated an additional set of TRM impacts that corrects the Residential CFL coincidence factor to reflect the intended value of 8.8%. These results are hereafter referred to as "TRM Corrected Top 100 Hours MW Achieved" or "TRM Corrected".

Finally, the Company has included an additional set of evaluation results that include specific deviations from the 2012 TRM protocols to more accurately assess the impacts of Residential Lighting during the Company's Top 100 Hours. The Company believes these more precise evaluation results, hereafter referred to as "*Evaluated Top 100 hours MW Achieved*" or "Evaluated" best demonstrates compliance with ACT 129's unique Demand Reduction target. The evaluation results adjust the TRM deemed values and protocols as follows:

1) An alternative methodology to assess the Coincidence Factor ("CF") of residential CFLs that uses residential CFL load shapes and the actual top 100 hours for Met Ed to establish the actual contributions of residential lighting to peak load reductions during the summer of 2012. As articulated in Section 1.1 of the 2012 TRM*: "The algorithms and methodologies set forth in this document must be used to determine EDC reported gross savings and evaluation measurement and verification (EM&V) verified savings, unless an alternative measurement approach or custom measure protocols is submitted and approved for use"*. Consistent with this guidance, the Company submits an alternative methodology in order to more accurately assess its peak load impacts during the top 100 hours. As described in Appendix A, use of load shapes and actual hours associated with the Company's top 100 hours more accurately comports with the steps for assessment of top 100 hour impacts as delineated in Section 4 of the TRM. The resulting coincidence factor is 11.8%.
2) Include interactive lighting impacts (i.e. interactive effect). As recognized in revisions to Residential lighting protocols in the 2014 TRM, accurately estimating demand reduction impacts of Residential CFLs requires consideration of the air conditioning load that is avoided by the use of more efficient

[6] *Joint EDC Comments on Residential Coincidence Factor*, March 12, 2013, p. 3, Items 2a-c.

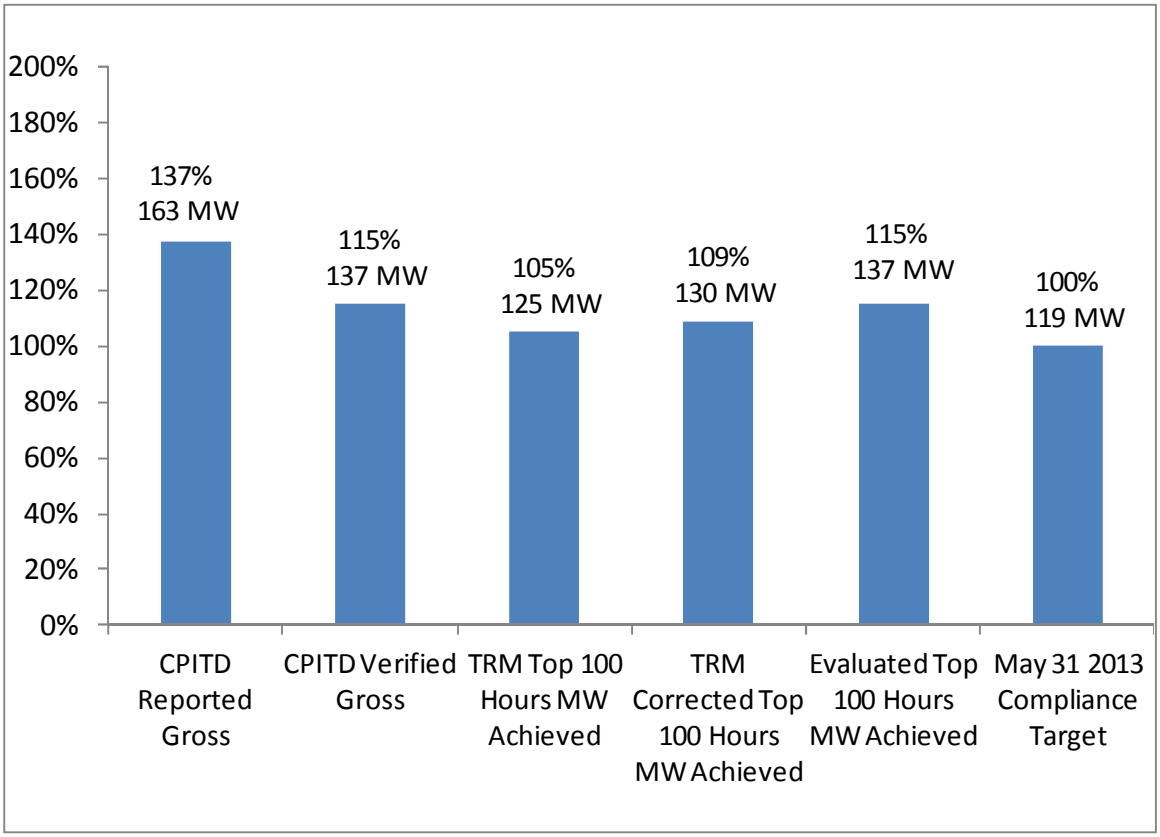
[7] The 5.0% coincidence factor listed in Table 2-42: ENERGY STAR Lighting – References, pp. 108-109, is an error in the 2012 TRM. The Company believes the correct value as pulled from the intended source document is 8.8% as shown in *RLW Analytics, "Energy Efficiency Measures/Programs Reference Document for the ISO Forward Capacity Market (FCM)", prepared for the New England State Program Working Group (SPWG), Spring 2007, p. IV*. FirstEnergy further believes that the 8.8% value is also not fully appropriate for Top 100 compliance targets because it is calculated in the PJM peak window (2 PM to 6 PM), while the Top 100 hours tend to include hours that are outside this window with higher lighting utilization.

[8] As adopted on December 19, 2013, the Pennsylvania *Technical Reference Manual*, revised June 2014, establishes the Coincidence Factor for Residential Energy Star Lighting as 9.1%, Table 2 73: *ENERGY STAR Lighting – References*, p. 151

lighting technology in homes. This adjustment is particularly important to recognize during summer peak periods. The 2012 TRM recognizes this impact in Non-Residential settings, and the 2014 Draft TRM recognizes these impacts in both Residential and Non-Residential settings. The Company's evaluator has performed Company specific data collection and modeling to estimate those impacts during the top 100 hours.[9]

Based on the adjustments discussed in this Section and further described in Appendix A, Met-Ed has achieved 115% of the demand reduction compliance target during the Top 100 hours of 2012 based only on installations in place and providing demand reductions during those hours, identified as *"Evaluated Top 100 Hours MW Achieved"* in Figure 1-2 (105% of the target using "TRM" results, and 109% using "TRM Corrected" results). Including demand reductions initiated for Act 129 programs occurring outside the top 100 hours, Met-Ed achieved 115% of the demand reduction compliance target based on CPITD gross demand reduction[10] achieved through Quarter 4 (CPITD-Q), as shown in Figure 1-2.

Figure 1-2. Portfolio CPITD Peak Demand Reduction



[9] See Appendix A for further detail related to this adjustment.

[10] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated. As referred to in this Figure, "TRM," "TRM Corrected," and "Evaluated" results are consistent with the terminology previously discussed in Section 1 of this Report.

Low Income Sector

Act 129 mandates that the number of measures offered to the low-income sector be proportionate to the low-income sector's share of total energy usage.[11] There are 7 measures available to the low-income sector and 42 measures available in total across all customer sectors[12]. The measures offered to the low-income sector therefore comprise 17 percent of the total measures offered. This exceeds the fraction of the electric consumption of the utility's low-income households divided by the total electricity consumption in the Met-Ed territory (8.8 percent). These values are shown in Table 1-2.

Table 1-2: Low-Income Sector Compliance Metrics

	Low-Income Sector	All Sectors	% Low-Income
# of Measures Offered	7	41	17.1%
Electric Consumption (MWh/yr)	1,273,589	14,494,013	8.8%

The CPITD reported gross energy savings for low-income sector programs (excluding low-income participation in non-low-income programs) is 5,998 MWh/yr; this is 1.1 percent of the CPITD total portfolio reported gross energy savings.

Including low-income customer participation in non-low-income programs, the CPITD reported gross energy savings achieved is 42,560 MWh/yr; this is 8.0 percent of the CPITD total portfolio reported gross energy savings.

The CPITD verified gross energy savings achieved for low-income programs (excluding low-income participation in non-low-income programs) is 5,728 MWh/yr; this is 1.2 percent of the CPITD total portfolio verified gross energy savings.[13]

[11] Act 129 includes a provision requiring electric distribution companies to offer a number of energy conservation measures to low-income households that are "proportionate to those households' share of the total energy usage in the service territory." 66 Pa.C.S. §2806.1(b)(i)(G). The legislation contains no provisions regarding targets for participation, or energy or demand savings.

[12] To keep calculations tractable, measures are grouped into homogeneous categories. For example, the "WARM Plus" low-income program offers more than 100 distinct measures, but it is counted as one of the seven broad measures available solely to low-income customers. Likewise, there may be scores of variants of linear fluorescent lamps rebated by the Efficient Equipment programs, but they are also categorized in the same group.

[13] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated.

Including low-income customer participation in non-low-income programs, the CPITD reported verified energy savings achieved is 40,195 MWh/yr; this is 7.6 percent of the CPITD total portfolio reported gross energy savings.[14] [15]*Government, Nonprofit and Institutional (GNI) sector*

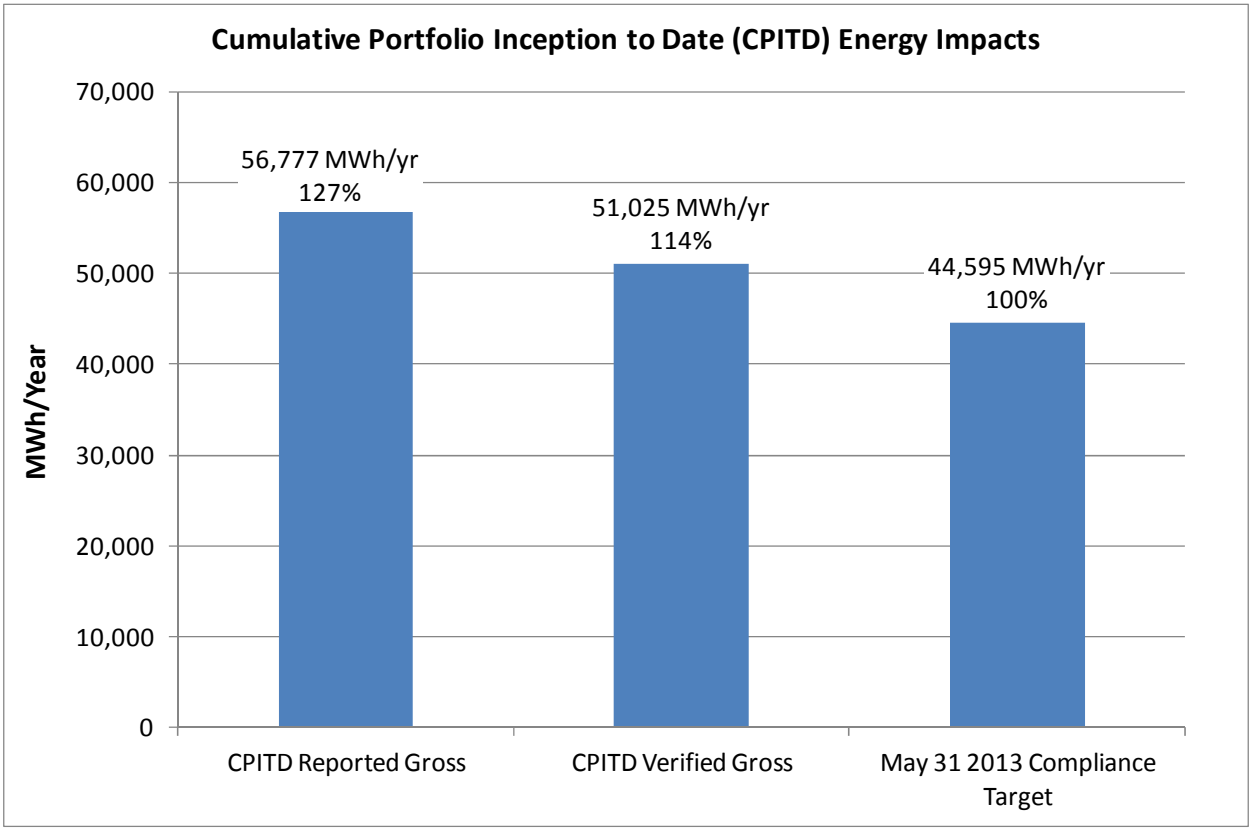
[14] The Energy Savings achieved in the low-income sector starting with the PY4Q2 report are calculated according to the procedure in the PY3 Annual report (page 14). This is a shift from the previous calculation procedure that was used for the PY4Q1 report, and the new methodology results in smaller claimed impacts, thus the adjustment from the PY4Q1 report.

[15] The estimated cost of low-income savings from non-low-income programs is $4,321,132.

Act 129 mandates that a minimum of 10% of the required energy and demand targets be obtained from units of federal, state and local governments, including municipalities, school districts, institutions of higher education and nonprofit entities. Herein, this group is referred to as the government, nonprofit and institutional (GNI) sector.

The energy savings compliance target for the GNI sector for Met-Ed is 45 GWh/yr, which must be obtained by May 31, 2013. Based on CPITD verified gross energy savings[16], Met-Ed achieved 114 percent of the target. These values are shown in Figure 1-3.

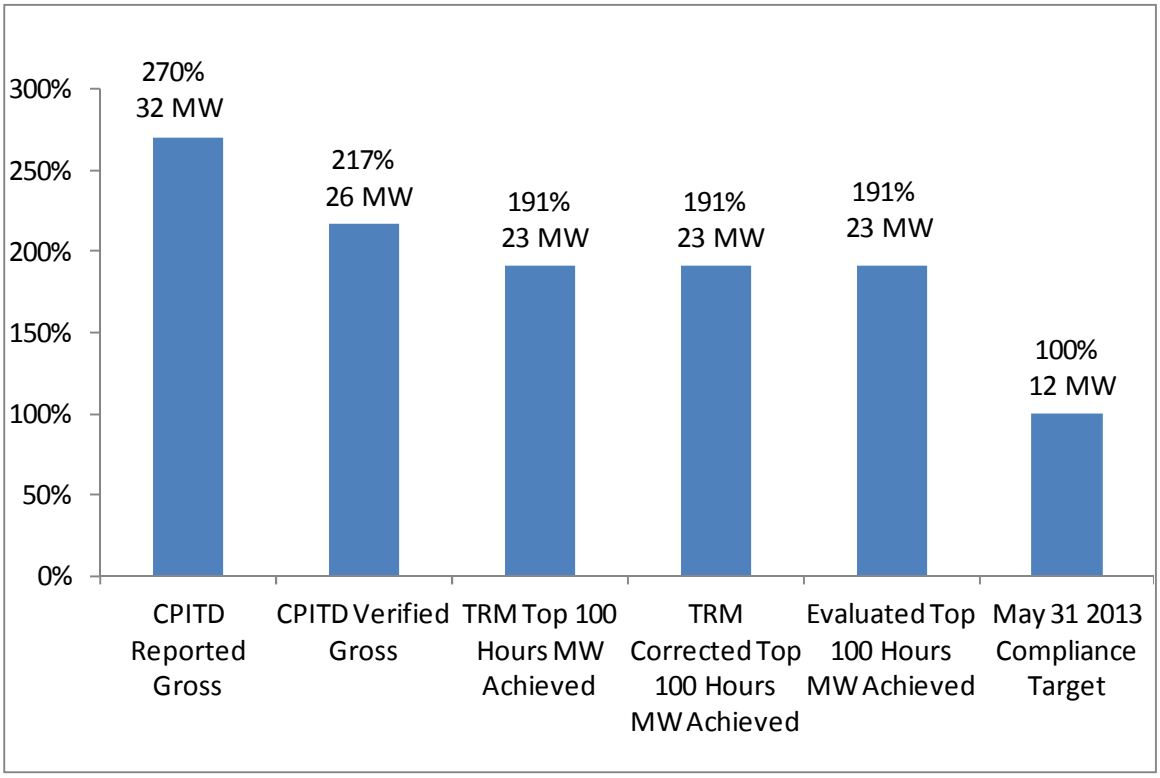
Figure 1-3: GNI CPITD Energy Savings



[16] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated.

The peak demand compliance target for the GNI sector for Met-Ed is 12 MW. Based on CPITD verified gross demand reduction[17], Met-Ed achieved 191% percent of the target, identified as *"Evaluated Top 100 Hours MW Achieved"* (191% of the target using "TRM" results, and 191% using "TRM Corrected" results). These values are shown in **Figure 1-4.**

Figure 1-4: GNI CPITD Peak Demand Reduction



Phase II Carry Over

According to the Phase II Implementation Order, Met-Ed is allowed by the PUC to "carry over" MWh savings into Phase II of Act 129. Table 1-3 below shows how many MWh of savings from PY4 Met-Ed will be carrying over into Phase II.

[17] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated. As referred to in this Figure, "TRM," "TRM Corrected," and "Evaluated" results are consistent with the terminology previously discussed in Section 1 of this Report.

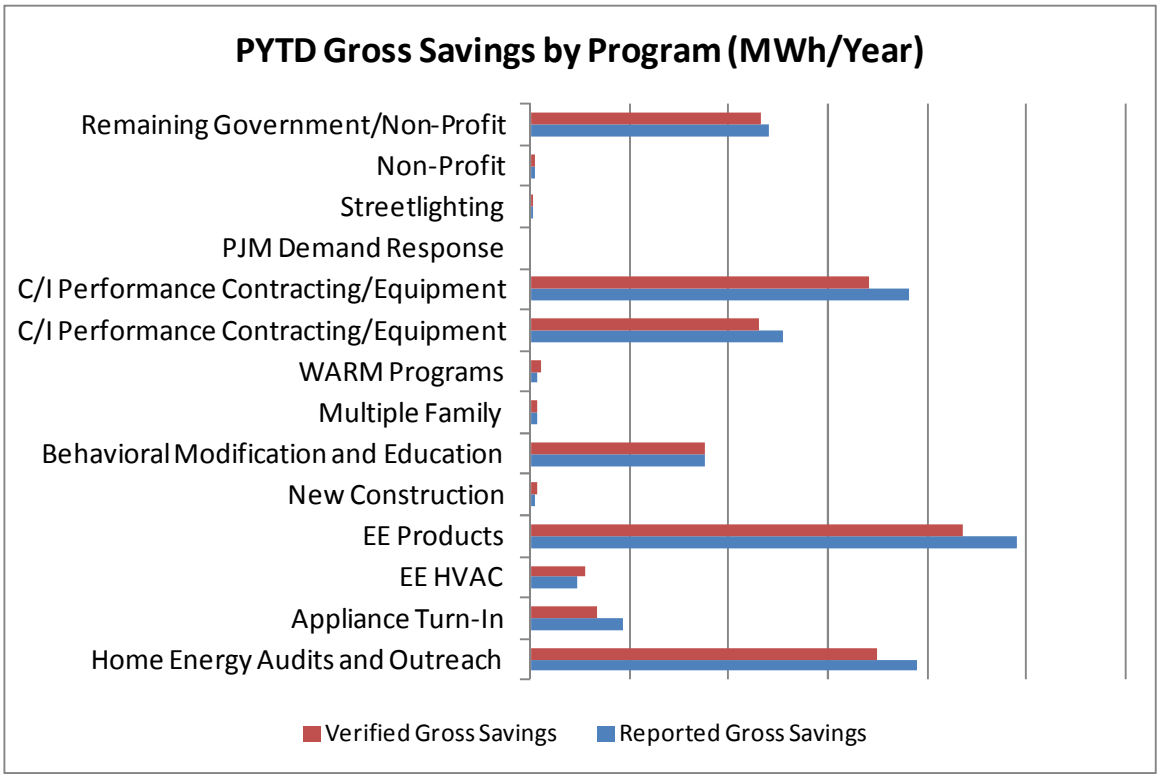
Table 1-3: Savings from PY4 Carried into Phase II

CPITD Verified Savings (MWh/Yr)	CPITD Unverified Savings (MWh/Yr)	Savings Carried into Phase 2 (MWh/Yr)
493,138	0	47,187

1.2 Summary of Energy Impacts

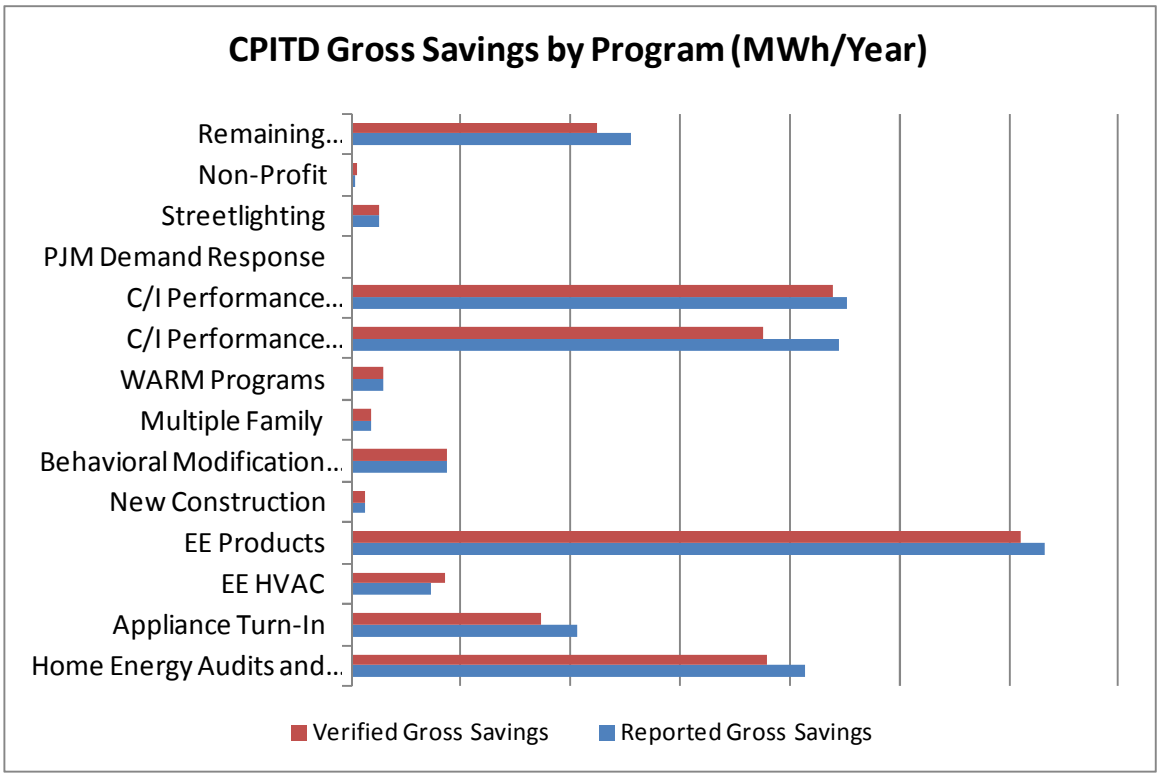
A summary of the reported and verified energy savings by program for Program Year 4 is presented in Figure 1-5.

Figure 1-5: PYTD Gross Energy Savings by Program



A summary of the cumulative reported and verified energy savings by program is presented in Figure 1-6.

Figure 1-6: CPITD Gross Energy Savings by Program



A summary of energy impacts by program through the PY4 Q4 is presented in Table 1-4 and Table 1-5.

Table 1-4: Reported Participation and Gross Energy Savings by Program

Program	Participants			Reported Gross Energy Savings (MWh/Year)		
	IQ	PYTD	CPITD	IQ	PYTD	CPITD
Demand Reduction[18]	-165	-4,428	16,219	n/a	n/a	n/a
Home Energy Audits and Outreach	6,055	61,912	142,921	3,841	39,005	82,938
Appliance Turn-In	1,218	5,135	22,976	2,249	9,437	41,273
EE HVAC	2,423	5,534	17,201	2,365	4,670	14,619
EE Products	92,456	293,867	756,539	15,507	49,016	126,566
New Construction	61	243	816	115	481	2,703
Behavioral Modification and Education	141,594	141,594	136,035	4,685	17,565	17,565
Multiple Family	0	2,621	8,016	0	765	3,491
WARM Programs	401	1,411	9,089	202	674	5,998
Small C/I Equipment	171	401	1,035	9,037	25,538	88,836
Large C/I Equipment	78	94	261	15,951	38,087	90,346
PJM Demand Response	0	177	177	0	0	0
Streetlighting	0	1	236	0	7	4,981
Non-Profit	4	11	43	256	455	813
Remaining Government/Non-Profit	241	358	663	15,966	24,043	50,983
TOTAL PORTFOLIO	**244,537**	**508,931**	**1,112,227**	**70,174**	**209,740**	**531,111**

[18] Negative participants for IQ and PYTD were due to customers opting out of the program.

Table 1-5: Verified Gross Energy Savings by Program

Program	PYTD Reported Gross Energy Savings (MWh/Year)	PYTD Energy Realization Rate	PYTD Verified Gross Energy Savings (MWh/Year)	PYTD Unverified Gross Energy Savings (MWh/Year)	PYTD Achieved Precision [1]	CPITD Verified Gross Energy Savings (MWh/Year)	CPITD Unverified Gross Energy Savings (MWh/Year)	CPITD Achieved Precision [2]
Demand Reduction	n/a	n/a	n/a	0	n/a	n/a	0	n/a
Home Energy Audits & Outreach	39,005	89%	34,864	0	6%	75,999	0	3%
Appliance Turn-In	9,437	72%	6,677	0	9%	34,334	0	5%
EE HVAC	4,670	119%	5,573	0	5%	17,251	0	3%
EE Products	49,016	89%	43,649	0	9%	122,030	0	5%
New Construction	481	152%	729	0	13%	2,537	0	8%
Behavioral Modification and Education	17,565	100%	17,565	0	21%	17,565	0	12%
Multiple Family	765	100%	765	0	11%	3,659	0	6%
WARM Programs	674	163%	1,096	0	12%	5,728	0	7%
Small C/I Equipment	25,538	90%	23,076	0	9%	75,237	0	5%
Large C/I Equipment	38,087	90%	34,119	0	12%	87,774	0	7%
PJM Demand Response	0	n/a	0	0		0	0	n/a
Streetlighting	7	100%	7	0	0%	4,977	0	0%
Non-Profit	455	98%	447	0	10%	1,191	0	6%
Remaining Government/Non-Profit	24,043	96%	23,172	0	13%	44,858	0	8%
TOTAL PORTFOLIO	**209,740**	91%	**191,739**	**0**	**4.8%**	**493,138**	**0**	**2.2%**

[1] At the 90% confidence level
[2] At the 90% confidence level

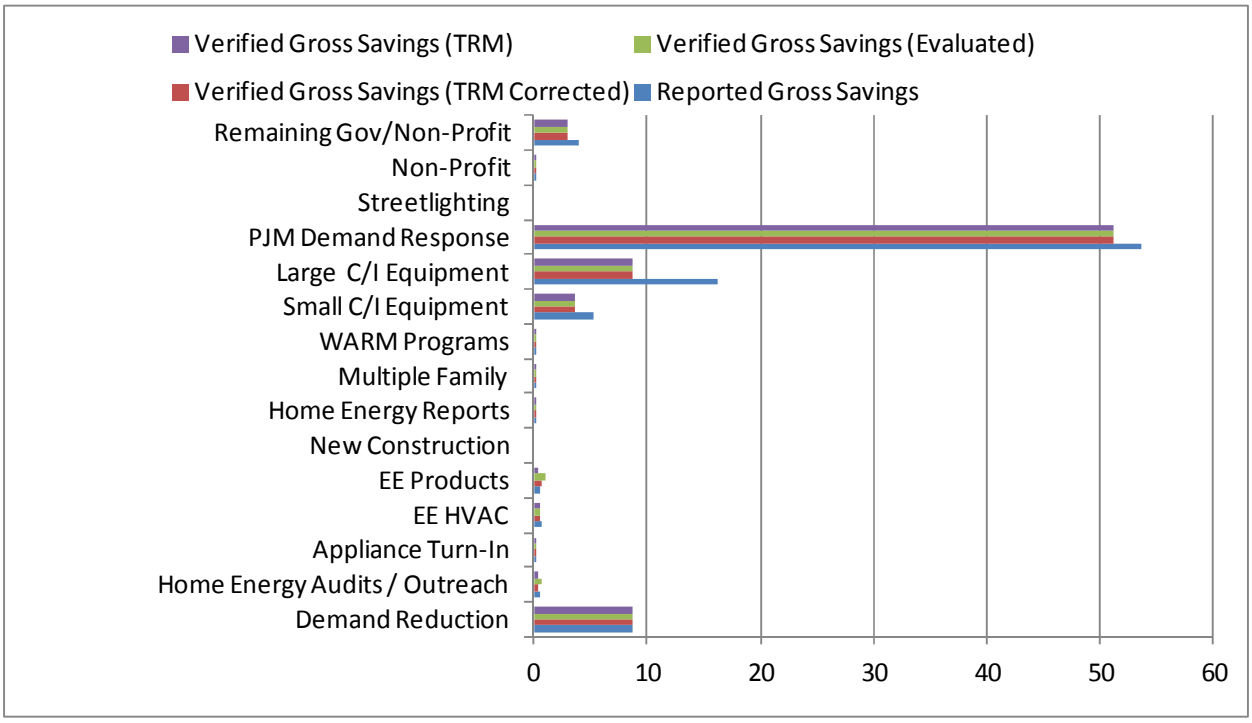
1.3 Summary of Fuel Switching Impacts

Met-Ed has not rebated any overt gas to electric fuel switching measures in its Plan. In certain programs where comparable gas appliances are available, there are rebates available for electric heat pumps or electric water heaters. For these programs, all participants are asked if gas is available at their homes or businesses. ADM surveyed customers that received rebates for electric heat pumps and electric water heaters. Out of 60 surveyed program participants, 50 reported that they did not have gas service available at their homes. Eight of the ten customers that did have gas service available replaced preexisting electric heat pumps or electric water heaters. The remaining two customers did not cite the Met-Ed rebate as the primary factor in the decision to switch to electric water heating. One customer reported that the electric heat pump water heater is more efficient to run, while the other customer did not state a reason for the change.

1.4 Summary of Demand Impacts

A summary of the reported and verified demand reduction by program within the top 100 hours for the program year is presented in Figure 1-7[19].

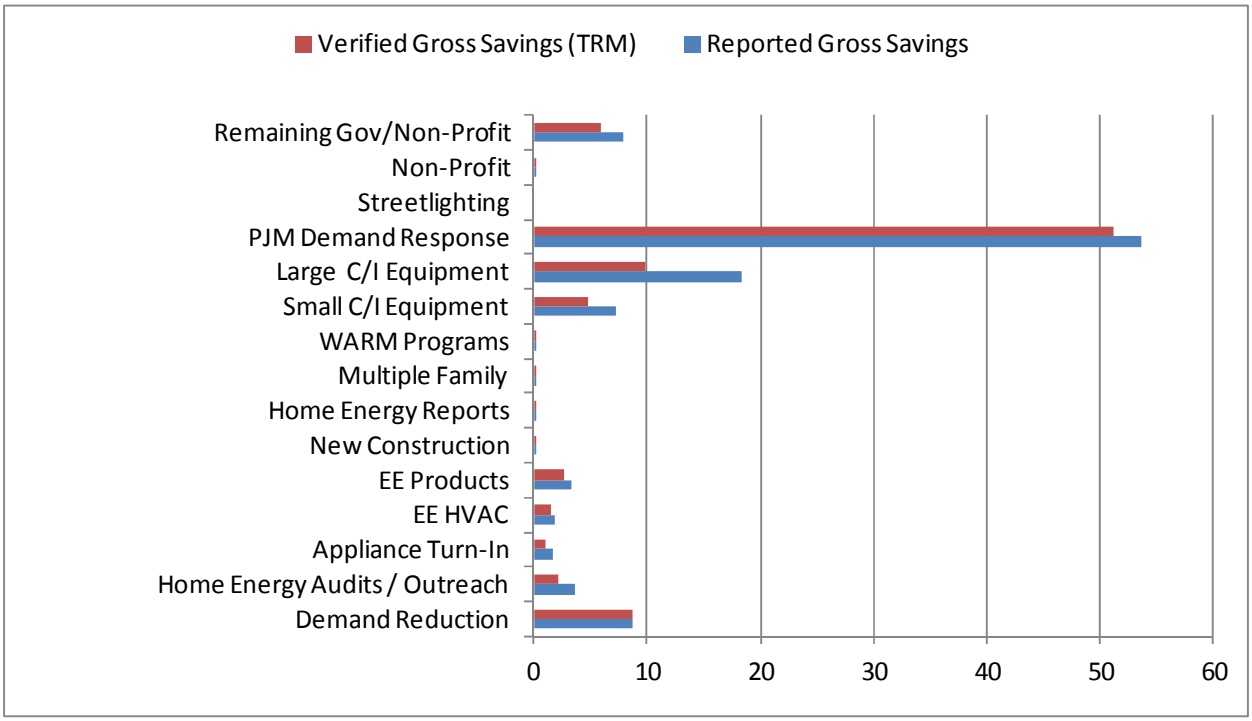
Figure 1-7: PYTD Reported Demand Reduction by Program (Top 100 Hours)



[19] As referred to in this Figure, "TRM," "TRM Corrected," and "Evaluated" results are consistent with the terminology previously discussed in Section 1 of this Report.

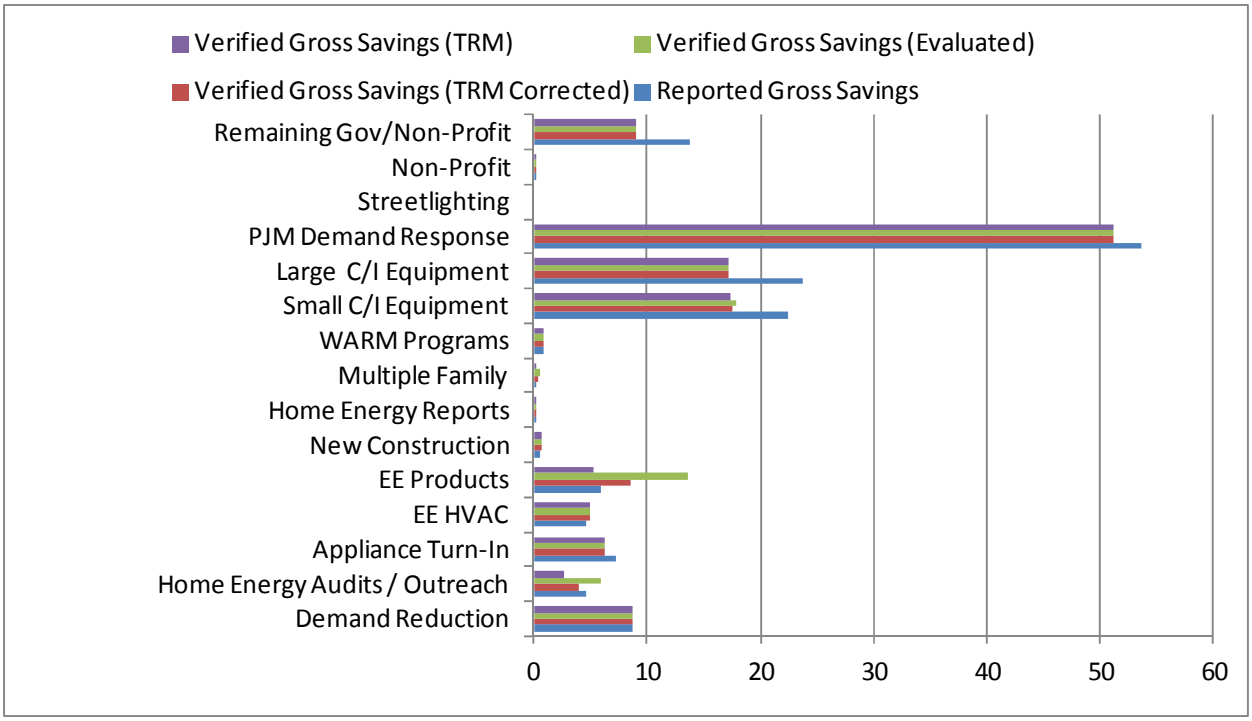
A summary of the reported and verified demand reductions by program including all MW savings for the program year is presented in Figure 1-8. The impacts below include the line loss factors presented in Table 1-1.

Figure 1-8: PYTD Reported Demand Reduction by Program (All MW Savings)



A summary of the cumulative reported and verified demand reduction by program, using the loss factors presented in Table 1-1, within the top 100 hours is presented in Figure 1-9[20].

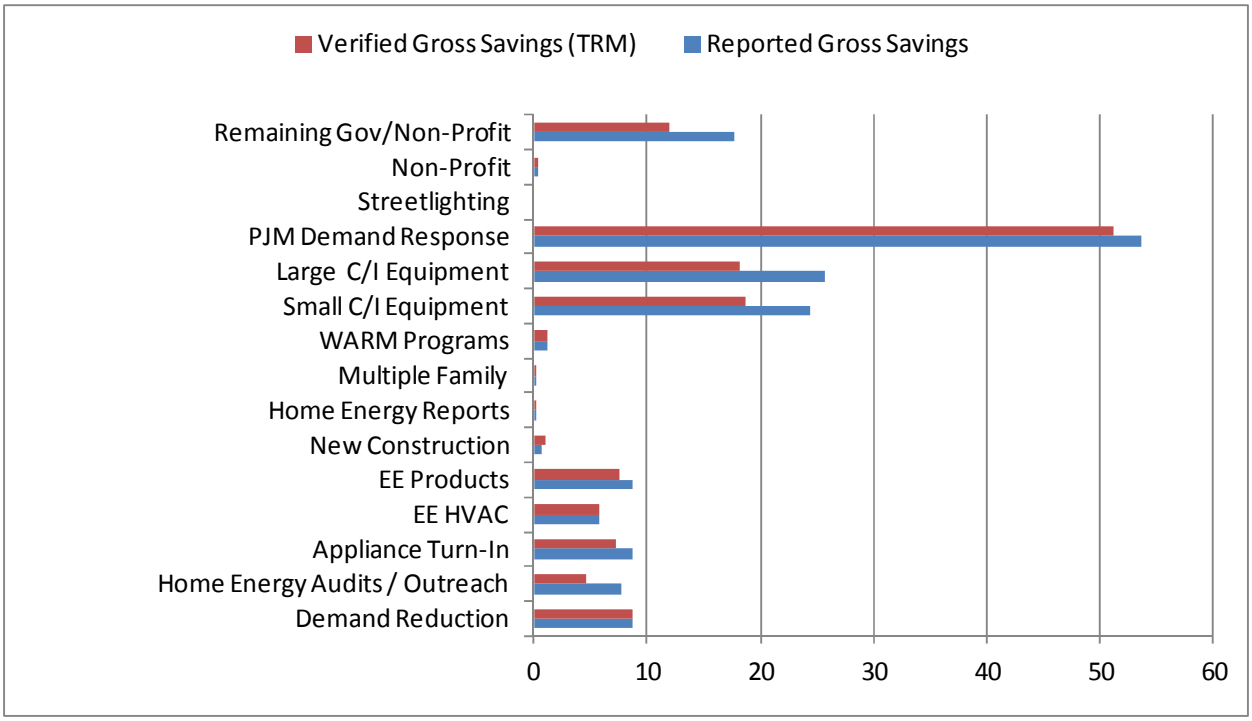
Figure 1-9: CPITD Reported Demand Reduction by Program (Top 100 Hours)



A summary of the cumulative reported and verified demand reduction by program, using the loss factors as presented in Table 1-1, including all MW savings for the program year is presented in Figure 1-10.

[20] As referred to in this Figure, "TRM," "TRM Corrected," and "Evaluated" results are consistent with the terminology previously discussed in Section 1 of this Report.

Figure 1-10: CPITD Reported Demand Reduction by Program (All MW Savings)



A summary of demand reduction impacts by program through PY4 Q4 is presented in Table 1-6, Table 1-7 and Table 1-8.

Table 1-6: EDC Reported Participation and Gross Demand Reduction by Program

Program	Participants			Reported Gross Demand Reduction (MW)		
	IQ	PYTD	CPITD	IQ	PYTD	CPITD
Demand Reduction[21]	-165	-4,428	16,219	0.00	8.69	8.69
Home Energy Audits & Outreach	6,055	61,912	142,921	0.36	3.68	7.77
Appliance Turn-In	1,218	5,135	22,976	0.39	1.66	8.69
EE HVAC	2,423	5,534	17,201	0.80	1.84	5.71
EE Products	92,456	293,867	756,539	1.11	3.38	8.72
New Construction	61	243	816	0.02	0.08	0.64
Behavioral Modification and Education	141,594	141,594	136,035	0.69	0.05	0.05
Multiple Family	0	2,621	8,016	0.00	0.04	0.18
WARM Programs	401	1,411	9,089	0.09	0.28	1.18
Small C/I Equipment	171	401	1,035	1.45	7.23	24.32
Large C/I Equipment	78	94	261	2.54	18.30	25.76
PJM Demand Response	0	177	177	0.00	53.61	53.61
Streetlighting	0	1	236	0.00	0.00	0.00
Non-Profit	4	11	43	0.06	0.10	0.37
Remaining Government/Non-Profit	241	358	663	3.47	7.86	17.74
TOTAL PORTFOLIO	**244,537**	**508,931**	**1,112,227**	**11.0**	**106.8**	**163.4**

[21] Negative participants for IQ and PYTD were due to customers opting out of the program.

Table 1-7: PYTD Verified Gross Demand Reductions in the Top 100 Hours by Program[22]

Program	PYTD Reported Gross Demand Savings (MW)	PYTD Demand Realization Rate	PYTD Verified Gross Demand Savings (MW)	PYTD Achieved Precision [1]	CPITD Verified Gross Demand Savings (MW/Year	CPITD Verified Gross Demand Savings (MW/Year)	CPITD Verified Gross Demand Savings (MW/Year)	CPITD Achieved Precision [2]
					TRM	TRM Corrected	Evaluated	
Demand Reduction	8.69	100%	8.69	15%	8.69	8.69	8.69	15%
Home Energy Audits & Outreach	0.69	68%	0.47	9%	2.72	3.91	5.86	5%
Appliance Turn-In	0.21	76%	0.16	10%	6.35	6.35	6.35	6%
EE HVAC	0.74	97%	0.72	9%	4.93	4.93	4.93	5%
EE Products	0.79	85%	0.67	11%	5.36	8.48	13.57	6%
New Construction	0.00	335%	0.01	13%	0.70	0.70	0.70	8%
Behavioral Modification and Education	0.05	97%	0.05	21%	0.05	0.05	0.05	12%
Multiple Family	0.07	100%	0.07	11%	0.18	0.32	0.55	6%
WARM Programs	0.02	77%	0.01	13%	0.95	0.95	0.95	8%
Small C/I Equipment	4.89	67%	3.29	15%	17.41	17.55	17.79	9%
Large C/I Equipment	16.30	54%	8.78	11%	17.17	17.17	17.17	6%
PJM Demand Response	53.61	96%	51.20	13%	51.20	51.20	51.20	13%
Streetlighting	0.00	n/a	0.00	0%	0.00	0.00	0.00	0%
Non-Profit	0.02	89%	0.02	7%	0.28	0.28	0.28	4%
Remaining Government/Non-Profit	3.93	76%	3.00	22%	9.03	9.03	9.03	13%
TOTAL PORTFOLIO	**90.0**	**86%**	**77**	**8%**	**125.0**	**129.6**	**137.1**	**6%**

[1] At the 90% confidence level
[2] At the 90% confidence level

[22] As referred to in this Figure, "TRM," "TRM Corrected," and "Evaluated" results are consistent with the terminology previously discussed in Section 1 of this Report.

Table 1-8: PYTD Total Verified Gross Demand Reductions by Program

Program	PYTD Reported Gross Demand Savings (MW)	PYTD Demand Realization Rate	PYTD Verified Gross Demand Savings (MW)	PYTD Achieved Precision [1]	CPITD Verified Gross Demand Savings (MW/Year)	CPITD Achieved Precision [2]
Demand Reduction	8.69	100%	8.69	15%	8.69	15%
Home Energy Audits & Outreach	3.68	61%	2.25	9%	4.64	5%
Appliance Turn-In	1.66	67%	1.11	10%	7.31	6%
EE HVAC	1.84	82%	1.50	9%	5.85	5%
EE Products	3.38	78%	2.63	11%	7.57	6%
New Construction	0.08	335%	0.26	13%	0.97	8%
Behavioral Modification and Education	0.05	100%	0.05	21%	0.05	12%
Multiple Family	0.04	100%	0.04	11%	0.18	6%
WARM Programs	0.28	77%	0.22	13%	1.15	8%
Small C/I Equipment	7.23	67%	4.86	15%	18.70	9%
Large C/I Equipment	18.30	54%	9.86	11%	18.25	6%
PJM Demand Response	53.61	96%	51.20	13%	51.20	13%
Streetlighting	0.00	n/a	0.00	0%	0.00	0%
Non-Profit	0.10	89%	0.09	7%	0.35	4%
Remaining Government/Non-Profit	7.86	76%	6.00	22%	12.02	13%
TOTAL PORTFOLIO	**106.8**	**83%**	**88.7**	**9%**	**136.9**	**6%**

[1] At the 90% confidence level
[2] At the 90% confidence level

1.5 Summary of PY4 Net to Gross Ratios

Per the 2011 TRC Order, EDCs are required to conduct Net-to-Gross (NTG) research. NTG ratios are not applied to gross savings and are not used for compliance purposes, but are used for future program planning purposes. Table 1-9 presents a summary of observed NTG ratios by program based on research for PY4.

Table 1-9: PY4 NTG Ratios by Program

Program Name	NTG Ratio PY4[23]	NTG Categories Included[24]
Residential Demand Response	Study not conducted	n/a
Residential Home Energy Audits and Outreach	87.9%	free ridership, participant spillover
Residential Appliance Turn-in	61.5%	free ridership
Residential Energy Efficiency HVAC	57.7%	free ridership, participant spillover
Residential Energy Efficient Products	50.5%	free ridership, participant spillover
Residential New Construction	Study not conducted	n/a
Residential Behavioral Modification and Education	Study not conducted	n/a
Residential Multiple Family	Study not conducted	n/a
Residential Low-income (WARM)	Study not conducted	n/a
Commercial/Industrial Small Sector Equipment	65.5%	free ridership, participant spillover
Commercial/Industrial Large Sector Performance Contracting/Equipment[25]	65.5%	free ridership, participant spillover
Commercial/Industrial Large Sector Demand Response	Study conducted by the PA Act 129 Statewide evaluator[26]	
Government/Non-profit Street Lighting	Study not conducted	n/a
Government/Non-profit[27]	65.5%	free ridership, participant spillover
Government/Remaining Non-profit[28]	65.5%	free ridership, participant spillover

[23] NTG studies were conducted once for each program in Phase I (unless otherwise noted) in PY3. Studies were not conducted for programs that have minimal contribution to total portfolio impacts.

[24] For example, free ridership, non-participant spillover, participant spillover.

[25] Net-to-gross research was conducted for combined Commercial/Industrial and Government/Non-profit Equipment programs/sectors. Caution is recommended when interpreting by sector.

[26] See "ACT 129 DEMAND RESPONSE STUDY, Final Report", May 16, 2013. http://www.puc.pa.gov/pcdocs/1230512.docx

[27] Net-to-gross research was conducted for combined Commercial/Industrial and Government/Non-profit Equipment programs/sectors. Caution is recommended when interpreting by sector.

[28] ibid.

1.6 Summary of Portfolio Finances and Cost-Effectiveness

A breakdown of the portfolio finances is presented in Table 1-10.[29]

Table 1-10: Summary of Portfolio Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$5,178	$18,339	$47,735
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	$5,178	$18,339	$47,735
Design & Development	-$57	$25	$187
Administration[1]	$1,138	$5,642	$33,004
Management[2]	$409	$1,204	$3,531
Marketing[3]	$33	$420	$1,302
Technical Assistance	$128	$280	$627
Subtotal EDC Implementation Costs	$1,651	$7,572	$38,651
EDC Evaluation Costs	$933	$1,597	$3,095
SWE Audit Costs	$111	$264	$1,175
Total EDC Costs[4]	$7,873	$27,772	$90,656
Participant Costs[5]	$336	$129,940	$190,042
Total TRC Costs[6]		**$140,078**	**$234,938**
Total Lifetime Energy Benefits	$0	$118,965	$327,321
Total Lifetime Capacity Benefits	$0	$21,868	$47,181
Total TRC Benefits[7]	**$0**	**$140,834**	**$374,502**
TRC Ratio[8]	**0.00**	**1.01**	**1.59**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only .

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

[29] Reflects the Company's portfolio accounting as of October 31, 2013 and is subject to true up or revision.

1.7 Summary of Cost-Effectiveness by Program

TRC ratios are calculated by comparing the total TRC benefits and the total TRC costs. Table 1-11 shows the TRC ratios by program and other factors used in the TRC ratio calculation.

Table 1-11: PYTD TRC Ratios by Program

Program	TRC Benefits ($1000)	TRC Costs ($1000)	TRC Ratio	Discount Rate	Line Loss Factor
Demand Reduction	610	1,514	0.40	7.92%	11.0%
Home Energy Audits and Outreach	20,544	5,258	3.91	7.92%	11.0%
Appliance Turn-In	4,642	970	4.79	7.92%	11.0%
EE HVAC	5,424	4,289	1.26	7.92%	11.0%
EE Products	23,816	8,257	2.88	7.92%	11.0%
New Construction	896	781	1.15	7.92%	11.0%
Behavioral Modification and Education	1,557	597	2.61	7.92%	11.0%
Multiple Family	391	10	39.85	7.92%	11.0%
WARM Programs	1,170	1,255	0.93	7.92%	11.0%
Small C/I Equipment	22,640	30,438	0.74	7.92%	11.0%
Large C/I Equipment	31,281	56,878	0.55	7.92%	11.0%
PJM Demand Response	3,576	3,641	0.98	7.92%	11.0%
Streetlighting	6	-44	-0.13	7.92%	11.0%
Non-Profit	431	157	2.75	7.92%	11.0%
Remaining Government/Non-Profit	23,848	26,078	0.91	7.92%	11.0%

2 Residential Demand Reduction Program

This program paid an incentive to participants who agreed to have controls installed on their Central Air Conditioning (CAC) systems that enabled Met-Ed to limit its operation during peak load periods. Met-Ed was able to control CAC compressors for the duration of the load control event. This program was triggered during Met-Ed's top 100 load hours, typically from noon – 7 pm on selected weekdays.

2.1 Program Updates

This program was operated between June 1 and September 30, 2012. No changes to this program occurred during PY4. The program was briefly suspended during several of the initial Top 100 hour days of 2012 following customer complaints and Commission inquiries related to extreme heat conditions that persisted for several days, and concerns for customer health and satisfaction.

2.2 Impact Evaluation Gross Savings

Measurement and verification for the Met-Ed's Integrated Distributed Energy Resources (IDER) Program is enabled through real-time true power readings as measured by metering chips and current transformers installed on all participating units. The program implementer, BPL Global, calculates hourly impacts according to the following protocol:

1. For each event, a group of approximately 195 customers are selected as a control group. These participants will not have their CAC cycled. The typical usage per customer that would have occurred in the absence of the IDER program may be assessed from this control group.

2. For a 20-minute benchmarking period ending 30 minutes prior to event start, the average energy usage is calculated for the control group and for the intended treatment group. The control group is randomly selected from the set of all candidate participants, but due to the limited size of the control group, there may be differences (often less than 10%) between the usages of the control and treatment groups. Therefore, a scale factor is created to compensate for observed differences between the two groups. The scale factor is defined as the ratio of the average usage (in kWh) of the treatment group to the average usage of the control group:

   $$f_{kWh} = kWh_{Treatment} / kWh_{Control}$$

   Where,

   fkWh is the scale factor,

   $kWh_{Treatment}$ is the average kWh for the treatment group in the benchmarking period,

   $kWh_{Control}$ is the average kWh for the control group in the benchmarking period.

3. For the event period, the usage that would have occurred for the treatment group for a given hour is calculated as:

   $kWh_{Treatment} = f_{kWh} \times N_{Treatment} / N_{Control}$

   Where,

   $kWh_{Treatment}$ is the estimated usage of the treatment group during the event,

   f_{kWh} is the scale factor discussed above,

   $N_{Treatment}$ is the number of participants in the treatment group,

   $N_{Control}$ is the number of participants in the control group.

4. The energy savings during the event is the difference between the estimated energy usage that would have occurred in the absence of the event, as calculated in the steps above, and the actual energy usage as metered for the treatment group.

ADM's audit of the program included the following steps.

1. Check that the sample size for the control group is adequate.

   Prior to program launch ADM communicated the necessary sample size (~200) to BPL global. With a sample size of 200, the scale factor discussed in step 2 above can be known to ±10% at the 90% confidence level for each event.

2. Check that the control group is randomly selected.

   Based on the observed coefficient of variation for energy usage in a 20-minute period, randomly selected control groups should result in scale factors that are within 10% of unity most of the time. ADM reviewed BPL Global's data and calculations to confirm that this is the case.

3. Verify that calculations are performed correctly and in accordance to the protocols stated above.

   The data were made available to ADM in spreadsheets. ADM checked that calculations were performed correctly and consistently throughout the spreadsheets by performing independent calculations and random spot checks to confirm that the spreadsheet formulae were populated consistently throughout the worksheets.

4. Assess the program savings and the top 100 hours of demand for Met-Ed in 2012.

   The program savings in the top 100 hours was determined by calculated and creating 'addbacks' for all programs to each hour of the observed system loads to reconstruct the top 100 hours that would have occurred in the absence of Act 129 program reductions. Savings that occurred during the top 100 hours were counted toward the Act 129 demand reduction target.

Although this program likely achieved energy savings during the summer of 2012, Met-Ed did not claim any energy savings for this program.

Table 2-1: CPITD Reported Results by Quarter[30]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	17,154	0	7.45	8.69	8.69	8.69	8.69	8
PY4 Q2	-712	0	0.00	0.00	0.00	0.00	0.00	280
PY4 Q3	-95	0	0.00	0.00	0.00	0.00	0.00	0
PY4 Q4	-128	0	0.00	0.00	0.00	0.00	0.00	939
PY4 Total	16,219	0	7.45	8.69	8.69	8.69	8.69	667
CPITD Total	20,712	0	7.45	8.69	8.69	8.69	8.69	17,254

Table 2-2: Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Treatment	Treatment	>16,800	0.7	n/a	census	census	Treatment vs. Control Group Comparison
Control	Control	~195	0.7	n/a	200	195	
Event Reports	One per event-day	n/a	n/a	n/a	10	15	Check that event reports are consistent with data and calculations
Program Total		18,627*					
* Average number of participants during June-September 2012.							

[30] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 2-3: PY4 Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings	Unverified Gross Energy Savings
Treatment	n/a	n/a	n/a	n/a	n/a	n/a
Control	n/a	n/a	n/a	n/a	n/a	n/a
Program Total	n/a	n/a	n/a	n/a	n/a	n/a

The following table includes top 100 hour impacts at the generator level. There are no reported energy savings or lasting demand reductions for this program.

Table 2-4: PY4 Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
Treatment	8.69	100%	n/a	<10%	7.45	8.69	8.69	8.69
Control	0	n/a	n/a		0	0	0	0
Program Total	8.69	100%	n/a	<10%	7.45	8.69	8.69	8.69

2.3 Impact Evaluation Net Savings

A net-to-gross assessment was not conducted for this program in Phase I.

2.4 Process Evaluation

A process evaluation was not conducted for this program in Phase I.

2.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in Table 2-5

Table 2-5: Summary of Residential Demand Response Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$667	$667	$667
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$667**	**$667**	**$667**
Design & Development	-$6	$3	$21
Administration[1]	$568	$518	$15,713
Management[2]	$60	$143	$387
Marketing[3]	$2	$12	$48
Technical Assistance	$14	$78	$114
Subtotal EDC Implementation Costs	**$638**	**$753**	**$16,283**
EDC Evaluation Costs	$56	$94	$174
SWE Audit Costs	$12	$29	$130
Total EDC Costs[4]	$1,374	$1,544	$17,254
Participant Costs[5]	$0	$667	$667
Total TRC Costs[6]		**$1,514**	**$17,124**
Total Lifetime Energy Benefits		$0	$0
Total Lifetime Capacity Benefits		$610	$610
Total TRC Benefits[7]	**N/A**	**$610**	**$610**
TRC Ratio[8]	**N/A**	**0.40**	**0.04**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

3 Home Energy Audit and Outreach Program

The purpose of the Home Energy Audit Program is to: 1) identify energy savings opportunities; 2) install basic low-cost measures; and 3) make customers aware of other energy efficient programs offered by Met-Ed. Households will be able to identify energy saving opportunities through three types of home energy audits.

1. Online Audit – This program is a self-administered on-line audit that analyzes historic energy use, and calculates energy savings based on customer responses to a series of questions. Customers without internet access can complete the audit over the phone with a company representative. Customers who complete the on-line audit are eligible to receive an energy conservation kit once the audit is complete and submitted. There is no incremental cost to customers to complete the on-line audit.

2. Walk Through audit – This program is an on-site audit administered by a trained professional auditor. Customers pay a fee of $50 for the walk-through on-site audit and receive direct-installed low-cost energy savings measures selected by the trained auditor based on the needs of the home.

3. Whole House Comprehensive audit – This program provides comprehensive diagnostic assessments of households followed by direct installation of selected low-cost measures plus incentives for implementation of measures addressing building shell, appliances and other energy-consuming features. Customers are eligible to receive up to $300 in rebates for participating in a two-part (test in/test out) comprehensive energy audit and up to $900 in rebates calculated on performance-based kWh savings achieved by installing energy-saving improvements.

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3.1 Program Updates

Of the three components of this program, the Whole House Comprehensive audit components did not change during PY4. Beginning in PY4, the Company also offered phone-based audits to customers who had not completed an online audit. Customers who completed the phone-based audit were also eligible for an energy conservation kit and educational information that included tips on how to save energy in their home. For the Walk Thru audit program; the $50 participation fee was waived by the CSP from October 2012 through May 31, 2013 in an effort to boost participation.

3.2 Impact Evaluation Gross Savings

This program has three components: Online audits with mailings of conservation kits, walk-through audits with direct installation of low-cost measures, and comprehensive whole-house retrofits. In PY4, the conservation kits accounted for essentially all (well over 99%) of the program level energy savings. The majority of the savings from the whole house audit projects were attributable to CFLs, Low-flow showerheads, and pipe insulation.

Gross Impact Analysis for the Energy Conservation Kit Contents

Two separate energy conservation kits were sent to customers depending on their hot water fuel source. The kit provided to customers with electric water heating consists of CFLs, LED night lights, aerators and aerator adapters, a furnace whistle, a "smart" power strip, and a low flow showerhead. The kit provided to customers with non-electric water heating consists of CFLs, specialty dimmable CFLs, LED night lights, a furnace whistle, and a "smart" power strip.

In evaluating the gross impact analysis for the energy conservation kits in PY4, 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 PY4,
3. The installation rate 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, customer moving, or other such scenarios.

The first item has been determined through application of the partially deemed savings protocols in the 2012 TRM. The most significant adjustment in this process concerns the baseline change for 23W to 26W CFLs. Reported savings were calculated with a 100W lamp as the baseline for such lamps, and the gross verified savings reported herein are calculated with a 72W baseline in accordance with the 2012 TRM. All else held constant, this lowered the realization rate by approximately 9%.

Upon reviewing reported measure-level savings, ADM discovered that these savings included demand reductions for furnace whistles, while the 2012 TRM does not recognize demand reductions. Since most installed furnace whistles – particularly in Met-Ed territory, are installed in homes with central cooling, one would expect nonzero demand reductions from this measure. As such, the realization rate for demand reduction was lower than the realization rate for energy savings. Although the 2014 proposed TRM does recognize demand reductions for this measure, the gross verified impacts are calculated in accordance with the 2012 TRM and zero demand reductions are credited to this measure. Since most of the conservation kits were shipped after the top 100 hours, the resulting underestimation in demand reductions is minimal.

The second item, the total number and type of kits mailed to customers in PY4, is determined by reviewing the program T&R system. Specifically, the T&R system is checked to ensure that duplicate shipments to the same physical address are not double counted and that all kits being claimed for PY4 are eligible based on delivery dates.

The third item, installation rates, are determined through online surveys, except for CFLs which are given "deemed" installation rates of 0.84 (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 low flow showerheads are only counted as "installed" if they are installed in a home that has electric water heating. Smart power strips are counted as "installed" if: (1) there are appliances plugged into the "controlled" sockets that are turned on and off by the smart strip; and (2) an appliance that is not uniformly on is installed in the "master" socket. ADM uses EDC specific ISRs to calculate the verified savings for the kits.

The final item, the delivery rate is determined through the online survey instrument and through follow up interviews. Online survey respondents are asked to indicate whether they received the conservation kit that was mailed to them. For the small percentage of respondents who indicated that they did not receive the kits, follow up email or telephone interviews were conducted at a later date to determine if the customer had misunderstood the question in the online survey. 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 by Met-Ed.

The online 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. The accuracy of the online survey instrument was verified in prior program years through supplementary on-site data collection activities of a nested sample of the online survey respondents. The results of this analysis indicate that the variance in savings attributable to this program is primarily a result of installation rates. This variance is best captured in the online survey instrument, as it allows for a large sample size not easily obtained through on-site data collection. Furthermore, the online survey seems particularly appropriate because the majority of program participants completed the audit process online (as opposed to the telephone and walk-through methods). The more anonymous nature of online survey method is through to less likely introduce bias in the estimates of installation rates.

Gross Impact Analysis for the Walk-Through and Comprehensive Audits

The items that are installed during the walk-through visits include a variable quantity of conservation kit items and other low-cost measures to be determined or judged as appropriate by the auditor. Apart from air sealing, all of the energy efficiency measures distributed in the walk-through audits have energy savings protocols that are in the 2012 PA TRM. A relatively small number of homes received comprehensive measures that include air sealing, duct sealing, window upgrades, and insulation. These homes accounted for about 50 MWh of savings for Met-Ed in PY4. The program implementer calculates energy savings with a whole-house simulation that is informed with site-specific data and measurements such as pre-measure and post–measure air leakage rates measured with a blower door test. ADM has reviewed this process with the implementer in PY4 and finds the data acquisition and calculation process to be appropriate. Approximately 75% of the impacts associated with the in-house audits are attributable to measures such as CFLs, low-flow showerheads and faucet aerators, and hot water pipe insulation. The T&R system reported the measures with adequate resolution to enable a calculation review for the census of participants. ADM verified that the proper TRM algorithms were used for these measures. In addition

to the savings calculation review, ADM conducted a small number of verification surveys to verify that the reported conservation measures are in service.

3.2.1 **Program Sampling**

The two program components - online and walk-through/comprehensive audits - are treated as separate sub-programs, each with distinct populations, samples, and realization rates. A sample point in the context of this program is "a program participant." For the online/telephone audits component, this is equivalent to "one energy conservation kit." For the walk-through audit component, it is equivalent to saying "one home."

Online Audits

The sampling approach for the online audit program component is random sampling. Stratification by kit type was done to ensure that appropriate realization rates are determined for the two individual kit types.

Overall, there are two tiers of sampling involved.

1. A census of the energy and demand savings calculations in the program tracking data are reviewed to ensure that the energy savings and demand reductions are being claimed according to the protocols in the PA TRM, with reasonable assumptions for installation rates.
2. The sample size for online surveys was sufficiently large to determine gross impact with ±15% relative precision at the 85% confidence level. This large sample size (see Table 1-9) is motivated by the fact that the various kit components have different installation rates and only a large sample can accurately capture a true estimate of the installation rate. This is the main advantage of an online survey instrument as compared to on-site data collection for this program.

Walk-Through Audits

There were very few walk-through audits completed in PY4 as well as in previous years due to the program fee of $50. Though the on-site audits account for approximately 0.5% of program impacts, M&V efforts involved conducting calculation reviews with a small number of verification interviews. The sampling approach for the walk-through audit program component is random sampling. For the purely prescriptive, low-cost measures such as CFLs, smart power strips, showerheads, aerators, and DHW pipe insulation, a census of the energy and demand savings calculations in the T&R system supporting reported savings for the program are reviewed to ensure that the energy savings and demand reductions are claimed according to the protocols in the PA TRM.

Table 3-1. CPITD Reported Results by Quarter[31].

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	27,713	17,416	1.64	0.54	0.33	0.47	0.69	1,952
PY4 Q2	24,009	15,179	1.43	0.00	0.00	0.00	0.00	1,893
PY4 Q3	4,116	2,585	0.24	0.00	0.00	0.00	0.00	301
PY4 Q4	6,074	3,825	0.36	0.00	0.00	0.00	0.00	516
PY4 Total	61,912	39,005	3.67	0.54	0.33	0.47	0.69	4,662
CPITD Total	142,921	82,938	6.66	4.63	2.72	3.91	5.86	10,832

Table 3-2: Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Conservation Kits	all	61,508	0.5	15%	50	75	Online Surveys
In-Home Audits	all	404	n/a	50%	census	census	Calculation Review.
Program Total		61,912		15%	50	75	

[31] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 3-3: PY4 Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings	Unverified Gross Energy Savings
PY4 Electric Water Heat Kits	38,799	89%	< 0.5	6%	34,660	
In-Home Audits	206	99%	< 0.5	10%	204	
Program Total	39,005			6%	34,864	

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program. Please note, as discussed in Section 1 and Appendix A of this Report, the CPITD Top 100 demand reduction values in this table are shown using values that represent: 1) calculations published in the 2012 Pennsylvania TRM ("TRM"); 2) calculations that include a correction to the Residential CFL coincidence factor ("TRM Corrected"); and, 3) calculations that incorporate alternative measurement approaches from the 2012 TRM to more accurately assess the peak load impacts from residential lighting during the Company's Top 100 Hours ("Evaluated").

Table 3-4: PY4 Summary of Evaluation Results for Demand (Top 100 Hours) Stratum

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
Conservation Kits	3.15	61%	0.34	9%	1.92			
In-Home Audits	0.00	83%	0.5	10%	0.00			
Program Total	3.15	61%		9%	1.93	2.72	3.91	5.86

3.3 Impact Evaluation Net Savings

The evaluation team employed the self-report approach (SRA) to estimate free-ridership and spillover effects. The participant survey included a series of questions to quantitatively assess the program's influence on the installation of energy-saving measures received or rebated through the program. In

addition, the participant survey included a series of questions to assess additional energy-saving actions taken by customers since participating in the program and the extent of the program's influence on these actions. A total of 151 surveys were completed for a 4.6 percent relative precision with 90 percent confidence (for free-ridership assessment) at the program level.[32]

Free-ridership was evaluated at the measure category level for each participant surveyed. Participants were sampled for up to two of the following measure categories received/rebated through each program: 1) test-out improvements (only applicable for the Whole-House Comprehensive program), 2) CFLs, 3) smart strips, 4) hot water equipment, 5) LED nightlights, and 6) furnace whistles. A free-ridership rate was calculated for each measure category for each participant. Individual scores were then weighted to account for disproportionate sampling, nonresponse, and differential energy savings.

Spillover was evaluated at the participant level. A spillover rate was calculated for each participant surveyed by dividing spillover savings attributable to the program by the participant's total program gross energy savings. Individual scores were then weighted to account for disproportionate sampling, nonresponse, and differential program energy savings.

The net-to-gross research shows that the program has influenced the majority of program gross savings. Generally, net-to-gross ratios were strong with the overall program free-ridership at 24.8 percent, spillover at 12.7 percent, and a net-to-gross ratio of 87.9 percent. The Online Audits and Outreach component had a free-ridership rate of 24.9 percent and a spillover rate of 12.9 percent, resulting in a net-to-gross ratio of 88.0 percent. The Walk-Through Audit component had an overall free-ridership rate of 34.9 percent and a spillover rate of 8.0 percent, resulting in a net-to-gross ratio of 73.2 percent. Lastly, the Whole-House Comprehensive component had a free-ridership rate of 17.3 percent and a spillover rate of 2.4 percent, translating into a net-to-gross ratio of 85.1 percent.

Comparing the net-to-gross results across the program components, the Whole-House Comprehensive component had the lowest levels of free-ridership and spillover. Given the higher cost of a comprehensive audit, the additional technical assistance and information provided, and holistic focus of the program along with the added incentives for building shell and weatherization improvements, this is expected.

Based on this net-to-gross research, the evaluation team did not recommend program design changes.

[32] Based on 242 completed surveys at the measure category level; participants were surveyed for up to two measure categories.

3.4 Process Evaluation

Evaluation Methodology

The process evaluation effort consisted of participant surveys conducted in conjunction with net-to-gross research surveys and in-depth interviews with participating auditors. Key researchable issues were identified based on the evaluator's experience assessing other residential home energy audits and outreach programs and through interviews with program staff. These issues included:

Participants

- **Program marketing.** Participants were asked how they heard about the program and preferred methods for receiving information from Met-Ed about energy efficiency.
- **Participant satisfaction.** Participants were asked a number of satisfaction questions with regards to equipment received, interactions with program staff, rebate amounts and application process, and with the program overall.
- **Funneling to other Met-Ed programs.** Participants were asked about their awareness of and participation in other Met-Ed energy efficiency programs, along with the influence their participation in the Home Energy Audit and Outreach program had on their participation in other Met-Ed programs.

Contractors

- **Program partner collaboration**. Contractors were asked about the effectiveness of collaboration between all parties (I.e., FirstEnergy, PSD, and BPI contractors).
- **Level of program involvement**. The level of contractor involvement, or participation in the program, was assessed and questions asked to determine reasons for less active involvement by some and what could be done to increase involvement in the program. Additionally, contractors were asked about the benefits they received for participating in the program.
- **Program support for contractors.** Contractors were asked if the level of support and training was sufficient and about the usability of the Green Energy Compass software tool (program implementer software tool used to track project status, model household energy usage, document low-cost measures installed and recommendations contractors make to customer, and analyze the energy-savings resulting from test-out performance measures).
- **Compensation/incentive structure and influence.** Contractors were asked about compensation structure for low-cost measures, rebate levels, and the impact the program had on customers' decisions to install energy-saving measures from their perspectives.
- **Program participation barriers**. Questions were asked to assess the types of program barriers and to solicit ideas to address these barriers along with opportunities for improvement with the program from the contractors' perspectives.

The sampling frame for the participant survey was the population of Program Year 3 program participants. The evaluation team removed accounts previously contacted by ADM for Program Year 3 evaluation activities from the eligible survey sample frame to avoid double-contacting individual participants for multiple evaluation activities. A census was used for the Walk-through Audit and Comprehensive Audit components.

We spoke with a variety of BPI contractors, including some that specialized in conducting home energy audits, as well as some who do performance contracting in addition to energy audits. Contractors interviewed served a variety of FirstEnergy Pennsylvania utility service territories, with several contractors operating in multiple territories. Six of the 11 contractors we spoke with had Met-Ed customers.

Key Findings – Participant Phone Surveys

- Participant satisfaction was high and over half of all participants surveyed have recommended the program to others.
- The $50 co-pay for the Walk-Through Audit program and the time it took to receive rebates for the Whole-House Comprehensive program received the lowest satisfaction ratings.
- Survey results suggest that the Home Energy Audits and Outreach program has had limited success in Program Year 3 *funneling* customers to other FirstEnergy programs. However, when asked what *influence* their participation in the Home Energy Audits and Outreach Program had on their participating in other FirstEnergy programs, respondents gave an average influence rating of 8.3 out of 10, with zero being “no influence” and 10 being “total influence”.
- Direct mail marketing efforts were most effective at generating awareness and interest in the program in Program Year 3 and participants generally prefer to receive information about Met-Ed’s energy efficiency programs via direct mail and/or email. Relatively few participants reported learning about the program via mass media such as radio, newspaper, or television.
- Evidence from Online Audit participants supports feedback from participating Whole-House Comprehensive contractors that lack of awareness, lack of knowledge of the benefits provided by comprehensive audits, and first cost are primary barriers to participation in the Whole-House Comprehensive program.
- Evidence from the participant survey suggests the Walk-Through Audit program has been effective in reaching electric water heating homes, which provide more opportunities for capturing energy savings through hot-water-saving low-cost measures.
- Survey results reveal potential opportunities for more targeted marketing, especially for the Whole-House Comprehensive program, to reach customers that could gain the most from program participation (i.e. electric heating customers).

Key Findings – Contractor Interviews

- The program has been effective at engaging auditors and contractors through a variety of different avenues including FirstEnergy staff, Honeywell staff, PSD staff, FirstEnergy marketing materials, and information found online.

- Most participating contractors became involved with the program to help expand their business and there is evidence that the emergence of programs like the Whole-House Comprehensive program have increased the number of BPI home auditors.
- Less active contractors we spoke with pointed to an inability to generate program leads as the main reason they have not completed more audits through the program.
- Contractors unanimously report very positive interactions with PSD staff.
- Contractors agreed that the program has provided them with sufficient training and support to successfully complete projects through the program.
- Feedback suggests that many of the challenges initially faced by contractors in working with the Green Energy Compass software have improved; however, several contractors mentioned difficulties calibrating the Surveyor model with actual energy usage, especially for duel fuel homes.
- Some contractors (typically smaller businesses) are dissatisfied with the requirement to purchase, in advance, the measures installed during test-in audits. They are hesitant to carry the inventory for the limited number of sites they audit as they are concerned the inventory may not be used.
- Contractors generally agreed that the program's current rebate levels are adequate for all-electric customers, but had more mixed feedback on whether they are sufficient to encourage widespread participation among customers with non-electric appliances.
- The most frequently mentioned barriers to customer participation were a lack of awareness of the program, a lack of knowledge of the benefits provided by comprehensive audits, and the first cost.
- A few contractors noted lengthy turnaround times for customer test-in rebates and compensation for low-cost measures while two indicated processing times have become shorter. Two interviewees also reported that it has taken too long to receive their compensation rebates for low-cost measures installed during test-in audits.
- Feedback from participating contractors suggests high levels of program attribution. Respondents generally thought that most customers would not have installed the same low-cost measures had they not recommended it to the customer or it was not offered for free by the program.

Table 3-5: Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Residential Home Energy Audits and Outreach	
Provide more formalized training to walk-through auditors to promote a more standardized audit approach.	Implemented
Provide walk-through auditors with Met-Ed marketing materials and rebate applications to provide to customers along with training on appropriate marketing opportunities.	Implemented
Target customers who have not already completed the online Home Energy Analyzer and who were not already mailed an energy conservation kit to maximize the effectiveness of low-cost measures.	Implemented
Consider cost-effective strategies to offset a portion of the $50 co-pay for the Walk-Through Audit program to encourage participation in the program.	Implemented
Track specific recommendations made to customers of other Met-Ed rebate programs. Also consider following-up directly by telephone or via web survey with walk-through audit participants to see if they have moved forward with any of the auditors recommendations, and if so, whether or not they pursued a Met-Ed rebate.	Being considered
Based on auditors' feedback of the Home Energy Analyzer tool, evaluate the usefulness of completing the Home Energy Analyzer for walk-through audit participants, or explore the feasibility of an offline version of the tool.	Implemented
Continue to work to bridge geographical separation and to strengthen internal communication between auditors and other program implementation staff.	Implemented
Provide additional guidance to walk-through auditors on where to install LED night lights in order to realize the estimated savings from these measures.	Implemented
Continue to inform participants about other Met-Ed Utility programs and educate customers on how to take advantage of program incentives. Emphasize return-on-investment and payback information for energy efficiency improvements and the role that Met-Ed Utility program incentives can play in overcoming first-cost barriers.	Implemented
Continue direct marketing efforts such as utility bill inserts, direct mailings, and email blasts.	Implemented
To support future evaluation efforts, supplement utility customer contact information with contact information collected in the process of scheduling/conducting walk-through audits.	Rejected; will address contact data needs as appropriate for future evaluation efforts
Consider providing walk-through auditor staff with portable appliance electricity monitoring devices.	Rejected due to risk of property damage
Conduct additional research to assess the extent of free-ridership and spillover.	Implemented

3.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in Table 3-6.

Table 3-6: Summary of Home Energy Audit and Outreach Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$528	$4,662	$10,832
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$528**	**$4,662**	**$10,832**
Design & Development	-$9	$4	$29
Administration[1]	$1	-$475	$953
Management[2]	$56	$183	$535
Marketing[3]	$22	$233	$428
Technical Assistance	$20	$35	$86
Subtotal EDC Implementation Costs	**$89**	**-$21**	**$2,030**
EDC Evaluation Costs	$60	$125	$287
SWE Audit Costs	$17	$41	$183
Total EDC Costs[4]	$695	$4,807	$13,332
Participant Costs[5]		$5,155	$11,654
Total TRC Costs[6]		**$5,258**	**$13,972**
Total Lifetime Energy Benefits	$0	$19,645	$48,277
Total Lifetime Capacity Benefits	$0	$899	$2,005
Total TRC Benefits[7]	**N/A**	**$20,544**	**$50,282**
TRC Ratio[8]	**N/A**	**3.91**	**3.60**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

4 Residential Appliance Turn-In 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) per household per calendar year. All units must be working and meet established size requirements.

4.1 Program Updates

No changes to this program during PY4.

4.2 Impact Evaluation Gross Savings

The M&V values for this program are based on the energy savings resulting from a customer taking a working refrigerator, freezer or RAC out of service. The savings from refrigerator recycling are stipulated in the TRM, and the protocol for computing savings from RAC recycling are stipulated in an interim TRM protocol. While RAC energy savings are dependent on location and are mapped using the participant's zip code, RAC demand savings are not location dependent. In PY4, the deemed energy impacts for refrigerators and freezers are as follows:

Measure Description	Unit Annual Energy Savings	Unit Annual Demand Reduction
Refrigerator/Freezer Recycling without replacement	1659 kWh	0.2057 kW
Refrigerator/Freezer Recycling with replacement with Energy Star	1205 kWh	0.1494 kW
Refrigerator/Freezer Recycling with replacement with non Energy Star[33]	1091 kWh	0.1350 kW
RAC	Varies by Zip Code	0.6395 kW

Verifying the savings from this program requires telephone verification, with the final sample encompassing a range of participants entering the program at various times throughout the year. The verification survey was designed to identify whether a refrigerator or freezer was recycled without replacement or if it was replaced with a standard or Energy Star unit. The survey also verifies that the room AC, refrigerator, or freezer was operational at the time of retirement. A final step is necessary to avoid double-counting of savings in the case that a refrigerator is replaced with an Energy Star unit and rebated under the Efficient Products program. ADM conducted a database lookup to identify customers

[33] This entry is from the 2012 TRM.

that recycled a refrigerator or freezer, and also received rebates for EnergyStar refrigerators or freezers during the same program year. The savings associated with the EnergyStar refrigerators or freezers were then subtracted from the gross verified savings for the program.

For refrigerators and freezers, the reported savings were calculated only for the "recycling without replacement" scenario. The gross verified impacts were calculated according to the process discussed above, which results in lower savings for refrigerators and freezers that are recycled with replacement. The realization rate for the program is attributable almost entirely to this difference.

4.2.1 Program Sampling

The sampling approach for this program is a simple random sample. Sample sizes target 90% confidence level and 10% precision.

Table 4-1 CPITD Reported Results by Quarter[34]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	1,551	2,838	0.41	0.22	0.14	0.14	0.14	87
PY4 Q2	1,282	2,354	0.37	0.00	0.00	0.00	0.00	71
PY4 Q3	1,085	1,996	0.30	0.00	0.00	0.00	0.00	58
PY4 Q4	1,218	2,249	0.33	0.00	0.00	0.00	0.00	74
PY4 Total	5,135	9,437	1.42	0.22	0.14	0.14	0.14	290
CPITD Total	22,976	41,273	7.45	7.24	6.35	6.35	6.35	1,217

[34] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 4-2: Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Refrigerators/Freezers	n/a	5611	0.5	15%	23	64	Verification Survey
				5%	census	census	Cross check to EE Products
Room ACs	n/a	453	0.5	20%	5	2	Verification Survey
				5%	census	census	Calculation Review
Program Total		6,064		15%	28	66	

Table 4-3: PY4 Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings	Unverified Gross Energy Savings
Refrigerators/Freezers	9,309	71%	CV<<0.5	9%	6,613	
Room ACs	128	50%	CV<<0.5	51%	64	
Program Total	9,437	71%		9%	6,677	

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program.

Table 4-4: PY4 Summary of Evaluation Results for Demand (Top 100 Hours)Stratum

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
Refrigerators /Freezers	1.15	71%	CV<<0.5	9%	0.82			
Room ACs	0.27	50%	CV<<0.5	51%	0.14			
Program Total	1.42	67%		11%	0.95	6.35	6.35	6.35

4.3 Impact Evaluation Net Savings

The evaluation team employed the self-report approach (SRA) to estimate free-ridership. The participant survey included a series of questions to quantitatively assess the program's influence on the installation of energy-saving measures received or rebated through the program. The effort was stratified by end-use, or measures, within the Appliance Turn-in program: refrigerators, freezers, and room air conditioners. A total of 201 surveys were completed at the measure level for a 5.6 percent relative precision with 90 percent confidence (for free-ridership assessment) at the program level.

Data was also collected to assess unlike spillover for this program; however, as the program design and implementation is not structured to induce additional non-program savings through energy education, spillover was not quantified for this program. Based on review of the survey data, any potential spillover effects would have been minimal; previous net-to-gross studies of appliance recycling programs have shown spillover attributed to this program to be around one to two percent.

The Met-Ed overall Appliance Turn-in free-ridership result was 38.5 percent for a net-to-gross of 61.5 percent. This is the weighted average based on kWh savings of the individual end-use measure free-ridership rates of 38.4 percent for refrigerators, 36.9 percent for freezers, and 52.6 percent for room air conditioners.

Based on this net-to-gross research, the evaluation team did not recommend program design changes.

4.4 Process Evaluation

Evaluation Methodology

The process evaluation effort consisted of participant surveys conducted with customers who participated in the program in Program Year 3. Key researchable issues were identified based on the evaluator's experience assessing other residential appliance recycling programs and through interviews with program staff. These issues included:

- **Program marketing.** Participants were asked how they heard about the program and preferred methods for receiving information from Met-Ed about energy efficiency.
- **Participant satisfaction.** Participants were asked a number of satisfaction questions in regards to equipment received, interactions with program staff, rebate amounts and application process, and with the program overall.
- **Condition of the turned-in equipment.** Participants were asked if the equipment turned in through the program was in working condition at the time of removal.
- **Disposal and replacement of equipment turned in through the program.** Participants were asked about what would have been done with the equipment if not for the program and if the equipment had been replaced.

A random sample was drawn at the customer level, ensuring the measure mix for each replicate is similar to that of the overall sample frame. During the analysis phase, weight ratios were applied to the data so that the analyses are reflective of the population.

Key Findings

- Bill inserts were the most effective marketing tool in generating awareness of and interest in the program.
- Met-Ed customers are willing to participate in the program with a lower incentive amount, or no incentive at all. This finding suggests that the free pick-up and recycling of the appliance is more important than the incentive to many customers.
- In the absence of the program, most surveyed participants would still have disposed of their appliance.
- A small portion of the recycled appliances were not operational at the time of program participation.
- Recycled appliances were often replaced with ENERGY STAR® rated appliances and removed from older homes.

Table 4-5: Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Residential Appliance Turn-in Program	
Consider adopting enhanced cross-marketing strategies.	Being considered in Phase II.
Emphasize environmental issues and convenience factors in program marketing materials.	Implemented.
Consider lowering incentives for recycled appliances.	Rejected - program results indicate that the higher rebate level was required to support participation goals.
Continue to target recycling primary appliances, as well as secondary appliances that will not be replaced.	Implemented.

4.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in Table 4-6.

Table 4-6: Summary of Residential Appliance Turn-In Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$74	$290	$1,217
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$74**	**$290**	**$1,217**
Design & Development	-$3	$1	$9
Administration[1]	$54	$522	$2,634
Management[2]	$14	$44	$143
Marketing[3]	$1	$6	$23
Technical Assistance	$6	$11	$26
Subtotal EDC Implementation Costs	**$72**	**$584**	**$2,834**
EDC Evaluation Costs	$71	$95	$178
SWE Audit Costs	$5	$12	$56
Total EDC Costs[4]	$223	$982	$4,285
Participant Costs[5]	$0	$290	$1,217
Total TRC Costs[6]		**$970**	**$4,230**
Total Lifetime Energy Benefits	$0	$4,180	$22,681
Total Lifetime Capacity Benefits	$0	$462	$3,100
Total TRC Benefits[7]	**N/A**	**$4,642**	**$25,781**
TRC Ratio[8]	**N/A**	**4.79**	**6.10**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

5 Residential Energy Efficient HVAC Program

This program provides incentives supporting implementation of contractor-installed HVAC or other eligible systems in existing or new residential buildings. The program promotes the sale of high-efficiency, ENERGY STAR® compliant equipment through installation contractors selling to residential customers who are replacing existing home HVAC equipment and provides incentives to customers who replace existing or standard HVAC equipment in residential applications with qualifying energy-efficient heating and cooling systems.

Additionally, the program also provides incentives for maintenance (tune-ups) of existing CAC or heat pump equipment and offers an additional incentive toward replacement of furnace fans meeting ENERGY STAR efficiency guidelines.

5.1 Program Updates

No changes to this program during PY4.

5.2 Impact Evaluation Gross Savings

Gross Impact Analysis

The evaluation effort is conducted using separate methodologies for rebated HVAC equipment such as heat pumps, CACs and solar water heaters, and for HVAC maintenance. Details of the methodologies are described in the subsections below. A calculation review is part of all methodologies ensuring that the energy savings and demand reductions for each measure are calculated according to the appropriate protocols in the PA TRM.

Gross Impact for CACs and Heat Pumps

Savings associated with these HVAC equipment types are estimated using a partially deemed approach, with the kWh reduction determined using deemed hours of operation of the equipment determined by which reference city the installed location is closest to and nameplate information from the equipment regarding unit capacities and efficiencies.

For all new HVAC systems, the baseline efficiencies are stipulated in the PA TRM and are in accordance with Federal codes and standards.

The 'nameplate' data (e.g. capacity, SEER, EER, COP, HSPF) that provides the basis for deemed savings calculation will be verified through a combination of three activities:

1. A review of the T&R system to identify claimed nameplate data,
2. Participant surveys to confirm measure installation or service completion, and to obtain customer-specific parameters needed by the TRM protocols.

3. A review of program application materials including contractor and retailer invoices, rebate applications, and AHRI certificates.

The first activity, reviewing the T&R system, consists of several elements. First the tracking data are checked for duplicate entries, program eligibility based on date, and proper use of PA TRM protocols for calculating savings. As with previous years, the reported savings values are computed using "average" capacity, efficiency, and equivalent full load hour assumptions rather than characteristics specific to each unit/application. In the context of this program, proper use of PA TRM protocols for calculating savings requires data fields listing the 'nameplate' data for each unit. These data, as well as the AHRI certificate number for new equipment applications, are captured and stored in the tracking system. However, these are not reported for the census of sites in the T&R database. As such, a sufficiently large sample of program applications was checked on a one-by-one basis in the online database to determine actual capacities and efficiencies. The AHRI database was then cross-checked to ensure that the capacities and efficiencies listed in the online database were accurate. The zip-code "lookup" in the 2012 TRM was used to identify the closest reference city and therefore the most appropriate deemed hours of operation.

Participant surveys were conducted to verify installation and operation of equipment and confirmation of HVAC maintenance services for a random sample of program participants. The surveys also collected additional parameters that are required by the PA TRM for ductless mini-split systems. For these systems, the TRM requires the location of installation within the house and the type of HVAC system that was replaced, if any.

The proper PA TRM protocols for savings calculations were then applied to this sample of program participants, and the results were compared with the claimed savings from the T&R system to develop a realization rate.

The third activity, reviewing program application materials, is performed in an effort to verify that program application materials, on-site data, AHRI database specifications, and information found in the online program database are all in agreement.

Final verified savings are a product of the "installation verification rate," and the per-unit savings adjusted for any discrepancies found through review of the online database, application materials, and survey data collection activities. The variance between claimed and verified savings comes as a result of using proper capacities, efficiencies, and deemed hours of operation rather than assumed averages.

Gross Impact for AC Tune Ups

The verification for AC tune-ups includes two components. First, it must be verified that a tune-up actually occurred as claimed in the T&R system.

This was accomplished by surveying program participants via telephone to confirm that they had received a tune-up during PY4. Program application materials, including invoices for services provided and a list of maintenance measures provided were also reviewed for a sample of tune-up participants.

Secondly, to properly utilize the PA TRM protocols for savings calculations, the capacities and efficiencies of the units being serviced needs to be known. The capacities of the units in question are inferred through the model numbers. This information is not always available, but most of the sampled application forms or invoices did include model numbers or capacities. The 2012 TRM recognizes impacts during the heating season for tune-ups performed on heat pumps. As such, the fraction of heat pumps is also determined from the sampled application packets. Proper deemed hours of operation were also determined using the zip-code "lookup" mentioned above.

The PA TRM deemed savings calculations were applied using the capacities, efficiencies, and deemed hours of operation as described above. The resulting savings estimates were then compared to the claimed savings values from the T&R system to develop a "preliminary desk review realization rate." Final verified savings are a product of this preliminary realization rate and the verification rate determined through the participant telephone interviews.

Evaluation Findings

The program's telephone surveys confirmed that 100% of sampled participants received an AC tune-up. Variances between the gross reported and gross verified savings, as shown in the tables below, were attributable to the application of PA TRM protocols to gross reported savings that were estimated based on 'typical' capacities, efficiencies, and heating, cooling hours.

5.2.1 Program Sampling

The two program components – new equipment rebates and AC tune-ups - are treated as separate programs, each with distinct populations, samples, and realization rates. A sample point in the context of this program is "a participating unit." For new equipment, this is equivalent to one CAC, ASHP, or GSHP, or single or multi-zone mini-split system. For the AC tune-up component, it is equivalent to "one serviced CAC or ASHP."

There are three sampling activities associated with this component of the program. The first is sampling from the T&R system to identify unit characteristics from the online program database, the second is sampling for application and invoice reviews, and the third is for telephone verification surveys. The confidence and precision for each stratum are based upon the combined sample sizes for telephone verification surveys, although the evaluation is also informed with specifics such as heating and cooling capacities as obtained from HVAC tune-up application materials.

The first sampling activity was to select new equipment participants from the T&R system to identify relevant unit capacities and efficiencies from the online program database. The characteristics of these

sample points were also verified using the AHRI database. To ensure accuracy at the measure level (i.e., CACs, ASHPs and GSHPs), each measure was treated as a separate population, from which a simple random sample was drawn. The sample size was then determined such that the results would exceed ±10% relative precision at the 90% confidence level at the measure level. Because ADM has amassed a large number of AHRI rating information over the last four evaluation cycles, over 1,000 of the 2,491 rebated HVAC units were matched to corresponding data from the AHRI database.

The invoice and application review focused on the Tune-ups because TRM algorithm inputs such as unit capacity and type (heat pump or CAC) are only available through a review of application materials and invoices. The target sample size for this activity was 40 units.

A stratified random sampling approach was used for participant surveys, with a goal of achieving 40 sample points for tune-ups, 25 sample points for ductless mini-splits, and 10 more sample points randomly selected from other measures.

Table 5-1: CPITD Reported Results by Quarter[35]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	1,297	816	0.37	0.72	0.59	0.59	0.59	205
PY4 Q2	1,159	669	0.34	0.00	0.00	0.00	0.00	148
PY4 Q3	653	819	0.18	0.00	0.00	0.00	0.00	202
PY4 Q4	2,425	2,366	0.68	0.00	0.00	0.00	0.00	539
PY4 Total	5,534	4,671	1.58	0.72	0.59	0.59	0.59	1,093
CPITD Total	17,201	14,619	4.89	4.59	4.93	4.93	4.93	3,492

[35] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 5-2: Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
HVAC Equipment	Qualitative Strata: GSHP, ASHP, CAC	2,170	2.0	15%	369	762	AHRI Lookups, TRM calculation review
HVAC Equipment	All		0.5	25%	8	10	Inspection of Invoices
MiniSplit	n/a	321	0.5	20%	13	26	Verification Surveys, TRM calculations
HVAC Tune-Ups	n/a	3,031	0.5	15%	23	39	Inspection of Invoices
			0.5	15%	23	39	Telephone Verification Interviews
Solar Water Heaters	n/a	12	0.5	30%	6	12	TRM Calculation Review
Program Total		5,534		15%	442	888	

Table 5-3: PY4 Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings
HVAC Equipment	3,017	126%	1.51	8%	3,788
Mini-Splits	613	50%	0.68	19%	304
HVAC Tune-Ups	1,013	144%	0.16	4%	1,456
Solar Water Heaters	28	89%	0.5	30%	25
Program Total	**4,671**	**119%**		**6%**	**5,573**

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program.

Table 5-4: PY4 Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
HVAC Equipment	0.60	113%	1.51	8%	0.57			
Mini-Splits	0.10	257%	0.68	19%	0.11			
HVAC Tune-Ups	0.88	70%	0.68	4%	0.61			
Solar Water Heaters	0.01	79%	0.16	30%	0.00			
Program Total	**1.58**	**97%**	**0.50**	**4%**	**1.29**	**4.93**	**4.93**	**4.93**

5.3 Impact Evaluation Net Savings

The evaluation team employed the self-report approach (SRA) to estimate free-ridership and spillover effects. The participant survey included a series of questions to quantitatively assess the program's influence on the installation of energy-saving equipment received or rebated through the program. In addition, the participant survey included a series of questions to assess additional energy-saving actions taken by customers since participating in the program and the extent of the program's influence on these actions. The evaluation team completed 116 participant surveys at the measure level for a 7.4 percent relative precision with 90 percent confidence (for free-ridership assessment) for the program.

Free-ridership was evaluated at the equipment level (heat pump and central air conditioner[36]) for each participant surveyed. Individual scores were weighted to account for disproportionate sampling, nonresponse, and differential energy savings. The free-ridership estimation algorithm assessed the

[36] Solar water heaters were excluded from the research effort due to low participation in PY3. Tune-ups were excluded as experience shows that it is difficult to estimate net-to-gross of tune-up offerings based on customer self-report as this service is highly contractor driven and contractor interviews were not included in this effort.

program influence on timing, efficiency, and quantity purchased with adjustments to account for various channels through which the program may have influenced the participant: the influence of participation in other Met-Ed programs; the influence of the program rebate; and, the influence of the contractor.

"Unlike participant spillover" was evaluated at the customer level and was calculated for each surveyed participant by dividing spillover savings (savings attributable to the program) by the participant's total program gross energy savings. Individual scores were then weighted to account for disproportionate sampling, nonresponse, and differential program energy savings.

The Met-Ed program NTG research indicates estimates of 42.6 percent free-ridership and 0.3 percent spillover for a net-to-gross ratio of 57.7 percent. The free-ridership estimates for heat pumps and central air conditioners were 43.0 and 38.2 percent, respectively.

No recommendations for measure-level modifications were made based on this research.

5.4 Process Evaluation

Evaluation Methodology

Tetra Tech conducted interviews with program staff, participants, and contractors. Tetra Tech designed the program participant process evaluation survey to evaluate the general experiences with the program and to verify program impact indicators based on participant perceptions. Records were randomly sampled for each measure type from the Program Year 3 rebate population. Key researchable issues included:

- **Program marketing.** Participants were asked how they heard about the program and preferred methods for receiving information from Met-Ed about energy efficiency.
- **Participant satisfaction.** Participants were asked a number of satisfaction questions in regards to equipment received, interactions with program staff, rebate amounts and application process, and with the program overall.
- **Funneling to other FirstEnergy programs.** Participants were asked about their awareness of and participation in other Met-Ed energy efficiency programs, along with the influence their participation in the Residential HVAC program had on their participation in other Met-Ed programs.

Key Findings

- Contractors and retailers were the most effective marketing tool to generate awareness and interest in the program in Program Year 3.
- Participants report that contractors and retailers discuss ways to save energy and maintain high-efficiency equipment during their visit.
- Participant satisfaction is high with overall satisfaction rated at 9.2 (1 to 10 scale).

- Respondents report tuning up their equipment frequently, even those without annual maintenance contracts
- Survey results suggest that the HVAC program has funneled some customers to other FirstEnergy programs.
- Contractors report challenges to selling high efficiency equipment and the primary contributing factor stated is that the current group of rebates (i.e., from utilities, manufacturers, as well as the federal tax credit) does not sufficiently reduce the incremental costs of moving from a 13 SEER to a 14.5+ SEER central air conditioner or heat pump.

Table 5-5: Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Residential Energy Efficiency HVAC	
Watch participation trends for equipment installations, and consider modifications to program design elements in light of reduced Federal tax credits.	Being considered for Phase II.
Target tune-up participants who do not have pre-existing maintenance contracts in order to maximize program savings, or offer an enhanced tune-up not currently offered as standard practice.	Rejected due to practical challenges of data availability.
Market the program through an aggressive multi-tiered approach: contractor marketing, cross-marketing between programs, program leave-behind materials, etc.	Implemented.
Refine the application process to ensure it is both streamlined and user-friendly and consider online applications.	Implemented as appropriate. Online applications are not available.

5.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in Table 5-6.

Table 5-6: Summary of Residential Energy Efficient HVAC Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$539	$1,093	$3,492
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$539**	**$1,093**	**$3,492**
Design & Development	-$4	$2	$15
Administration[1]	-$10	$191	$1,150
Management[2]	$32	$110	$306
Marketing[3]	$1	$21	$161
Technical Assistance	$10	$18	$43
Subtotal EDC Implementation Costs	**$29**	**$342**	**$1,674**
EDC Evaluation Costs	$37	$69	$150
SWE Audit Costs	$9	$21	$93
Total EDC Costs[4]	$613	$1,524	$5,409
Participant Costs[5]	$0	$3,878	$11,232
Total TRC Costs[6]		**$4,289**	**$13,056**
Total Lifetime Energy Benefits	$0	$4,622	$15,311
Total Lifetime Capacity Benefits	$0	$802	$3,246
Total TRC Benefits[7]	**N/A**	**$5,424**	**$18,557**
TRC Ratio[8]	**N/A**	**1.26**	**1.42**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

6 Residential Energy Efficient Products Program

This program provides financial incentives to customers and support to retailers that sell energy-efficient products such as ENERGY STAR® qualified appliances or CFLs. The program includes promotional support, point-of-sale materials, training, promotional events and "up-stream product buy-down" rebates to retailers, distributors or manufacturers for select appliances. The program also includes existing catalog sales channel, and support for community-based initiatives, or other distribution channels that can reliably document effective distribution of energy-efficient products.

6.1 Program Updates

There were no changes to this program during PY4.

6.2 Impact Evaluation Gross Savings

Gross Impact Analysis

The evaluation effort is conducted using separate methodologies for CFLs and for other appliances, with the details of the methodologies described in the subsections below.

Gross Impact for CFLs

Savings associated with the CFL component are estimated using a deemed approach, with the energy savings and demand reductions taken as deemed in accordance with the TRM.

As with previous years, there were two separate activities within the CFL component of this program in PY4: upstream discounts and giveaway events. The impact evaluation for both activities within the CFL program component includes the following verification elements:

- Review of shipment invoices, including types and quantities of CFLs distributed to participating retailers. These shipment invoices are matched to the T&R system to confirm proper counts and bulbs types claimed.
- Review of the T&R system to assure there are no duplicate entries and that all bulbs were eligible for being counted in PY4 based on invoice dates.
- Review of CSP energy savings and demand reduction calculations.
    - A review of the assumptions regarding the wattages of the baseline incandescent bulbs presumed to be supplanted by CFLs is particularly important.

Gross Impact for Appliances

Gross kWh savings for appliances sold through the Residential Energy Efficient Products program are estimated using a deemed approach for measures included in the statewide TRM.

The impact evaluation for the appliance program component will include the following components:

- Verification of proper installation through on-site visits; and
- Review of CSP energy savings and demand reduction calculations
    - Calculations are reviewed to ensure that they are done according to the PA TRM or PA Interim TRM.
    - For three particular measures – room air conditioners, dehumidifiers, and clothes washers – the PA TRM requires a partially deemed approach. That is, certain characteristics of the appliance or the household in which the appliance is used affect the calculations.

For measures with partially deemed TRM protocols, the T&R system calculated impacts with one savings scenario rather than with specific scenarios that occur in measure implementation. For example, the energy savings and demand calculations for room air conditioners used Harrisburg as the reference city in all cases. This was corrected by using a zip-code "lookup" to identify the closest reference city to the household in which the unit was used for each case. Additionally, the savings for dehumidifiers assumed that all of the rebated units had a capacity between 25 and 35 pint per day. This resulted in an understatement of energy savings attributable to dehumidifiers, as many of the units had capacities greater than that range (and accordingly greater deemed savings). While the T&R system for the program did not have a data field listing the capacities of each dehumidifier rebated, these parameters *are* captured and recorded in the CSP tracking database, though in a format that precludes determination of these parameters for the census of the population. Accordingly, ADM sampled a sufficiently large number of rebated dehumidifiers to check the distribution of capacities. Deemed energy savings and demand reductions from the PA TRM were applied to this sample of dehumidifiers and compared to the claimed savings in the T&R system. The resulting realization rate was applied to the population of dehumidifiers rebated through the program. Finally, the T&R system energy savings calculations for clothes washers assumed that all units were operating in households with electric water heating. However, survey data collection activities revealed that this was not necessarily the case. For the sample of clothes washers verified by participant surveys, information regarding the households' water heating fuel source was documented and used to properly assign energy savings according to the PA TRM. These energy savings were compared to the T&R system's claims and used to develop a realization rate that was applied to the population of clothes washers rebated through the program.

The preceding discussion illustrates the fact that the majority of the variance between claimed savings and verified savings was the result of adjustments to reflect actual vs. "typical" savings values, or baseline adjustments to reported savings, which were corrected during the "desk review" phase of verification. The only exception, which was revealed with participant surveys was the presence of non-electric water heating and its effect on verified savings for clothes washers.

Determination of Cross Sector Sales

Surveys were utilized to establish "cross-sector sales" whereby CFLs purchased in stores with support of the Residential program were installed in non-residential businesses, and conversely, CFL kits distributed to small Commercial & Industrial customers were installed in residential applications. In previous program years, ADM decremented both energy savings and demand reduction impacts for CFLs that are distributed for use in the non-residential sector but were installed in residential settings. In PY4, ADM administered broad, "random digit dial" telephone surveys to assess the cross-over from residential to non-residential. A total of 827 complete responses were collected from respondents who reported to have purchased CFLs at retailers that participate in the Company's upstream buy-down programs. Out of a total 11,745 CFLs reported to have been purchased, 579 were reported to be installed in non-residential settings. Based on this, the evaluation utilizes a conservative crossover rate from residential to non-residential use of 4.9%. The PA TRM protocols are used to evaluate impacts for CFLs that migrate to the non-residential sector. The calculation inputs are summarized in the table below.

Table 6-1. Parameters used for crossover CFL demand impact calculations.

Building Type	Percent of Reported "Crossover" CFLs	CF	Likelihood that it's in a cooled space1	Cooling Interactive Factor	Effective Cooling Interactive Factor
Hospitals	17%	0.84	90%	34%	30.6%
Industrial Manufacturing	2%	0.77	90%	34%	30.6%
Lodging – Guest Rooms	7%	0.84	80%	34%	27.2%
Light Manufacturing	4%	0.77	90%	34%	30.6%
Manufacturing – Light Industrial	1%	0.63	90%	34%	30.6%
Nursing Home	9%	0.77	90%	34%	30.6%
Restaurant – Sit-Down	2%	0.77	90%	34%	30.6%
Retail – Large	1%	0.88	90%	34%	30.6%
Other	56%	0.33[2]	60%	34%	20.4%
Weighted Average		0.54	79%	25%	27%

1. These likelihoods are estimations based on EM&V experience from Phase I

2. The coincidence factor for facility types listed as "other" is taken from metering conducted by ADM to evaluate the CF of CFLs distribute to small commercial customers in PY3.

Cross sector sales have the effect of increasing demand reductions for the Small Commercial and Industrial Efficient Equipment program, and lowering the demand reductions as reported for the Efficient Products program (by 4.9% to account for CFLs are not installed in the residential sector). Consistent with these results, the Company has moved funds between Sectors and Programs to account for these findings. Although additional energy savings are also expected from CFL crossover, Met-Ed is taking a conservative approach and not reporting any adjustments to energy savings for either program at this time.

Peak Demand Coincidence Factor and Cooling Interactive Factor

As discussed in Section 1.1 and Appendix A, the 2012 PA TRM protocols for the non-residential sector recognize additional demand reductions associated with space cooling that result for lighting wattage reductions within conditioned space. The cooling interactive factor for demand is 34%, which means that for every 1 Watt of coincident peak reductions from lighting within conditioned space, an additional 0.34 Watt savings results from avoided air conditioner usage. The proposed 2014 TRM protocols recognize this basic fact for CFLs installed in cooled space in the residential sector as well. As discussed in detail in Appendix A, Met-Ed is:

1. including a cooling interactive factor to demand reductions from residential CFLs to more accurately depict the demand reductions for residential CFLs; and,

2. including an adjustment to the calculation of CFL coincidence factor based on the metering study that is also the source for the CFL hours of use in the 2013 TRM and proposed 2014 TRM.

The incremental impacts from these two considerations are included in the demand reduction tables in Section 1 as "Evaluated Top 100 MW Achieved". Please refer to Appendix A for further details on these two protocol adjustments.

6.2.1 Program Sampling

For the upstream and giveaway CFL program component, a sample of shipment invoices along with the calculations in the T&R system were reviewed to ensure that the energy savings and demand reductions are claimed according to the protocols in the PA TRM. Minor discrepancies were found regarding baseline wattage assumptions and there were some rounding errors but overall there was very little variance between claimed and verified savings for all lamps except in cases where the baseline lamp wattage has been updated from 100W to 72W in the 2012 TRM.

The sampling approach for the appliance rebate program component is stratified random sampling with the stratification defined such that measures with common reasons for realization rates (e.g. lack of electric water heater or dryer for clothes washers) are grouped together. A sample point in the context of the appliance rebate component of this program is defined as "one appliance." A large sample (census when possible) of the energy and demand savings calculations in the program tracking data are reviewed to ensure that the energy savings and demand reductions are claimed according to the protocols in the PA TRM, as described in the previous section.

Two sampling activities were required for the appliance component of the program:

1. A sample of rebated dehumidifiers from the T&R system was examined in the online program database to identify each unit's capacity in pints per day. This was a simple random sample that achieved ±4% precision at the 90% confidence level.
2. The sample size for survey verifications is sufficient to determine gross impact with ±15% relative precision at the 85% confidence level. The sampling technique for verification was stratified random

sampling with clothes washers comprising one stratum, and all other appliances composing a separate stratum. This stratification was chosen because of the variance in savings for clothes washers with electric and non-electric water heating sources.

Table 6-2. CPITD Reported Results by Quarter[37]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	47,174	8,009	0.50	0.54	0.42	0.64	0.99	285
PY4 Q2	61,875	9,895	0.58	0.00	0.00	0.00	0.00	386
PY4 Q3	92,362	15,605	0.87	0.00	0.00	0.00	0.00	570
PY4 Q4	92,456	15,507	0.95	0.00	0.00	0.00	0.00	619
PY4 Total	293,867	49,016	2.89	0.54	0.42	0.64	0.99	1,859
CPITD Total	756,539	126,566	7.48	5.88	5.36	8.48	13.57	5,442

Table 6-3: Sampling Strategy for PY4

Stratum	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Achieved Sample Size	Evaluation Activity
Upstream Lighting	258,570	0.25	10%	Census on TRM calculations + 7 invoices for verification	Calculation Review, Invoice check
CFL Giveaway	17,128	0.25	15%	Census on TRM calculations	Calculation Review, Invoice check
Clothes Washers	3,766	0.5	15%	40	Verification Survey
Dehumidifiers	1,357	0.5	15%	561 calculation reviews, 10 verification surveys	TRM Calculation Review
LED Holiday Lights	10,131	0.5	15%	census	TRM calculation review
All Other	11,054	0.5	15%	34	Verification Survey
Program Total	302,006		10%	84	

[37] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 6-4: PY4 Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings	Unverified Gross Energy Savings
Upstream Lighting	41,764	89%	CV <0.25	10%	37,313	
CFL Giveaway	3,314	96%	CV <0.25	20%	3,177	
Clothes Washers	972	53%	CV <<0.5	20%	512	
Dehumidifiers	160	169%	CV <<0.5	20%	270	
LED Holiday Lights	108	100%	CV <<0.5	20%	108	
All Other	2,697	84%	CV <<0.5	20%	2,269	
Program Total	49,016	89%		9%	43,649	

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program. Please note, as discussed in Section 1 and Appendix A of this Report, the CPITD Top 100 demand reduction values in this table are shown using values that represent: 1) calculations published in the 2012 Pennsylvania TRM ("TRM"); 2) calculations that include a correction to the Residential CFL coincidence factor ("TRM Corrected"); and, 3) calculations that incorporate alternative measurement approaches from the 2012 TRM to more accurately assess the peak load impacts from residential lighting during the Company's Top 100 Hours ("Evaluated").

Table 6-5: PY4 Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
Upstream Lighting	2.17	138%	CV <<0.5	10%	1.70			
CFL Giveaway	0.17	149%	CV <<0.5	20%	0.15			
Clothes Washers	0.06	98%	CV <<0.5	20%	0.06			
Dehumidifiers	0.02	67%	CV <<0.5	20%	0.01			
LED Holiday Lights	0.00	n/a	n/a	20%	0.00			
All Other	0.48	69%	CV <<0.5	20%	0.33			
Program Total	2.89	126%		10.8%	2.25	5.36	8.48	13.57

6.3 Impact Evaluation Net Savings

The evaluation team employed the self-report approach (SRA) to estimate free-ridership and spillover effects. The participant survey included a series of questions to quantitatively assess the program's influence on the installation of energy-saving measures received or rebated through the program. In addition, the participant survey included a series of questions to assess additional energy-saving actions taken by customers since participating in the program and the extent of the program's influence on these actions.

The participant population file was sampled by measure category with the sample strategy focused on measures with the greatest contribution to the program savings and, therefore, excluded those measures with lower relative participation and/or contribution to the program in terms of total savings (water heaters, room air conditioners, smart strips, and torchieres) with the exception of LED holiday lights as these were a measure of interest. The evaluation team completed 131 surveys at the measure level for a 7.1 percent relative precision with 90 percent confidence (for free-ridership assessment). Data were weighted during analysis to represent the population of interest (customers).

Free-ridership was evaluated at the measure category level for each participant surveyed. A free-ridership algorithm assessed the program influence on timing, efficiency, and quantity purchased and the rate was calculated for each measure category for each participant. Individual scores were then weighted to account for disproportionate sampling, nonresponse, and differential energy savings.

"Unlike spillover" was evaluated at the customer level, and is expressed as a percentage of program gross energy savings. A spillover rate was calculated for each surveyed participant by dividing spillover savings (savings attributable to the program) by the participant's total program gross energy savings. Individual scores were then weighted to account for disproportionate sampling, nonresponse, and differential program energy savings.

The Met-Ed program NTG research indicates estimates of 56.5 percent free-ridership and 7.0 percent spillover for a net-to-gross ratio of 50.5 percent. Individual measure free-ridership estimates were: 57.4 for washers; 56.8 for refrigerators/freezers; 60.5 for dehumidifiers; and 33.8 percent for LED lighting.[38]

The evaluation team does not recommend program design changes.

6.4 Process Evaluation

Evaluation Methodology

[38] Caution for small sample size for dehumidifiers (n=18) and LED lighting (n=21).

The process evaluation effort consisted of participant surveys in conjunction with the net-to-gross research effort. Key researchable issues were identified based on the evaluator's experience assessing other efficient products programs and through interviews with program staff. These issues included:

- **Program marketing.** Participants were asked how they heard about the program and preferred methods for receiving information from Met-Ed about energy efficiency.
- **Participant satisfaction.** Participants were asked a number of satisfaction questions in regards to equipment received, interactions with program staff, rebate amounts and application process, and with the program overall.

Key Findings

- Retailers were the most effective marketing tool to generate awareness and interest in the program in Program Year 4 and many retailers are discussing ways to save energy and maintain high-efficiency equipment with program participants.
- Participant satisfaction is high with an average overall rating of 9.1
- Survey results suggest that the Energy Efficient Products program has funneled some customers to other Met-Ed programs and the overall rating of the influence of the Energy Efficient Products program in their participation in other Met-Ed programs was 6.0 out of 10.0 with 52 percent at seven or higher, indicating that the Energy Efficient Products program has influenced participation in other Met-Ed programs.

Table 6-6: Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Residential Energy Efficient Products	
There were no recommendations based on this research.	

6.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in Table 6-7.

Table 6-7: Summary of Residential Energy Efficient Products Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$619	$1,859	$5,442
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$619**	**$1,859**	**$5,442**
Design & Development	-$7	$3	$24
Administration[1]	$239	$2,851	$5,187
Management[2]	$69	$149	$429
Marketing[3]	$0	$93	$430
Technical Assistance	$16	$28	$70
Subtotal EDC Implementation Costs	**$317**	**$3,125**	**$6,140**
EDC Evaluation Costs	$160	$211	$319
SWE Audit Costs	$14	$33	$149
Total EDC Costs[4]	$1,111	$5,228	$12,049
Participant Costs[5]	$0	$4,921	$13,122
Total TRC Costs[6]		**$8,257**	**$19,581**
Total Lifetime Energy Benefits	$0	$22,776	$66,429
Total Lifetime Capacity Benefits	$0	$1,040	$3,123
Total TRC Benefits[7]	**N/A**	**$23,816**	**$69,551**
TRC Ratio[8]	**N/A**	**2.88**	**3.55**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

7 Residential Energy Efficient New Construction Program

This program provides incentives to builders for achieving ENERGY STAR® Homes status, or the Home Energy Rating System program (HERS) associated with a highly energy-efficient home. The program supports implementation of contractor-installed HVAC, solar, or other eligible systems in existing or new residential buildings, as well as measures addressing building shell, appliances and other energy consuming features. This program involves promoting the sale of high-efficiency, ENERGY STAR compliant equipment through local builders. Participants can receive a rebate based on calculation of the energy savings related to the home's construction over standard practice.

7.1 Program Updates

There were no changes to this program during PY4.

7.2 Impact Evaluation Gross Savings

This program contributes less than 0.25% of the portfolio level savings for PY4. The PY4 evaluation approach is similar to that employed in PY3, but did not include any on-site visits.

For the PY4 evaluation, ADM focused on conducting engineering reviews of a sample of projects. The engineering review involved inspection of the REM/Rate models associated with the rebated buildings. For each sampled home, ADM analysts ran the REM/Rate input files and made the following considerations:

1. Are the baseline specifications in accordance to those in the 2012 PA TRM?
2. Are the claimed impacts attributable to improved construction practices and premium efficiency HVAC systems and appliances, or do they result from modifications that are not supportable by the PA TRM[39]
3. Is the REM/Rate modeling performed correctly and does it provide accurate results[40]?
4. Are the participating HERS raters accurately describing the homes in the REM/Rate models and HERS ratings?

If any irregularities or inconsistencies were discovered in the above checks, ADM recalculated the energy savings and determined the realization rate for the particular sampled project.

[39] For example, it would not be appropriate to claim energy savings based on differences in the 'reference' and 'as built' models' thermostat settings, or by virtue of using different heating or cooling degree days in the two models.

[40] There can be relatively minor variations in savings because the HERS raters may have different versions of REM/Rate. ADM used version 12.98 to conduct the simulation model reviews.

Evaluation Findings

The engineering review validated that most of the reference homes were modeled in accordance with the PA 2012 TRM requirements. In PY3, there were some rare cases where the REM/Rate models miscalculated the energy usage of ground source heat pumps. No such cases were discovered in PY4. As with PY3, the HERS raters that participate in the program did not fully report counts of CFLs and Energy Star appliances installed in the homes. ADM conducted telephone surveys with program participants to estimate the impacts associated with these measures.

7.2.1 Program Sampling

The sampling approach for this program is stratified random sampling. The sample size is sufficient to determine this program's gross impact with ±15% relative precision at the 85% confidence level. The sample employs three strata due to the skewed distribution of energy savings. Homes with electric space heating and electric water heating tend to have much higher claimed savings than homes with gas heating. Homes with ground source heat pumps tend to have the highest claimed savings in the population. ADM sampled homes that been selected for quality control inspections by the program implementer. The quality control inspectors take detailed notes which describe any deviation between the as-built home and the home as described and simulated by the participating HERS rater. The inspectors also count the number of installed CFLs and Energy Star appliances so that extrinsic TRM calculations may be performed as required by the TRM. It is important to note that the implementer does not adjust the energy savings for homes that undergo the QC process. This facilitates ADM's evaluation effort because the gross reported numbers for these homes are unbiased with respect to the implementers QA/QC process.

Table 7-1: Residential Energy Efficient New Construction CPITD Reported Results by Quarter[41]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	51	140	0.03	0.00	0.00	0.00	0.00	44
PY4 Q2	59	98	0.01	0.00	0.00	0.00	0.00	31
PY4 Q3	72	128	0.02	0.00	0.00	0.00	0.00	50
PY4 Q4	61	115	0.02	0.00	0.00	0.00	0.00	71
PY4 Total	243	481	0.07	0.00	0.00	0.00	0.00	196
CPITD Total	816	2,703	0.55	0.56	0.70	0.70	0.70	971

[41] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 7-2: Residential Energy Efficient New Construction Sampling Strategy for PY4

Stratum	Strata Boundaries (kWh)	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Achieved Sample Size	Evaluation Activity
1	3,000	22	0.5	1	Model Review and Adjustment, Survey for Lights/Appliances
2	2,100	82	0.1	3	Model Review and Adjustment, Survey for Lights/Appliances
3	1,200	80	0.2	9	Model Review and Adjustment, Survey for Lights/Appliances
4	0	59	0.2	9	Model Review and Adjustment, Survey for Lights/Appliances
Program Total		243		22	

Table 7-3: PY4 Residential Energy Efficient New Construction Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings	Unverified Gross Energy Savings
1	89,289	105%	0.5	65%	94,080	
2	209,704	145%	CV<<0.5	7%	303,603	
3	120,011	186%	CV<<0.5	8%	223,276	
4	61,942	175%	CV<<0.5	7%	108,369	
Program Total	480,946	152%		13%	729,329	

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program.

Table 7-4: PY4 Summary of Evaluation Results for Demand (Top 100 Hours)Stratum

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
1	0.02	98%	0.5	65%	0.02			
2	0.04	265%	CV<<0.5	7%	0.11			
3	0.01	602%	CV<<0.5	8%	0.07			
4	-0.01	-457%	CV<<0.5	n/a	0.03			
Program Total	0.07	337%		13%	0.23	0.70	0.70	0.70

7.3 Impact Evaluation Net Savings

A net-to-gross assessment was not conducted for this program in Phase I due to the minimal contribution of this program against the Portfolio reported Gross CPITD MWh totals.

7.4 Process Evaluation

A process evaluation was not conducted for this program in Phase I due to the minimal contribution of this program against the Portfolio reported Gross CPITD MWh totals.

Table 7-5: Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Residential New Construction	
n/a	

7.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in Table 7-6:

Table 7-6: Summary of Residential Energy Efficient New Construction Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$71	$196	$971
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$71**	**$196**	**$971**
Design & Development	-$2	$1	$6
Administration[1]	$31	$332	$1,444
Management[2]	$9	$30	$98
Marketing[3]	$0	$4	$14
Technical Assistance	$4	$7	$18
Subtotal EDC Implementation Costs	**$43**	**$373**	**$1,580**
EDC Evaluation Costs	$11	$47	$82
SWE Audit Costs	$4	$9	$38
Total EDC Costs[4]	$129	$625	$2,672
Participant Costs[5]	$0	$360	$1,209
Total TRC Costs[6]		**$781**	**$2,872**
Total Lifetime Energy Benefits	$0	$715	$2,606
Total Lifetime Capacity Benefits	$0	$181	$686
Total TRC Benefits[7]	**N/A**	**$896**	**$3,292**
TRC Ratio[8]	**N/A**	**1.15**	**1.15**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

8 Residential Behavioral Modification and Education Program

This program is designed to educate residential customers on a variety of measures and behaviors that can reduce energy consumption or energy demand and encourage them to adopt a more energy efficient lifestyle. This information will be conveyed through various means, such as: 1) periodic reports to customers that compare their usage with other, comparable customers in the same geographical area; 2) outreach programs that emphasize the importance of peak load reduction during peak periods and ways to shift energy use away from these periods; 3) informational materials that provide general conservation tips (such as adjusting the thermostat during heating and cooling periods, turning off lights, shortening showers); 4) informational materials that provide low-cost energy efficiency tips (such as replacing incandescent lights with CFLs, installing weather stripping, and using power strips); and 5) informational materials that direct a customer to the FirstEnergy Pennsylvania utility website where additional energy savings information and tools are available.

8.1 Program Updates

The program launched during PY4.

8.2 Impact Evaluation Gross Savings

Impact evaluation involved analysis of monthly bills with a "difference in differences" approach and is consistent with the custom measure protocol for behavioral programs. NMR Group, Inc., conducted an independent billing analysis. NMR and ADM identified customer in both the control group and treatment group that participated in other Act 129 programs. The participant group had slight but significant increases in Act 129 rebate program participation. To adjust for potential double counting of savings, the billing analyses results were corrected for observed difference in participation rates. Although participation rates for upstream CFLs are not known for the two groups, ADM made corrections for CFLs according to the guidance provided in the Phase II evaluation framework.

Due to a relatively late program launch in PY4, the top 100 hour demand reduction for this program was very small. Only two of the top 100 hours occurred after the initial set of mailers were delivered to customers.

8.2.1 Program Sampling

The program design includes the designation of a comparable control group. One step of the analysis was to verify that the control groups was appropriately defined and adequate for impact evaluation purposes.

Table 8-1: Residential Behavioral Modification and Education Program Reported Results by Quarter[42]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	141,594	4,391	0.04	0.05	0.05	0.05	0.05	0
PY4 Q2	141,594	4,391	0.00	0.00	0.00	0.00	0.00	0
PY4 Q3	141,594	4,391	0.00	0.00	0.00	0.00	0.00	0
PY4 Q4	141,594	4,391	0.00	0.00	0.00	0.00	0.00	0
PY4 Total	141,594	17,565	0.04	0.05	0.05	0.05	0.05	0
CPITD Total	141,594	17,565	0.04	0.05	0.05	0.05	0.05	0

Table 8-2: Residential Behavioral Modification and Education Program Sampling Strategy

Stratum	Strata Boundaries (kWh)	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Achieved Sample Size	Evaluation Activity
Treatment	n/a	141,594	n/a	141,509	Difference in Difference Billing analysis
Control	n/a	42,180	n/a	42,180	Difference in Difference Billing analysis
Program Total		141,594		183,689	

[42] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 8-3: Residential Behavior Modification Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings
Treatment	17,565.3	100%	n/a	20.7%	17,565
Program Total	17,565.3			20.7%	17,565

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program.

Table 8-4: Residential Behavioral Modification and Education Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
Treatment	0.040	100%	n/a	20.7%	0.04			
Program Total	0.040			20.7%	0.04	0.05	0.05	0.05

8.3 Impact Evaluation Net Savings

Due to the design of this program, net-to-gross research was not conducted. This behavioral program is set up as a random control trial (RCT) with treatment and control groups– an approach that inherently controls for free-ridership and participant spillover. To the extent that the control group is affected by the program, nonparticipant spillover is not addressed; however, this effect is likely to be small.

8.4 Process Evaluation

Evaluation Methodology

The evaluation team completed quantitative telephone interviews with 154 customers who were included in the treatment group and 158 customers in the control group in PY4 (for overall 4.7 percent relative precision with 90 percent confidence). The survey focused on the following issues:

- **Customer engagement with the program.** The Residential Behavior Modification program is an auto-enroll program with which customers have not expressed interest or actively enrolled. An objective of the survey was to assess whether customers are aware of the program and read the HERs that were delivered to their homes. Other measures of engagement included reported usefulness of the information, perceived relevance of the energy-saving tips, and use of on-line tools associated with the program.
- **Barriers to engaging the program.** The survey measured how readership of the HERs changes over time and why. Customers' reactions to the HERs, including open-ended questions eliciting more information, and reasons for not pursuing additional information through the program are examined to identify barriers for the program.
- **Evidence of behavioral change.** While the impact of the program on household energy use resulting from the changes in behavior is the focus of separate evaluation activities using different methods, the telephone survey provides preliminary information on customer behavior. Do customers take steps to reduce their energy use as a result of the HERs? Are there measurable differences in energy-saving activities between treatment and control groups?

Key Findings

- Awareness of the program and readership of the HERs is high with almost 90 percent of households recalling that they received the reports and all but 2 percent at least scan or look at certain parts of the reports.
- Engagement with the program remains stable, or tends to improve, over time - households that read the report at the start continued to read the report throughout the program and the change in readership was more likely to have increased than decreased based on retrospective self-reports.
- Information provided in the HERs is viewed as useful with over 80 percent of households finding the HERs at least somewhat useful and just under one-quarter describing the HERs are "very useful."
- Households more often find comparisons of their own energy-use over time to be useful (over 80 percent) than comparisons with their neighbors (about 60 percent). Households express low confidence in the validity and accuracy of the neighbor comparison—a central motivational component of the program. Among six types of information regularly reported in the HERs, the neighbor comparisons receive the lowest usefulness ratings.

- While readership of the paper HERs is high, very few households engage on-line resources promoted by the program.
- Evidence that the HERs shape behavior is mixed. About one-half of households report that they have taken steps to reduce their energy use as a result of the HERs, but comparisons of energy-saving behaviors among households randomly assigned to the treatment and control groups yield few significant differences.

Table 8-5: Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Residential Behavioral Modification and Education	
Increase confidence in the HERs by addressing misperceptions and perceived inaccuracies, particularly with how neighbors are explained (through meaningful illustrations of households that may or may not be included in its comparison group, for example).	Being Considered
Emphasize *over-time* comparisons rather than *neighbor* comparisons.	Being Considered
Encourage the use of on-line tools cautiously and clearly outline an added value for customers. For example, present a compelling case for on-line use that addresses common complaints about the paper HERs (e.g., cost-efficiencies, more accurate neighbor comparisons or customized energy-saving tips).	Being Considered
Motivate energy-saving behavior by telling a success story—outline how a typical household that has low to moderate efficiency can take specific and practical steps to improve their energy efficiency. Link this story to tracking information available in the HER or on-line to help customers understand how they can use this information as tools for themselves.	Being Considered

8.5 Financial Reporting

This program started implementation in early PY4. All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in **Table 8-6**

Table 8-6: Summary of Residential Behavioral Modification and Education Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$0	$0	$0
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$0**	**$0**	**$0**
Design & Development	-$3	$1	$10
Administration[1]	$74	$409	$1,514
Management[2]	$15	$48	$158
Marketing[3]	$1	$6	$23
Technical Assistance	$7	$12	$29
Subtotal EDC Implementation Costs	**$93**	**$476**	**$1,734**
EDC Evaluation Costs	$92	$107	$124
SWE Audit Costs	$6	$14	$62
Total EDC Costs[4]	$191	$597	$1,919
Participant Costs[5]	$0	$0	$0
Total TRC Costs[6]		**$597**	**$1,919**
Total Lifetime Energy Benefits	$0	$1,553	$1,553
Total Lifetime Capacity Benefits	$0	$3	$3
Total TRC Benefits[7]	**N/A**	**$1,557**	**$1,557**
TRC Ratio[8]	**N/A**	**2.61**	**0.81**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

[10] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

9 Residential Multi Family Program

This program leverages audit services already being provided by the Pennsylvania Housing Finance Agency (PHFA) by marketing the program to property managers and owners who have participated and completed the PHFA audits. By leveraging other resources available through PHFA, the program targets other property managers and owners who have not participated in the PHFA audits. The program also targets tenants in these multifamily buildings by directly providing an energy conservation kit at no incremental cost to tenants. For purposes of this report, and consistent with the Companies' February 5, 2010 EE&C filing, all energy savings and demand reduction results for this program are reported in the Residential sector.

9.1 Program Updates

This program mailed out the last energy conservation kits in early PY4.

9.2 Impact Evaluation Gross Savings

The program was implemented by PowerDirect and distributed conservation kits to apartment managers to be either directly installed in dwellings, or to be distributed to tenants for self-installation. The managers collected contact information for the tenants when possible, so it was possible to contact the tenants directly for verification purposes. In PY2, ADM conducted verification activities through on-site visits and telephone surveys. The resulting verification rate was 100%. With the program accounting for less than 0.75% of portfolio level savings, and a high historic realization rate, the PY3 verification effort did not require on-site visits. ADM performed verification surveys in PY3 to confirm kit receipt. The ISR for CFLs within kits was taken to be the product of 84%, the TRM ISR for CFLs, and the kit receipt rate. The ISR for LED night lights was taken as the product of the kit receipt rate and the 84% TRM ISR for LED night lights.

9.2.1 Program Sampling

By program design, varying numbers of kits were distributed to apartment complexes according to the number of units per complex. Therefore, larger apartment complexes accounted for more energy savings than the smaller ones. The T&R system included contact information for apartment managers. Inspection of the telephone numbers revealed that certain property management companies represented multiple apartment complexes. These property managers accounted for a majority of reported gross impacts. ADM used the property managers as the sampling unit and created a stratified sample with sufficient points to achieve ±15% precision at the 85% confidence level.

Table 9-1. CPITD Reported Results by Quarter[43]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	2,621	765	0.03	0.04	0.04	0.07	0.12	13
PY4 Q2	0	0	0.00	0.00	0.00	0.00	0.00	2
PY4 Q3	0	0	0.00	0.00	0.00	0.00	0.00	0
PY4 Q4	0	0	0.00	0.00	0.00	0.00	0.00	(10)
PY4 Total	2,621	765	0.03	0.04	0.04	0.07	0.12	5
CPITD Total	8,016	3,491	0.16	0.18	0.18	0.32	0.55	139

Table 9-2: Residential Multiple Family Program Sampling Strategy for PY4

Stratum	Strata Boundaries (kWh)	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Achieved Sample Size	Evaluation Activity
1	200,000	1	0.25	1	Survey Property Managers to verify kit receipt and distribution
2	30,000	6	0.25	2	Survey Property Managers to verify kit receipt and distribution
3	0	7	0.25	1	Survey Property Managers to verify kit receipt and distribution
Program Total		14		4	

[43] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 9-3: Residential Multiple Family Program PY4 Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings	Unverified Gross Energy Savings
1	287	100%	n/a	0%	287	
2	353	100%	n/a	21%	353	
3	125	100%	n/a	33%	125	
Program Total	765			11%	765	

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program. Please note, as discussed in Section 1 and Appendix A of this Report, the CPITD Top 100 demand reduction values in this table are shown using values that represent: 1) calculations published in the 2012 Pennsylvania TRM ("TRM"); 2) calculations that include a correction to the Residential CFL coincidence factor ("TRM Corrected"); and, 3) calculations that incorporate alternative measurement approaches from the 2012 TRM to more accurately assess the peak load impacts from residential lighting during the Company's Top 100 Hours ("Evaluated").

Table 9-4: PY4 Residential Multiple Family Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
1	0.01	100%	n/a	0%	0.01			
2	0.02	100%	n/a	21%	0.02			
3	0.01	100%	n/a	33%	0.01			
Program Total	0.03	100%		10%	0.03	0.18	0.32	0.55

9.3 Impact Evaluation Net Savings

Net-to-gross research was not conduced for this program as participation and contribution to portfolio savings in Phase I was limited. The Phase II effort is currently planning to conduct net-to-gross research.

9.4 Process Evaluation

A process evaluation was not conduced for this program as participation in Phase I was limited. The Phase II effort is currently planning to conduct a process evaluation.

9.5 Financial Reporting

This program implementation occurred prior to PY4, however the program continues to receive minimal supplemental costs. All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in Table 9-5.

Table 9-5: Summary of Residential Multiple Family Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$5	$5	$139
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	$5	$5	$139
Design & Development	$0	$0	$1
Administration[1]	$0	$0	$16
Management[2]	$1	$3	$10
Marketing[3]	$0	$0	$1
Technical Assistance	$0	$1	$2
Subtotal EDC Implementation Costs	**$1**	**$4**	**$30**
EDC Evaluation Costs	$0	$1	$14
SWE Audit Costs	$0	$1	$4
Total EDC Costs[4]	$7	$11	$187
Participant Costs[5]	$0	$0	$0
Total TRC Costs[6]		**$10**	**$183**
Total Lifetime Energy Benefits	$0	$377	$1,918
Total Lifetime Capacity Benefits	$0	$14	$64
Total TRC Benefits[7]	**N/A**	**$391**	**$1,982**
TRC Ratio[8]	**N/A**	**39.85**	**10.84**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

10 Residential Low-Income (WARM) Programs

WARM Extra Measures Program: This program is an expansion of, and enhancement to the existing comprehensive Low-Income Usage Reduction Program (LIURP), known as WARM, that provides additional electric energy savings measures and services to income-eligible customers. Expanded measures include an average of four (4) additional CFLs (including specialty CFLs such as candelabras, 3-way, outdoor, recessed and flood lights), LED night lights, furnace whistles and smart power strips.

WARM Plus Program: This program is an expansion of, and enhancement to the existing comprehensive Low-Income Usage Reduction Program, known as WARM, that will provide additional electric energy savings measures and services to income-eligible customers. The WARM Plus program will support a 25 percent increase above the existing WARM/LIURP program, in the number of income-eligible homes receiving comprehensive treatments for Met-Ed.

Low-Income, Low-Use Program: **T**his program is for low-income customers that do not meet the minimum usage of 600 kWh/month to qualify for the WARM program. These customers received CFLs, faucet aerators, LED nightlights, a furnace whistle and energy education materials.

10.1 Program Updates

There were no changes to this program in PY4

10.2 Impact Evaluation Gross Savings

In PY4, there were reported savings and participation for WARM Plus and WARM Extra Measures only. WARM Plus accounted for nearly 80% of PY4 program level savings. The evaluation activities for the two program components are discussed below.

WARM Plus Program:

The ex-ante energy savings for the Warm Plus program are based on the impact evaluation of the PY2 WARM Plus program by job type,[44] which employed a statistical billing analysis. Given the need for pre- and post- treatment history, and the fact that PY4 and PY3 programs were the same, ADM conducted an independent billing analysis of the PY3 WARM Plus program participant data to support PY4 impacts. The billing analysis used a 'difference in differences' approach, where the same analysis was run on the treatment and control groups, and the net impact was the difference in relative energy savings for the

[44] The three job types are as follows: Electric heat jobs are weatherization jobs that direct at least $250 to reduce space heating energy usage for electrically heated homes; electric water heat jobs direct at least $25 to reduce water heating energy usage for homes that have electric water heaters, and electric baseload jobs, which may include refrigerator/freezer replacement and lighting retrofits.

two groups. The billing analysis measured 11% energy savings for the treatment group, but a 3% energy increase for the control group, the total relative savings are 13.94%. The control group was comprised of past (PY2 and PY1) program participants. The monthly energy usages for the control group[45] and the treatment group, combined for all EDCs, are shown in Figure 10-1.

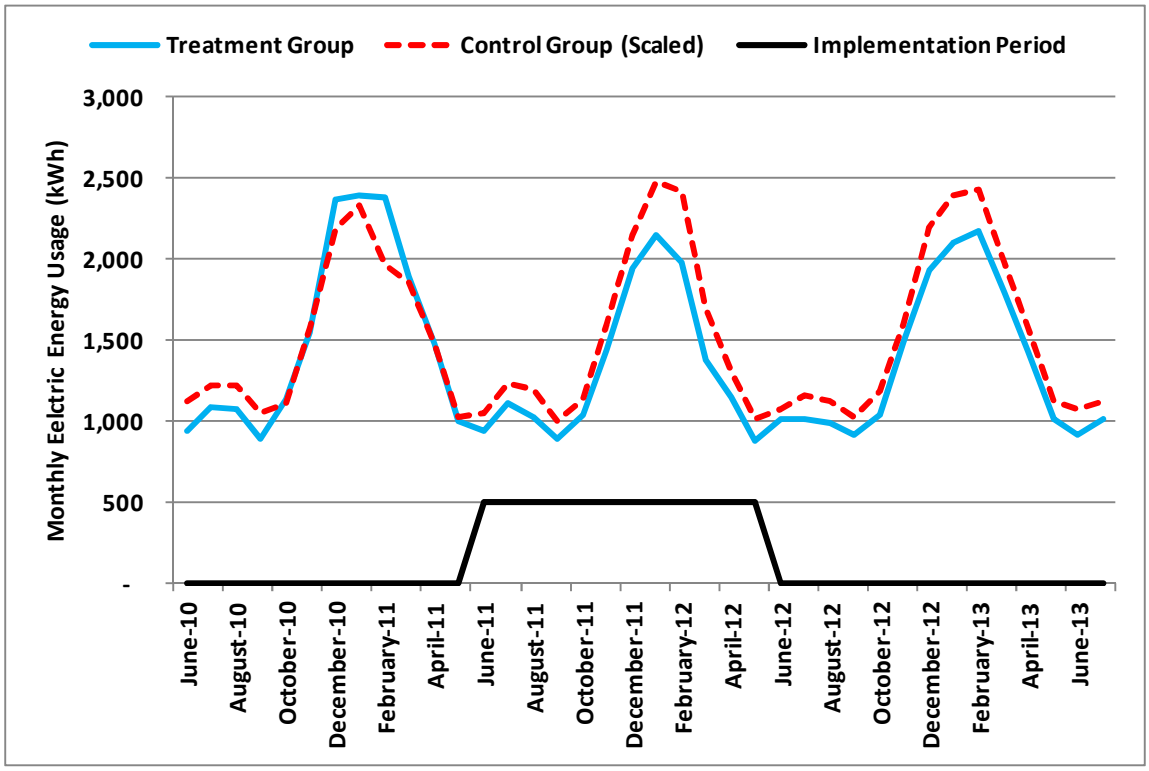

Figure 10-1. Comparison of pre and post treatment energy usages for a control group (dashed red profile) and for PY3 WARM Plus participants (solid blue profile).

WARM Extra Measures Program:

ADM reviewed completed program inspection checklists from on-site QA/QC visits conducted by the program's QA/QC contractor. The in-service rates for various measures were determined through this review process.

[45] In the figure, the energy usage of the control group has been scaled to match the total energy usage of the treatment group in the year that preceded implementation. The plot shows results for Met-Ed, Penelec, and Penn Power combined.

10.2.1 **Program Sampling**

The sampling schemes for each program component are described below. The overall statistical precision of the program was 10% at the 85% confidence level.

WARM Extra Measures Program:

The simple random sample for this program component included 6 reviews of QA/QC verification visit checklists.

WARM Plus Program:

The billing analysis attempted to include as many past participants as possible. Certain customers had multiple meter reads for the same billing period. For such customers, in certain cases, ADM was able to clearly identify the correct meter read. In other cases where there was much uncertainty about the actual electric energy usage for a given period, the observation was excluded from the evaluation sample. One commonly used method of estimating uncertainty for billing analysis is through comparison of the standard error to the mean of the variable of interest (the dummy variable that measures the savings after treatment). By this measure, the relative precision for the billing analysis is ±13% at the 85% confidence level.

One aspect of ADM's independent analysis reduced savings compared to 2008 and 2009 involved the subtraction of the savings claimed for the "WARM Extra Measures" program from the WARM Plus participants in the billing analysis. This resulted in an approximate 2% reduction in savings.

Table 10-1: Residential Low-Income (WARM) Programs Reported Results by Quarter[46]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	605	300	0.07	0.02	0.01	0.01	0.01	361
PY4 Q2	642	273	0.06	0.00	0.00	0.00	0.00	158
PY4 Q3	636	250	0.05	0.00	0.00	0.00	0.00	135
PY4 Q4	871	401	0.10	0.00	0.00	0.00	0.00	296
PY4 Total	2,755	1,223	0.27	0.02	0.01	0.01	0.01	950
CPITD Total	9,089	5,998	1.02	0.92	0.95	0.95	0.95	2950

[46] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 10-2: Residential Low-Income (WARM) Programs Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Warm Plus	All	470	n/a	n/a	Billing Ana of prior year participants	470	Billing Analysis
Warm Extra Measures	All	941	0.5	25%	15	23	Desk review audit
Program Total		1411		15%		493	

Table 10-3: PY4 Residential Low-Income (WARM) Programs Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings
Warm Plus	536	176%	n/a	14%	943
Warm Extra Measures	138	110%	0.81	24.33%	153
Program Total	**674**	**163%**		**12%**	**1,096**

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program.

Table 10-4: PY4 Residential Low-Income (WARM) Programs Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
Warm Plus	0.23	76%	n/a	14%	0.18			
Warm Extra Measures	0.01	111%	0.98	30%	0.01			
Program Total	**0.24**	**77%**		13%	**0.19**	**0.95**	**0.95**	**0.95**

10.3 Impact Evaluation Net Savings

Per Statewide Evaluator (SWE)[47], "the SWE Team recommends using a NTGR value of 1.0 for low-income programs, based on the literature review of expert resources and practices in other states. ". Therefore, this research was not conducted.

10.4 Process Evaluation

Tetra Tech completed a process evaluation for the Residential Low-income (WARM) program in PY2. Given there were no significant issues identified through this process evaluation, and no change in program delivery, process evaluation activities were not included as part of this evaluation scope.

[47] Statewide Evaluator Guidance Memo, *New-to-gross Study Methods, Review and Recommendations*. January 13, 2013.

10.5 Financial Reporting

The TRC for this program is much lower in PY4 than in PY3. This is expected because in PY2, the TRC was heavily influenced by the cost-effective low-income low-use program, while in PY3 the main component was the WARM Plus program which provides comprehensive weatherization services to qualified customers. A breakdown of the program finances is presented in **Table 10-5**

Table 10-5: Summary of Residential Low-Income (WARM) Programs Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$296	$950	$2,950
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$296**	**$950**	**$2,950**
Design & Development	-$2	$1	$8
Administration[1]	$18	$81	$242
Management[2]	$51	$141	$357
Marketing[3]	$1	$5	$19
Technical Assistance	$5	$10	$41
Subtotal EDC Implementation Costs	**$73**	**$238**	**$668**
EDC Evaluation Costs	$21	$68	$226
SWE Audit Costs	$5	$11	$48
Total EDC Costs[4]	$394	$1,266	$3,891
Participant Costs[5]	$296	$0	$0
Total TRC Costs[6]		**$1,255**	**$3,843**
Total Lifetime Energy Benefits	$0	$1,027	$4,750
Total Lifetime Capacity Benefits	$0	$143	$729
Total TRC Benefits[7]	**N/A**	**$1,170**	**$5,479**
TRC Ratio[8]	**N/A**	**0.93**	**1.43**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

11 Commercial / Industrial Small Sector Equipment Program

This program consists of the following components:

Equipment: This program component provides for the implementation of cost effective, high efficiency measures through the Nonstandard Lighting, Heating Ventilating and Air-conditioning, Motors & Drives, Specialty Equipment and Custom incentive programs.

Energy Audit and Technical Assessment: This program component provides information, a list of auditors and funds all of the CFL installations for this class of customers marketed through Nonstandard Lighting incentives.

11.1 Program Updates

No changes to this program during PY4.

11.2 Impact Evaluation Gross Savings

This program implements both custom measures and prescriptive measures.

The majority of the gross reported energy savings for this program were attributable to lighting measures. The remainder of the savings were attributable to prescriptive and custom motors projects, and the remainder to custom projects. The M&V methodology for this program is described below.

Analytical Desk Review: Prescriptive and Custom

At the end of each quarter ADM reviewed an updated dataset from the T&R system to define a discrete set of rebates that would be included in the population for that quarter's evaluation sampling process. Each sampled site underwent a thorough desk review before ADM visited the site or calculated ex post verified savings. The desk review included verifying invoices, re-calculating claimed savings using TRM algorithms and/or ex ante assumptions (i.e. fixture quantities, motor horse-powers, EFLHs, etc.), and identifying key parameters to be researched in the M&V plan.

This review informed ADM's data acquisition activities by identifying missing data and sites at which ADM needed to install monitoring equipment. The desk review was also used to flag sites that were claimed using prescriptive algorithms, but whose savings needed to be calculated using a custom approach. Examples include process cooling chillers mistakenly identified as space cooling chillers, and variable frequency drives installed in instances that require metering or trending. In certain cases – particularly with photovoltaic, compressed air, or refrigeration upgrade measures, metering or trending data were available. On-site data collection was not required in such cases where the available data was sufficient to complete the measurement and verification.

For custom projects desk reviews were performed in order to create an Evaluation, Measurement, & Verification plan for each sampled site. ADM used the project documentation and site contact to determine what monitoring equipment needed to be installed and if baseline monitoring was possible or needed. Many of the larger custom projects fell in ADM's 'certainty' stratum and were evaluated concurrently. In such cases the gross reported and gross verified savings are equal.

ADM worked with SAIC and Met-Ed to identify custom sites at which monitoring would be required by reviewing site documentation for sites early in SAIC's approval process and flagging sites which would only be evaluable with monitored baseline data. ADM reviewed each Custom Incentive application before its approval to ensure its ability to be evaluated.

Verification /Data Acquisition (DAQ)

ADM used surveys, on-site verification, and/or data logging in order to address uncertainties identified in the desk review process. ADM determined the requisite level of additional verification by applying the following general rule-set:

- Photovoltaic projects were evaluated with Solar Advisor Model (SAM) simulations that were first calibrated to historical generation records and then weather normalized.
- Lighting projects required on-site visits[48] and larger projects required logging hours of use
- Large savings custom HVAC upgrades were evaluated by billing analyses when possible
- Some very small, prescriptive projects (e.g., one rooftop unit, five traffic signals, or one solid door refrigerator) did not require on-site inspections if a desk review is conclusive.
- If projects that came in prescriptive paths such as the HVAC or Motors/Drives applications appear to be "custom" in nature, they were evaluated as custom projects.

In this way ADM ensured that enough information was gathered to make accurate and robust site analyses.

Post Data Acquisition analysis

In order to promote consistency and accuracy, ADM created a Microsoft Excel based calculator for each prescriptive measure rebated in the program that has a stipulated savings algorithm in the Pennsylvania TRM. Each calculator has one spreadsheet that is used to recreate the claimed savings values by entering in values according to the rebate application and site documentation during the desk review. There is a

[48] There are exceptions to this rule. Two of 35 sampled lighting projects underwent desk review but did not require on-site visits. These projects were small savings projects and, weighted by the sample weights, represented approximately 5% of the overall program's impacts.

second sheet that is then used to calculate ex post verified savings by updating key parameters according to on-site data collection. In many cases no changes were made between these two sheets, as all key variables were identified correctly through the desk review.

Custom measures were evaluated according to the site-specific EM&V plan that was written during the desk review and modified, if need, after an initial interview with the project applicant or contact person. Given the nature of these measures, the custom analyses employed monitored data, cut-sheets, and one-time power measurements to characterize energy use and energy savings. For measures installed on equipment used in industrial processes, ADM also collected annual production data (in addition to any production collected during the monitored time period). This was used to normalize energy savings to production.

11.2.1 Program Sampling

ADM evaluated the commercial and industrial programs using stratified ratio estimation. Separate samples were drawn, at the 85% confidence level with 15% precision at the annual evaluation level, for each operating company, program, and quarter. A 'sample point' denotes a particular rebate which was randomly sampled within its population.

At the end of the second, third, and fourth quarter ADM reviewed tracking data to define a discrete list of rebates that became the sample population for that quarter. Once separated into their respective operating companies and programs, this population was then stratified according to measure category (prescriptive vs. custom), common drivers of realization rates or the variability of the realization rates, modes, and the magnitude of rebated savings (used to create 'certainty' strata[49]). ADM used a coefficient of variation (CV) of 0.4 for all "Nonstandard Lighting for Business" projects, a CV of 0.6 for all custom projects and "Standard Lighting for Business" projects, and a CV of 1.0 for prescriptive non-lighting projects based on the PY2 and PY3 evaluations. The actual observed error ratios for the various strata, as trended from ADM's sample of previous evaluation years are significantly smaller than the CV estimates used herein.

[49] There are some projects that were evaluated concurrently but ADM but had savings that fell below the certainty threshold. These projects were also placed in the certainty category so that they would represent only themselves in ADM's evaluation sample.

Table 11-1: Commercial / Industrial Small Sector Equipment Program Reported Results by Quarter[50]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	174	14,394	3.74	5.31	3.57	3.57	3.57	631
PY4 Q2	70	4,613	1.21	0.00	0.00	0.00	0.00	358
PY4 Q3	104	3,728	0.65	0.00	0.00	0.00	0.00	273
PY4 Q4	53	2,803	0.60	0.00	0.00	0.00	0.00	466
PY4 Total	401	25,538	6.20	5.31	3.57	3.57	3.57	1,727
CPITD Total	1,035	88,836	20.85	22.41	17.41	17.55	17.78	5,909

Table 11-2: Commercial / Industrial Small Sector Equipment Program Sampling Strategy for PY4

Stratum Name	Reported Gross Savings	Strata Boundaries	Population Size	Assumed CV	Achieved Sample	Evaluation Activity
CFL0	0	n/a	0	0.5	0	N/A
NSL0	7,332,190	100,000	269	0.4	10	Desk review, In-Situ
NSL1	5,842,576	500,000	30	0.4	6	Desk review, In-Situ
NSL2	5,546,839	n/a	5	0.4	3	Desk review, In-Situ
SLB0	32,153	100,000	3	0.6	1	Desk review, In-Situ
SLB1	0	500,000	0	0.6	0	N/A
SLB2	0	n/a	0	0.6	0	N/A
Prescriptive0	478,800	499,999	44	1.0	1	Desk review, In-Situ
Prescriptive1	0	500,000	0	1.0	0	N/A
Prescriptive2	0	n/a	0	1.0	0	N/A
Custom0	1,507,908	499,999	29	0.6	4	Desk review, In-Situ
Custom1	0	500,000	0	0.6	0	N/A
Custom2	0	n/a	0	0.6	0	N/A
PV0	3,413,285	500,000	15	0.3	2	Simulation calibrated to generation records
PV1	1,265,323	2,000,000	2	0.3	2	Simulation calibrated to generation records
PV2	0	n/a	0	0.3	0	N/A
SAL0	118,450	99,999	4	0.4	1	Desk review, In-Situ
SAL1	0	100,000	0	0.4	0	N/A
SAL2	0	n/a	0	0.4	0	N/A
Total	**25,537,524**	**n/a**	**401**	**n/a**	**30**	

[50] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 11-3: PY4 Commercial / Industrial Small Sector Equipment Program Summary of Evaluation Results for Energy

Stratum Name	Reported Gross Energy Savings	Realization Rate	Observed CV	Relative Precision	Verified Gross Energy Savings
CFL0	0	n/a	0.5	n/a	
NSL0	7,332,190	82%	0.4	18%	6,017,657
NSL1	5,842,576	83%	0.4	21%	4,865,290
NSL2	5,546,839	94%	0.4	21%	5,232,825
SLB0	32,153	133%	0.6	71%	42,638
SLB1	0	n/a	0.6	n/a	
SLB2	0	n/a	0.6	n/a	
Prescriptive0	478,800	56%	1.0	142%	266,722
Prescriptive1	0	n/a	1.0	n/a	
Prescriptive2	0	n/a	1.0	n/a	
Custom0	1,507,908	95%	0.6	40%	1,432,071
Custom1	0	n/a	0.6	n/a	
Custom2	0	n/a	0.6	n/a	
PV0	3,413,285	109%	0.3	24%	3,726,112
PV1	1,265,323	108%	0.3	0%	1,371,668
PV2	0	n/a	0.3	n/a	
SAL0	118,450	102%	0.4	50%	121,163
SAL1	0	n/a	0.4	n/a	
SAL2	0	n/a	0.4	n/a	
Total	**25,537,524**	**90%**	**n/a**	**9%**	**23,076,145**

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program. Please note, as discussed in Section 1 and Appendix A of this Report, the CPITD Top 100 demand reduction values in this table are shown using values that represent: 1) calculations published in the 2012 Pennsylvania TRM ("TRM"); 2) calculations that include a correction to the Residential CFL coincidence factor ("TRM Corrected"); and, 3) calculations that incorporate alternative measurement approaches from the 2012 TRM to more accurately assess the peak load impacts from residential lighting during the Company's Top 100 Hours ("Evaluated").

Table 11-4: PY4 Commercial / Industrial Small Sector Equipment Program Summary of Evaluation Results for Demand

Stratum Name	Reported Gross Demand Savings (kW)	Realization Rate	Observed CV	Relative Precision	Verified Gross Demand Savings (kW)
CFL0	0	n/a	0.5	n/a	
NSL0	1,428	82%	0.4	18%	1,175
NSL1	841	101%	0.4	21%	849
NSL2	657	94%	0.4	21%	617
SLB0	6	221%	0.6	71%	13
SLB1	0	n/a	0.6	n/a	
SLB2	0	n/a	0.6	n/a	
Prescriptive0	82	53%	1.0	142%	43
Prescriptive1	0	n/a	1.0	n/a	
Prescriptive2	0	n/a	1.0	n/a	
Custom0	108	46%	0.6	40%	50
Custom1	0	n/a	0.6	n/a	
Custom2	0	n/a	0.6	n/a	
PV0	2,241	47%	0.3	24%	1,053
PV1	831	44%	0.3	0%	368
PV2	0	n/a	0.3	n/a	
SAL0	2	n/a	0.4	50%	
SAL1	0	n/a	0.4	n/a	
SAL2	0	n/a	0.4	n/a	
Total	**6,196**	**67%**	**n/a**	**10%**	**4,167**
CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)					17.41
CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)					17.55
CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)					17.78

11.3 Impact Evaluation Net Savings

The evaluation team employed the self-report approach (SRA) to estimate free-ridership and spillover effects. The participant survey included a series of questions to quantitatively assess the program's influence on the installation of energy-saving measures received or rebated through the program. In addition, the participant survey included a series of questions to assess additional energy-saving actions taken by customers since participating in the program and the extent of the program's influence on these actions.

The sampling frame for the customer decision-maker survey was C&I Equipment program participants[51] from Program Year 3. The evaluation team surveyed a census of customers in all equipment areas to

[51] The net-to-gross research and process evaluation effort was combined for small and large C&I equipment, and government/non-profit sector participants. Process and net-to-gross evaluations were completed for these sectors overall because the programs were designed, marketed, and operated essentially the same and participation was limited at the small, large, and government/non-profit sectors at the time of the evaluation effort. Caution is recommended when interpreting by sector. In Phase II, this will be reviewed and consideration given to an expanded effort, or separate efforts, if warranted.

estimate net-to-gross, with the exception of lighting. For lighting, the evaluation team sampled a sufficient number of participants to achieve a confidence interval level of 90 percent +/- 10 percent at the utility level.

Free-ridership and like spillover were evaluated by measure category: standard lighting, non-standard lighting, HVAC, motors, and custom. The evaluation team completed 70 participant surveys at the measure level for a 7.9 percent relative precision with 90 percent confidence (for free-ridership assessment).

The Met-Ed program NTG research indicates estimates of 43.4 percent free-ridership and 8.9 percent spillover for a net-to-gross ratio of 65.5 percent at the combined measure level. The non-standard lighting free-ridership rate was 37.2 percent, spillover was 10.5 percent, and the net-to-gross ratio was estimated to be 73.3 percent. Measure level free-ridership and spillover rates for measures other than non-standard lighting ranged from 0.0 percent to 99.9 percent; however, great caution is needed when interpreting these results as sample sizes are very small. The evaluation team recommends the inclusion of market actor interviews in future net-to-gross research to assess the attribution of the program to decisions made by these program partners. Given the limited number of sample points at each measure-level, the evaluation team did not provide any recommendations for specific measure-level modifications based on this research.

11.4 Process Evaluation

Evaluation Methodology

The process evaluation effort consisted of participant surveys and in-depth interviews with participating auditors. Key researchable issues were identified based on the evaluator's experience assessing other residential home energy audits and outreach programs and through interviews with program staff. These issues included:

- **Equipment installed and impact of program on participation.** Participants were about the equipment supported by the program and if the program was successful at getting them to install higher-efficient equipment.
- **Program marketing.** Participants were asked how they heard about the program and any barriers to implementing energy efficiency projects.
- **Participant satisfaction.** Participants were asked a number of satisfaction questions in regards to specific equipment, interactions with program staff, and with the program overall.
- **Program wait-list affected on project.** Participants placed on a wait-list were asked about the status of their project, how often they receive program updates, and their wait list status.

Tetra Tech conducted a telephone survey of C&I Equipment program participants from Program Year 3 in conjunction with the net-to-gross research. Process and net-to-gross evaluations were completed for the C&I and government/non-profit sectors overall as participation was limited at the time of the evaluation

effort. In Phase II, this will be reviewed and consideration given to an expanded effort, or separate efforts, if warranted.

Key Findings

Key findings were reported in the Program Year 3 Annual report.

Table 11-5: Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Commercial/Industrial Small Sector Equipment	
Collect all participation data electronically including all project information including such as detailed equipment description (old and new) and the quantity of equipment installed, when appropriate.	Being Considered
Consider additional marketing efforts. The preferred methods of contact mentioned most often were through email, mail or the FirstEnergy website. FirstEnergy may want to consider more strategic marketing efforts, particularly to small businesses.	Being Considered
Provide a means (such as website notification or periodic e-blasts) for contractors and customers to check the status of the program prior to applying to the program.	Being Considered
Review the rebate application process to ensure requirements are easy to understand and that rebates are issued in a timely fashion.	Being Considered

11.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in **Table 11-6**

Table 11-6: Summary of Commercial / Industrial Small Sector Equipment Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$466	$1,727	$5,909
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$466**	**$1,727**	**$5,909**
Design & Development	-$7	$3	$23
Administration[1]	$72	$1,045	$2,412
Management[2]	$34	$125	$369
Marketing[3]	$2	$14	$54
Technical Assistance	$16	$27	$68
Subtotal EDC Implementation Costs	**$117**	**$1,213**	**$2,924**
EDC Evaluation Costs	$364	$646	$802
SWE Audit Costs	$14	$32	$144
Total EDC Costs[4]	$959	$3,619	$9,778
Participant Costs[5]	$0	$28,579	$41,778
Total TRC Costs[6]		**$30,438**	**$45,503**
Total Lifetime Energy Benefits	$0	$19,394	$55,652
Total Lifetime Capacity Benefits	$0	$3,246	$9,786
Total TRC Benefits[7]	**N/A**	**$22,640**	**$65,438**
TRC Ratio[8]	**N/A**	**0.74**	**1.44**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

12 Commercial / Industrial Large Sector Equipment Program

This program consists of the following components:

Performance Contracting and Equipment: Large commercial and industrial (and other large non-residential) customers may elect to secure Demand Side Management/Energy Efficiency (DSM/EE) services through an Energy Services Company (ESCO) that will identify opportunities, implement retrofits and attain payment through the savings generated by the project over time.

Industrial Motors and Variable Speed Drives (VSD): This program is designed to encourage Met-Ed's commercial and industrial customers to: 1) upgrade their existing motors to NEMA Premium® motors when switching out old motors due to breakdowns and or programmed replacements; and, 2) install variable speed drives on motors that do not always operate at the same speed.

The variable speed drive program is designed for commercial and industrial energy customers whose motors are utilized for increased operating hours and have a higher variability of loads. Applications with low variability of loads where the motor runs at constant speed are not good candidates for a variable-speed drive.

12.1 Program Updates

No changes to this program during PY4.

12.2 Impact Evaluation Gross Savings

This program implements both custom measures and prescriptive measures. The great majority of the gross reported energy savings for this program were attributable to prescriptive and performance lighting measures. The M&V methodology for this program is identical to the approach used for the Small C/I equipment program described in section 11.2.

12.2.1 Program Sampling

The sampling methodology for this program is identical to the approach used for the Small C/I equipment program described in section. Program-specific details are in Table 12-3

Table 12-1: Commercial / Industrial Large Sector Equipment Program Reported Results by Quarter[52]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	66	24,627	9.69	16.30	8.78	8.78	8.78	671
PY4 Q2	21	6,288	2.40	0.00	0.00	0.00	0.00	391
PY4 Q3	4	2,117	0.12	0.00	0.00	0.00	0.00	32
PY4 Q4	3	5,055	3.48	0.00	0.00	0.00	0.00	827
PY4 Total	94	38,087	15.70	16.30	8.78	8.78	8.78	1,921
CPITD	261	90,346	22.09	23.76	17.17	17.17	17.17	5.788

Table 12-2: Commercial / Industrial Large Sector Equipment Program Sampling Strategy for PY4

Stratum Name	Reported Gross Savings	Strata Boundaries	Population Size	Assumed CV	Achieved Sample	Evaluation Activity
CFL0	0		0	0.5	0	Surveys + PY3 metering results
NSL0	12,957,744	1,500,000	61	0.6	3	Desk review, In-Situ
NSL1	1,666,433	5,555,555	1	0.4	1	Desk review, In-Situ
NSL2	0		0	0.4	0	N/A
SLB0	0	100,000	0	0.6	0	N/A
SLB1	0	500,000	0	0.6	0	N/A
SLB2	0		0	0.6	0	N/A
Prescriptive	61,494	100,000	3	1.0	1	Desk review, In-Situ
Prescriptive	0	500,000	0	1.0	0	N/A
Prescriptive	0		0	1.0	0	N/A
Custom0	1,883,055	500,000	18	0.6	2	Desk review, In-Situ
Custom1	0	1,000,000	0	0.6	0	N/A
Custom2	1,731,779		1	0.6	1	Desk review, In-Situ
PV0	1,434,094	1,000,000	4	0.3	1	Simulation calibrated to generation
PV1	3,362,211	3,000,000	2	0.3	1	Simulation calibrated to generation
PV2	14,990,426		4	0.3	4	Simulation calibrated to generation
SAL0	0	10,000	0	0.4	0	N/A
SAL1	0	100,000	0	0.4	0	N/A
SAl2	0		0	0.4	0	N/A
Total	**38,087,236**	**N/A**	**94**	**N/A**	**14**	

[52] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 12-3: PY4 Commercial / Industrial Large Sector Equipment Program Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings
CFL0	0	n/a	0.5	n/a	
NSL0	12,957,744	76%	0.6	49%	9,800,545
NSL1	1,666,433	72%	0.4	0%	1,204,882
NSL2	0	n/a	0.4	n/a	
SLB0	0	n/a	0.6	n/a	
SLB1	0	n/a	0.6	n/a	
SLB2	0	n/a	0.6	n/a	
Prescriptive0	61,494	84%	1.0	118%	51,869
Prescriptive1	0	n/a	1.0	n/a	
Prescriptive2	0	n/a	1.0	n/a	
Custom0	1,883,055	51%	0.6	58%	964,649
Custom1	0	n/a	0.6	n/a	
Custom2	1,731,779	8%	0.6	0%	146,925
PV0	1,434,094	102%	0.3	31%	1,467,465
PV1	3,362,211	99%	0.3	25%	3,320,959
PV2	14,990,426	114%	0.3	0%	17,162,127
SAL0	0	n/a	0.4	n/a	
SAL1	0	n/a	0.4	n/a	
SAI2	0	n/a	0.4	n/a	
Total	**38,087,236**	**90%**	**n/a**	**14%**	**34,119,420**

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program.

Table 12-4: PY4 Commercial / Industrial Large Sector Equipment Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction (kW)	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Demand Reduction (kW)
CFL0	0	n/a	0.5	n/a	
NSL0	1,824	96%	0.6	49%	1,745
NSL1	190	84%	0.4	0%	160
NSL2	0	n/a	0.4	n/a	
SLB0	0	n/a	0.6	n/a	
SLB1	0	n/a	0.6	n/a	
SLB2	0	n/a	0.6	n/a	
Prescriptive0	12	101%	1.0	118%	12
Prescriptive1	0	n/a	1.0	n/a	
Prescriptive2	0	n/a	1.0	n/a	
Custom0	286	21%	0.6	58%	61
Custom1	0	n/a	0.6	n/a	
Custom2	29	27%	0.6	0%	8
PV0	978	48%	0.3	31%	466
PV1	1,916	47%	0.3	25%	903
PV2	10,460	49%	0.3	0%	5,100
SAL0	0	n/a	0.4	n/a	
SAL1	0	n/a	0.4	n/a	
SAI2	0	n/a	0.4	n/a	
Total	**15,695**	**54%**		**11%**	**8,455**
CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)					**17.17**
CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)					**17.17**
CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)					**17.17**

12.3 Impact Evaluation Net Savings

Tetra Tech conducted a telephone survey of the C&I and Government/Non-profit Equipment programs participants from Program Year 3 in conjunction with the process evaluation research. Process and net-to-gross evaluations were completed for these sectors overall because the programs were designed, marketed, and operated essentially the same and participation was limited at the small, large, and government/non-profit sectors at the time of the evaluation effort. Caution is recommended when interpreting by sector. In Phase II, this will be reviewed and consideration given to an expanded effort, or separate efforts, if warranted.

12.4 Process Evaluation

Tetra Tech conducted a telephone survey of the C&I and Government/Non-profit Equipment programs participants from Program Year 3 in conjunction with the net-to-gross research. Process and net-to-gross evaluations were completed for these sectors overall because the programs were designed, marketed,

and operated essentially the same and participation was limited at the small, large, and government/non-profit sectors at the time of the evaluation effort. In Phase II, this will be reviewed and consideration given to an expanded effort, or separate efforts, if warranted.

Evaluation Methodology

See Section 11. Commercial/Industrial Small Sector Equipment.

Key Findings

See Section 11. Commercial/Industrial Small Sector Equipment.

Table 12-5: Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Commercial/Industrial Large Sector Performance Contracting/Equipment	
See Section 11. Commercial/Industrial Small Sector Equipment	

12.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in Table 12-6

Table 12-6: Summary of Commercial / Industrial Large Sector Equipment Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$827	$1,921	$5,788
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$827**	**$1,921**	**$5,788**
Design & Development	-$2	$1	$7
Administration[1]	-$71	-$175	$557
Management[2]	$10	$34	$111
Marketing[3]	$1	$4	$16
Technical Assistance	$5	$8	$20
Subtotal EDC Implementation Costs	**-$57**	**-$128**	**$712**
EDC Evaluation Costs	$4	-$11	$473
SWE Audit Costs	$4	$10	$44
Total EDC Costs[4]	$778	$1,792	$7,018
Participant Costs[5]	$0	$57,017	$73,704
Total TRC Costs[6]		**$56,878**	**$74,890**
Total Lifetime Energy Benefits	$0	$24,527	$65,977
Total Lifetime Capacity Benefits	$0	$6,754	$12,832
Total TRC Benefits[7]	**N/A**	**$31,281**	**$78,809**
TRC Ratio[8]	**N/A**	**0.55**	**1.05**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

13 Commercial / Industrial Demand Response Program – CSP Mandatory and Voluntary Curtailment Program

For C/I, as well as government sector customers, Met-Ed solicited curtailment service providers ("DR-CSPs") to provide customer curtailable load during the Company's targeted hours of 100 hours of highest demand. The Plan included both a Mandatory Program and a Voluntary Program. The Companies developed an RFP supporting the mandatory program offering firm pricing for commitments for peak load reductions during the top 100 hours, and a voluntary program offering supplemental payments for voluntary customer reductions during the top 100 hours.

13.1 Program Updates

Met-Ed contracted with nine DR-CSPs and eight individual customers to deliver load reductions under both the Mandatory and Voluntary Programs. Additional DR-CSPs participated in the Voluntary Program in conjunction with participation in PJM programs.

13.2 Impact Evaluation Gross Savings

This measurement and verification ("M&V") report describes ADM's impact evaluation for the Commercial and Industrial Demand Response Program offered by Met-Ed.

During the top 100 hours, the Met-Ed C/I Demand Response Program achieved 4,597 MWh of energy savings (equivalent to 45.97 MW average load reduction over the top 100 hours) at the gross reported level at the customer meters. ADM sampled 12 projects in its impact evaluation. The 12 sampled projects account for about 58% of the total program savings. The general evaluation approach was to conduct independent savings calculations. For each sampled site, ADM calculated the following customer load baselines (CBLs):

- PJM Three Day Type CBL
- PJM Three Day Type CBL with Symmetric Additive Adjustment (SAA)
- PJM Custom "Manual" CBL (3 hours post-event, 2 hours pre-event, 1 hour buffer)
- Several "Custom" CBLs created by ADM

Whenever custom CBLs are considered, the impacts from the 'next best' PJM protocol are also recorded. The program-level realization rate is reported for two scenarios:

- The 'ADM Best Approach' scenario that includes custom CBLs (non-PJM CBLs)
- The 'PJM-only' approach relies on the three PJM CBLs listed above

For all four FirstEnergy Pennsylvania EDCs, the program level realization rates are comparable (within 2%) for the two scenarios.

ADM used the following guidelines for auditing the proposed CBL schemes and in the determination of alternate CBLs if needed:

1. If the applicant was registered in PJM's Economic DR Programs, then ADM showed some preference for the CBL accepted by PJM.
    - The reasoning is that if PJM approved the CBL methodology, then the CBL can be considered to be vetted for Act 129 purposes.
2. In cases where the applicant had not registered in PJM's Economic DR Programs, and proposed CBL appeared to be reasonable, with acceptable relative root mean square errors (RRMSE) so that PJM would have likely accepted the proposed CBL, then ADM showed preference for the proposed CBL.
3. In case where the proposed CBL had validity issues or was significantly outperformed during influential event days by other CBLs, ADM overrode the proposed CBL and assigned an alternate CBL.
    - Consistent with PJM protocol, ADM preferred CBLs with lower RRMSE scores. In many cases several CBLs had comparable RRMSEs. ADM judged the apparent performance of CBLs on key event days (those with the largest potential top 100 hour energy savings) by comparing graphs of the CBLs and facility loads for the event day, for surrounding days, and for previous and subsequent "like" weekdays.
    - All other things comparable, the preferred CBL was the Three Day Type with SAA.
    - SAA or other day-of-event corrections were not used in cases where the applicant appeared to alter usage prior to the official event start. In such cases the SAA or 3/2 "manual" protocols may appear to have great RRMSEs but often produce biased results on event days.

ADM's independent analyses have resulted a realization rate of 95%, with a sampling precision of 12% at the 85% confidence level.

13.2.1 Program Sampling

ADM employed a stratified sampling scheme to evaluate this program. The sampling scheme separated the projects into four groups or strata. The first stratum includes the largest applicants in terms of expected top 100 hour contributions while the fourth stratum contains the smallest projects. A total of 12 projects were sampled for Met-Ed. The initial sample sizes were calculated with a goal of achieving ±15% relative precision at the 85% confidence level with an assumed coefficient of variation (CV) of 0.5. ADM later calculated the error ratio from 42 sampled projects across all four FirstEnergy Pennsylvania electric distribution companies and found that the error ratio was close to 0.3 reinforcing the reasonableness of the sample. The distribution of verified vs. reported impacts, along with project-level realization rates, is shown in Figure 13-1.

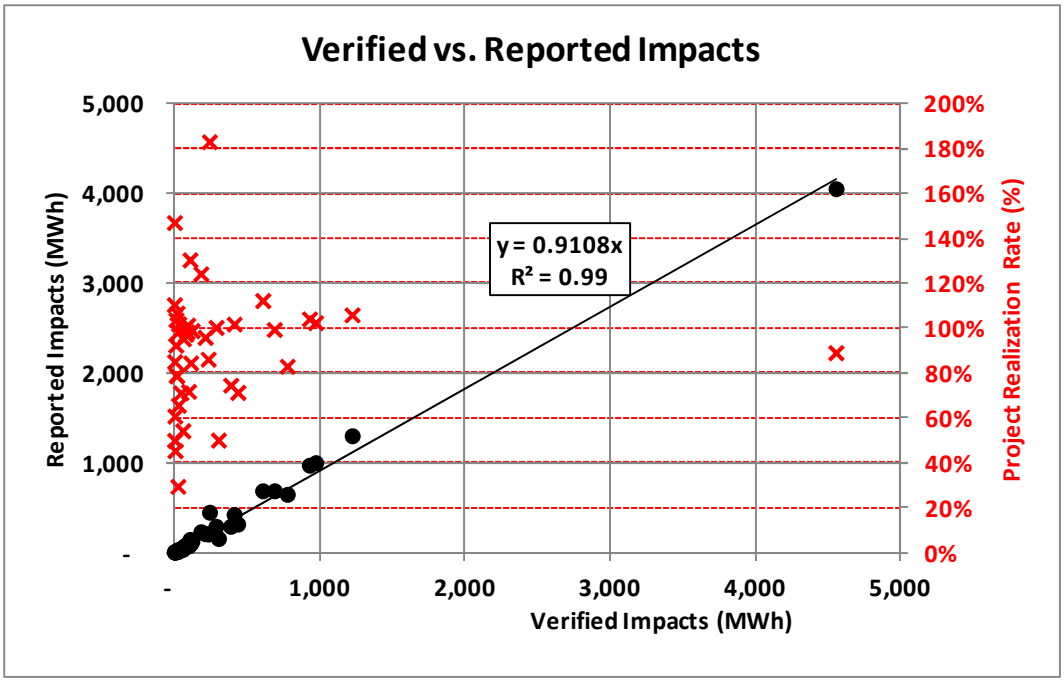

Figure 13-1. Verified vs. reported impacts during the top 100 hours for 42 projects sampled across all four EDCs.

Table 13-1: Sampling Strategy for PY4

Stratum	Strata Boundaries (MWh)	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Achieved Sample Size	Evaluation Activity
1	200	4	0.5	4	Independent CBL construction and top 100 hour overlap assessment
2	35	18	0.5	4	Independent CBL construction and top 100 hour overlap assessment
3	0	155	0.5	4	Independent CBL construction and top 100 hour overlap assessment
Program Total		177		12	

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program.

Table 13-2: PY4 Summary of Evaluation Results for Energy

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	PYTD TRM Verified Gross Demand Reduction (MW) (Retail)	CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)	CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)
1	22.65	93%	0.5	0%	20.98			
2	11.02	94%	0.5	32%	10.31			
3	12.30	101%	0.5	36%	12.40			
Program Total	45.97	98%		12.6%	43.69	51.20	51.20	51.20

13.3 . Impact Evaluation Net Savings

Net-to-gross research was conducted for this program by the statewide evaluator; therefore, the evaluation team did not conduct.

13.4 Process Evaluation

A process evaluation was not conducted for this program as it was a one-time offering not planned for Phase II.

13.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in **Table 13-3**

Table 13-3: Summary of Commercial / Industrial Large Sector Demand Response Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$40	$3,283	$3,663
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$40**	**$3,283**	**$3,663**
Design & Development	-$9	$4	$31
Administration[1]	-$1	$9	$20
Management[2]	$49	$173	$553
Marketing[3]	$3	$19	$73
Technical Assistance	$21	$40	$95
Subtotal EDC Implementation Costs	**$63**	**$245**	**$772**
EDC Evaluation Costs	$44	$113	$177
SWE Audit Costs	$19	$44	$196
Total EDC Costs[4]	$166	$3,685	$4,808
Participant Costs[5]	$40	$3,283	$3,663
Total TRC Costs[6]	**$147**	**$3,641**	**$4,612**
Total Lifetime Energy Benefits	$0	$0	$0
Total Lifetime Capacity Benefits	$0	$3,576	$3,576
Total TRC Benefits[7]	**N/A**	**$3,576**	**$3,576**
TRC Ratio[8]	**N/A**	**0.98**	**0.78**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

14 Governmental / Non-Profit Street Lighting Program

The Street Lighting program is offered to municipalities regardless of ownership of the street lights. This segment of the government program targeted the conversion of existing street lights to high pressure sodium units. In addition to street lights conversion, this program also provided an option to municipalities to upgrade existing outdoor area lights to high pressure sodium units and traffic and pedestrian signals to LEDs.

14.1 Program Updates

There were no changes to this program during PY4.

14.2 Impact Evaluation Gross Savings

The gross impact evaluation was identical to the PY2 and PY3 efforts. ADM conducted random sampling with on-site verifications. No metering is required as the lights operate dusk to dawn.

Table 14-1: Governmental / Non-Profit Street Lighting Program Reported Results by Quarter[53]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	1	7	0.00	0.00	0.00	0.00	0.00	0
PY4 Q2	0	0	0.00	0.00	0.00	0.00	0.00	0
PY4 Q3	0	0	0.00	0.00	0.00	0.00	0.00	0
PY4 Q4	0	0	0.00	0.00	0.00	0.00	0.00	0
PY4 Total	1	7	0.00	0.00	0.00	0.00	0.00	0
CPITD Total	236	4,981	0.00	0.00	0.00	0.00	0.00	3,212

[53] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 14-2: Governmental / Non-Profit Street Lighting Program Sampling Strategy for PY4

Stratum Name	Reported Gross Savings	Strata Boundaries	Population Size	Assumed CV	Achieved Sample	Evaluation Activity
CFL0	0	n/a	0	0.0	0	N/A
NSL0	0	100,000	0	0.4	0	N/A
NSL1	0	500,000	0	0.4	0	N/A
NSL2	0	n/a	0	0.4	0	N/A
SLB0	0	100,000	0	1.0	0	N/A
SLB1	0	500,000	0	1.0	0	N/A
SLB2	0	n/a	0	1.0	0	N/A
Prescriptive0	0	100,000	0	1.0	0	N/A
Prescriptive1	0	500,000	0	1.0	0	N/A
Prescriptive2	0	n/a	0	1.0	0	N/A
Custom0	0	40,000	0	1.0	0	N/A
Custom1	0	500,000	0	1.0	0	N/A
Custom2	0	n/a	0	1.0	0	N/A
SAL0	6,579	10,000	1	0.4	1	Desk review, In-Situ
SAL1	0	60,000	0	0.4	0	N/A
SAL2	0	n/a	0	0.4	0	N/A
Total	**6,579**	**n/a**	**1**	**n/a**	**1**	**-**

Table 14-3: PY4 Governmental / Non-Profit Street Lighting Program Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings
CFL0	0	n/a	0.0	n/a	
NSL0	0	n/a	0.4	n/a	
NSL1	0	n/a	0.4	n/a	
NSL2	0	n/a	0.4	n/a	
SLB0	0	n/a	1.0	n/a	
SLB1	0	n/a	1.0	n/a	
SLB2	0	n/a	1.0	n/a	
Prescriptive0	0	n/a	1.0	n/a	
Prescriptive1	0	n/a	1.0	n/a	
Prescriptive2	0	n/a	1.0	n/a	
Custom0	0	n/a	1.0	n/a	
Custom1	0	n/a	1.0	n/a	
Custom2	0	n/a	1.0	n/a	
SAL0	6,579	100%	0.4	0%	6,579
SAL1	0	n/a	0.4	n/a	
SAL2	0	n/a	0.4	n/a	
Total	**6,579**	**100%**	**n/a**	**0%**	**6,579**

There are no CPITD demand reductions reported for this program.

14.3 Impact Evaluation Net Savings

Net-to-gross research was not conducted for this program.

14.4 Process Evaluation

A process evaluation was not conducted for this program.

14.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in **Table 14-4**.

Table 14-4: Summary of Governmental / Non-Profit Street Lighting Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$0	$0	$3,212
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$0**	**$0**	**$3,212**
Design & Development	-$1	$0	$2
Administration[1]	$0	-$76	$3
Management[2]	$4	$11	$38
Marketing[3]	$0	$1	$5
Technical Assistance	$2	$3	$7
Subtotal EDC Implementation Costs	**$5**	**-$60**	**$55**
EDC Evaluation Costs	$2	$15	$46
SWE Audit Costs	$1	$3	$15
Total EDC Costs[4]	$8	-$42	$3,328
Participant Costs[5]	$0	$0.32	$833
Total TRC Costs[6]		**-$44**	**$934**
Total Lifetime Energy Benefits	$0	$6	$4,647
Total Lifetime Capacity Benefits	$0	$0	$0
Total TRC Benefits[7]	**N/A**	**$6**	**$4,647**
TRC Ratio[8]	**N/A**	**-0.13**	**4.98**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

15 Governmental / Non-Profit Program

This program targeted a small number of customers on special non-profit rates. They included volunteer fire companies, ambulance associations, some schools and municipal customers. This sector is eligible for all the incentive programs the small or large C/I sector is eligible for, including the Nonstandard Lighting, Heating Ventilating and Air-conditioning, Motors & Drives, Specialty Equipment and Custom. In March 2011, the Company received approval to enhance the program to include an opt-in CFL kit offering. Customers enrolled in this program were eligible to receive a single CFL kit or multiple CFL kits at no cost.

15.1 Program Updates

There were no changes to this program during PY4.

15.2 Impact Evaluation Gross Savings

The impact evaluation effort is identical to the 'Small Commercial/Industrial' program's effort, discussed in section 11.2.

Table 15-1: Governmental / Non-Profit Program Reported Results by Quarter[54]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	5	81	0.02	0.02	0.02	0.02	0.02	6
PY4 Q2	0	0	0.00	0.00	0.00	0.00	0.00	0
PY4 Q3	4	137	0.01	0.00	0.00	0.00	0.00	0
PY4 Q4	2	237	0.05	0.00	0.00	0.00	0.00	32
PY4 Total	11	455	0.09	0.02	0.02	0.02	0.02	39
CPITD Total	43	813	0.31	0.29	0.28	0.28	0.28	183

[54] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 15-2: Governmental / Non-Profit Program Sampling Strategy for PY4

Stratum Name	Reported Gross Savings	Strata Boundaries	Population Size	Assumed (Cv) or Proportion in Sample Design	Achieved Sample	Evaluation Activity
CFL0	0	25,000	0	0.0	0	N/A
NSL0	89,050	500,000	7	0.4	1	Desk review, In-Situ
NSL1	362,286	n/a	3	0.4	3	Desk review, In-Situ
NSL2	0	100,000	0	0.4	0	N/A
SLB0	3,335	500,000	1	0.6	1	Desk review, In-Situ
SLB1	0	n/a	0	0.6	0	N/A
SLB2	0	100,000	0	0.6	0	N/A
Prescriptive0	0	500,000	0	1.0	0	N/A
Prescriptive1	0	n/a	0	1.0	0	N/A
Prescriptive2	0	40,000	0	1.0	0	N/A
Custom0	0	500,000	0	0.6	0	N/A
Custom1	0	n/a	0	0.6	0	N/A
Custom2	0	10,000	0	0.6	0	N/A
SAL0	0	100,000	0	0.4	0	N/A
SAL1	0	n/a	0	0.4	0	N/A
SAL2	0	0	0	0.4	0	N/A
Total	**454,671**	**n/a**	**11**	**n/a**	**5**	**n/a**

Table 15-3: PY4 Governmental / Non-Profit Program Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings
CFL0	0	n/a	0.0	n/a	
NSL0	89,050	99%	0.4	53%	87,922
NSL1	362,286	99%	0.4	0%	357,237
NSL2	0	n/a	0.4	n/a	
SLB0	3,335	69%	0.6	0%	2,288
SLB1	0	n/a	0.6	n/a	
SLB2	0	n/a	0.6	n/a	
Prescriptive0	0	n/a	1.0	n/a	
Prescriptive1	0	n/a	1.0	n/a	
Prescriptive2	0	n/a	1.0	n/a	
Custom0	0	n/a	0.6	n/a	
Custom1	0	n/a	0.6	n/a	
Custom2	0	n/a	0.6	n/a	
SAL0	0	n/a	0.4	n/a	
SAL1	0	n/a	0.4	n/a	
SAL2	0	n/a	0.4	n/a	
Total	**454,671**	**98%**	**n/a**	**10%**	**447,448**

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program.

Table 15-4: PY4 Governmental / Non-Profit Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Demand Reduction
CFL0	0	n/a	0.0	n/a	
NSL0	10	99%	0.4	53%	10
NSL1	75	88%	0.4	0%	66
NSL2	0	n/a	0.4	n/a	
SLB0	1	90%	0.6	0%	1
SLB1	0	n/a	0.6	n/a	
SLB2	0	n/a	0.6	n/a	
Prescriptive0	0	n/a	1.0	n/a	
Prescriptive1	0	n/a	1.0	n/a	
Prescriptive2	0	n/a	1.0	n/a	
Custom0	0	n/a	0.6	n/a	
Custom1	0	n/a	0.6	n/a	
Custom2	0	n/a	0.6	n/a	
SAL0	0	n/a	0.4	n/a	
SAL1	0	n/a	0.4	n/a	
SAL2	0	n/a	0.4	n/a	
Total	**85**	**89%**	**n/a**	**7%**	**76**
CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)					**0.28**
CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)					**0.28**
CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)					**0.28**

15.3 Impact Evaluation Net Savings

Tetra Tech conducted a telephone survey of the C&I and Government/Non-profit Equipment programs participants from Program Year 3 in conjunction with the process evaluation research. Process and net-to-gross evaluations were completed for these sectors overall because the programs were designed, marketed, and operated essentially the same and participation was limited at the small, large, and government/non-profit sectors at the time of the evaluation effort. Caution is recommended when interpreting by sector. In Phase II, this will be reviewed and consideration given to an expanded effort, or separate efforts, if warranted.

15.4 Process Evaluation

Tetra Tech conducted a telephone survey of the C&I and Government/Non-profit Equipment programs participants from Program Year 3 in conjunction with the net-to-gross research. Process and net-to-gross evaluations were completed for these sectors overall because the programs were designed, marketed, and operated essentially the same and participation was limited at the small, large, and government/non-profit sectors at the time of the evaluation effort. In Phase II, this will be reviewed and consideration given to an expanded effort, or separate efforts, if warranted.

Evaluation Methodology

See Section 11. Commercial/Industrial Small Sector Equipment.

Key Findings

See Section 11. Commercial/Industrial Small Sector Equipment.

Table 15-5 : Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Government/Non-profit	
See Section 11. Commercial/Industrial Small Sector Equipment	

15.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in **Table 15-6**

Table 15-6: Summary of Governmental / Non-Profit Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$32	$39	$183
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$32**	**$39**	**$183**
Design & Development	$0	$0	$0
Administration[1]	$10	$7	$99
Management[2]	$0	$1	$3
Marketing[3]	$0	$0	$0
Technical Assistance	$0	$0	$1
Subtotal EDC Implementation Costs	**$10**	**$8**	**$104**
EDC Evaluation Costs	$3	$4	$5
SWE Audit Costs	$0	$0	$1
Total EDC Costs[4]	$45	$52	$293
Participant Costs[5]	$0	$145	$627
Total TRC Costs[6]		**$157**	**$736**
Total Lifetime Energy Benefits	$0	$372	$1,065
Total Lifetime Capacity Benefits	$0	$60	$247
Total TRC Benefits[7]	**N/A**	**$431**	**$1,312**
TRC Ratio[8]	**N/A**	**2.75**	**1.78**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

16 Governmental / Remaining Non-Profit Program

This sector is eligible for all the incentive programs the small or large C/I sector is eligible for, including the Nonstandard Lighting, Heating Ventilating and Air-conditioning, Motors & Drives, Specialty Equipment and Custom. In March 2011, the Company received approval to enhance the program to include an opt-in CFL kit offering. Customers enrolled in this program were eligible to receive a single CFL kit or multiple CFL kits at no cost.

16.1 Program Updates

There were no changes to this program during PY4.

16.2 Impact Evaluation Gross Savings

The impact evaluation effort is identical to the 'Small Commercial/Industrial' program's effort, discussed in section 11.2.

Table 16-1: Governmental / Remaining Non-Profit Program Reported Results by Quarter[55]

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Retail Level Reported Gross Demand Reduction (MW)	Generator Level Top 100 Reported Gross Demand Reduction (MW)	TRM Top 100 Verified Gross Demand Reduction (MW)	TRM Corrected Top 100 Verified Gross Demand Reduction (MW)	Evaluated Top 100 Verified Gross Demand Reduction (MW)	Incentives ($1000)
PY4 Q1	164	6,655	2.1	3.93	3.00	3.00	3.00	96
PY4 Q2	14	2,408	1.3	0.00	0.00	0.00	0.00	391
PY4 Q3	89	2,688	0.6	0.00	0.00	0.00	0.00	147
PY4 Q4	89	12,292	2.8	0.00	0.00	0.00	0.00	1,014
PY4 Total	356	24,043	6.7	3.93	3.00	3.00	3.00	1,647
CPITD Total	663	50,983	15.2	13.81	9.03	9.03	9.03	3,272

[55] For purposes of this report, all top 100 hour impacts are reported in PY4Q1.

Table 16-2: Governmental / Remaining Non-Profit Program Sampling Strategy for PY4

Stratum Name	Reported Gross Savings	Strata Boundaries	Population Size	Assumed CV	Achieved Sample	Evaluation Activity
CFL0	0	n/a	0	0.5	0	N/A
NSL0	5,192,085	100,000	191	0.4	4	Desk review, In-Situ
NSL1	6,744,877	600,000	32	0.4	4	Desk review, In-Situ
NSL2	4,784,110	n/a	2	0.4	2	Desk review, In-Situ
SLB0	0	100,000	0	0.6	0	N/A
SLB1	0	500,000	0	0.6	0	N/A
SLB2	0	n/a	0	0.6	0	N/A
Prescriptive0	642,846	100,000	48	1.0	1	Desk review, In-Situ
Prescriptive1	0	500,000	0	1.0	0	N/A
Prescriptive2	0	n/a	0	1.0	0	N/A
Custom0	1,818,271	285,000	28	0.6	1	Desk review, In-Situ
Custom1	259,534	500,000	1	0.6	1	Desk review, In-Situ
Custom2	1,367,629	n/a	1	0.6	1	Desk review, In-Situ
PV0	360,211	500,000	2	0.3	1	Simulation calibrated to generation records
PV1	2,596,750	750,000	4	0.3	2	Simulation calibrated to generation records
PV2	0	n/a	0	0.3	0	N/A
SAL0	80,335	10,000	27	0.4	2	Desk review, In-Situ
SAL1	196,345	100,000	14	0.4	1	Desk review, In-Situ
SAL2	0	n/a	0	0.4	0	N/A
Total	**24,042,993**	**n/a**	**350**	**n/a**	**20**	**n/a**

Table 16-3: PY4 Governmental / Remaining Non-Profit Program Summary of Evaluation Results for Energy

Stratum Name	Reported Gross Energy Savings	Realization Rate	Observed CV	Relative Precision	Verified Gross Energy Savings
CFL0	0	n/a	0.5	n/a	
NSL0	5,192,085	104%	0.4	28%	5,383,175
NSL1	6,744,877	104%	0.4	27%	7,001,257
NSL2	4,784,110	69%	0.4	0%	3,281,081
SLB0	0	n/a	0.6	n/a	
SLB1	0	n/a	0.6	n/a	
SLB2	0	n/a	0.6	n/a	
Prescriptive0	642,846	85%	1.0	142%	545,413
Prescriptive1	0	n/a	1.0	n/a	
Prescriptive2	0	n/a	1.0	n/a	
Custom0	1,818,271	93%	0.6	85%	1,694,681
Custom1	259,534	100%	0.6	0%	259,534
Custom2	1,367,629	100%	0.6	0%	1,367,629
PV0	360,211	131%	0.3	25%	471,407
PV1	2,596,750	111%	0.3	18%	2,889,514
PV2	0	n/a	0.3	n/a	
SAL0	80,335	100%	0.4	39%	80,366
SAL1	196,345	101%	0.4	56%	197,541
SAL2	0	n/a	0.4	n/a	
Total	**24,042,993**	**96%**	**n/a**	**13%**	**23,171,596**

The table below for demand reduction includes PYTD reported and verified demand reductions at the customer meter level for all impact evaluation sampling strata, and verified CPITD top 100-hour demand reductions at the generator level for the entire program.

Table 16-4: PY4 Governmental / Remaining Non-Profit Program Summary of Evaluation Results for Demand

Stratum Name	Reported Gross Demand Savings (kW)	Realization Rate	Observed CV	Relative Precision	Verified Gross Demand Savings (kW)
CFL0	0	n/a	0.5	n/a	
NSL0	1,158	78%	0.4	28%	903
NSL1	1,650	80%	0.4	27%	1,322
NSL2	645	86%	0.4	0%	555
SLB0	0	n/a	0.6	n/a	
SLB1	0	n/a	0.6	n/a	
SLB2	0	n/a	0.6	n/a	
Prescriptive0	620	53%	1.0	142%	327
Prescriptive1	0	n/a	1.0	n/a	
Prescriptive2	0	n/a	1.0	n/a	
Custom0	372	244%	0.6	85%	907
Custom1	27	100%	0.6	0%	27
Custom2	196	100%	0.6	0%	196
PV0	252	59%	0.3	25%	148
PV1	1,780	40%	0.3	18%	716
PV2	0	n/a	0.3	n/a	
SAL0	10	99%	0.4	39%	10
SAL1	29	101%	0.4	56%	29
SAL2	0	n/a	0.4	n/a	
Total	**6,739**	**76%**	**n/a**	**20%**	**5,141**
CPITD TRM Top 100 Verified Gross Demand Reduction (MW) (Generator)					**9.03**
CPITD TRM Corrected Top 100 Verified Gross Demand Reduction (MW) (Generator)					**9.03**
CPITD Evaluated Top 100 Verified Gross Demand Reduction (MW) (Generator)					**9.03**

16.3 Impact Evaluation Net Savings

Tetra Tech conducted a telephone survey of the C&I and Government/Non-profit Equipment programs participants from Program Year 3 in conjunction with the process evaluation research. Process and net-to-gross evaluations were completed for these sectors overall because the programs were designed, marketed, and operated essentially the same and participation was limited at the small, large, and government/non-profit sectors at the time of the evaluation effort. Caution is recommended when interpreting by sector. In Phase II, this will be reviewed and consideration given to an expanded effort, or separate efforts, if warranted.

16.4 Process Evaluation

Tetra Tech conducted a telephone survey of the C&I and Government/Non-profit Equipment programs participants from Program Year 3 in conjunction with the net-to-gross research. Process and net-to-gross evaluations were completed for these sectors overall because the programs were designed, marketed, and operated essentially the same and participation was limited at the small, large, and government/non-profit sectors at the time of the evaluation effort. In Phase II, this will be reviewed and consideration given to an expanded effort, or separate efforts, if warranted.

Evaluation Methodology

See Section 11. Commercial/Industrial Small Sector Equipment.

Key Findings

See Section 11. Commercial/Industrial Small Sector Equipment.

Table 16-5: Status Report for Process Evaluations

Recommendations	EDC Status Report for Process Evaluations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Government/Non-profit	
See Section 11. Commercial/Industrial Small Sector Equipment	

16.5 Financial Reporting

All program expenses were within approved budgets, and TRC results were within reasonable ranges. A breakdown of the program finances is presented in **Table 16-6**

Table 16-6: Summary of Governmental / Remaining Non-Profit Program Finances

	IQ ($1,000)	PYTD ($1,000)	CPITD ($1,000)
EDC Incentives to Participants	$1,012	$1,647	$3,272
EDC Incentives to Trade Allies	$0	$0	$0
Subtotal EDC Incentive Costs	**$1,012**	**$1,647**	**$3,272**
Design & Development	-$1	$0	$2
Administration[1]	$153	$403	$1,060
Management[2]	$3	$11	$36
Marketing[3]	$0	$1	$5
Technical Assistance	$2	$3	$7
Subtotal EDC Implementation Costs	**$158**	**$419**	**$1,110**
EDC Evaluation Costs	$8	$13	$38
SWE Audit Costs	$1	$3	$14
Total EDC Costs[4]	$1,179	$2,083	$4,434
Participant Costs[5]	$0	$25,646	$30,336
Total TRC Costs[6]		**$26,078**	**$31,484**
Total Lifetime Energy Benefits	$0	$19,771	$36,454
Total Lifetime Capacity Benefits	$0	$4,077	$7,173
Total TRC Benefits[7]	**N/A**	**$23,848**	**$43,627**
TRC Ratio[8]	**N/A**	**0.91**	**1.39**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011. Please see the "Report Definitions" section of this report for more details.

[1] Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical cost.

[2] Includes EDC program management, CSP program management, general management oversight, and major accounts.

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

[4] Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only.

[5] Per the 2011 Total Resource Cost Test Order, the net Participant Costs are the costs for the end-use customer.

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

[7] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits. Based upon verified gross kWh and kW savings. 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.

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

APPENDIX A: Evaluation: Residential Lighting Top 100 Hour Contributions

Overview - Top 100 Hour Demand Calculations

The top 100 hour calculations for all demand response and energy efficiency programs are calculated in accordance with Section 4 of the 2012 PA TRM[56]. To more accurately depict the load reductions associated with residential lighting, the Company presented additional evaluated load reductions for limited applicability during the top 100 hours of PY4. The additional evaluation results are referenced throughout this report as "Evaluated Top 100 hours MW Achieved"

Consistent with language in the TRMs supporting alternative evaluation methodologies[57], ADM Associates developed evaluation methodology for residential lighting very similar to that outlined in the SWE's guidance memo GM-004 for peak demand reduction calculations for nonresidential lighting. The approach used by Met-Ed for top 100 hour calculations is also in close alignment with updated protocols in the proposed 2014 TRM. Peak load reduction contributions of CFLs during the top 100 hours identified in accordance with Section 4 of the 2012 PA TRM are 16.6MW, based on evaluation results.

The evaluation approach:

a) Uses residential lighting load shapes and actual top 100 hours for the Met Ed system to define contributions of residential lighting during the summer of 2012,
b) Includes the impact of lighting load reduction on cooling (i.e., interactive effects).

Guidance Memo GM-004

This memo was released by SWE in February 22, 2011, specifically to address the measurement of coincidence factor as it pertains to the top 100 demand reduction target. The memo states:

"Act 129 requires reduction of "annual system peak demand in the 100 hours of highest demand." Because it is impossible to predict a priori the 100 hours of highest demand in any future year, the PA

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[56] Consistent with Section 1.8 of the State of Pennsylvania's *Technical Reference Manual*, published June 2012 allowing for correction or clarification of the TRM, the Company's demand reduction impacts in this Annual Report listed as "TRM Corrected Top 100 Hour MW Achieved" are calculated with a CFL coincidence factor of 8.8% for all residential CFLs installed in Phase I, unless otherwise noted. This 8.8% coincidence factor corrects the inaccurately referenced value (5%) from the TRM source document, *RLW Analytics, "Development of Common Demand Impacts for Energy Efficiency Measures/Programs for the ISO Forward Capacity Market (FCM)", prepared for the New England State Program Working Group (SPWG), March 25, 2007, p. IV*. Demand Reduction impacts calculated with the published 5% coincidence factor are referred to as "TRM Top 100 Hour MW Achieved."

[57] 2012 TRM Section 1.1: "The algorithms and methodologies set forth in this document must be used to determine EDC reported gross savings and evaluation measurement and verification (EM&V) verified savings, unless an alternative measurement approach or custom measure protocols is submitted and approved for use."

TRM 2010 (hereafter referred to as the TRM) has established a period of 12pm to 8pm, weekdays from June through September as a proxy to represent the 100 hours of highest demand for calculating the Coincident Peak Demand Savings. The TRM does not, however, describe how to use this proxy period to calculate the peak demand for the baseline and efficient measures for calculating the Coincident Peak Demand Savings."

The memo blends load shapes[58] for lighting energy savings with likelihoods of top 100 hour loads for the hours of noon to 8 PM. The primary application of the memo is for large non-residential lighting projects where a coincidence factor is not provided by the TRM, but is often determined by metering lighting hours of usage.

Lighting Energy Efficiency Evaluation Best Practices

For these large lighting projects, the PA TRM (as supplemented by GM-004) accurately reflects peak demand reductions. The accuracy of the PA Act 129 protocols for nonresidential lighting projects that require site-specific data collection for hours of use and coincidence factor determination is attributable to the following factors:

1. As outlined in GM-004, the evaluation requires the construction of lighting load shapes
2. The evaluation protocol accounts for additional peak demand reductions for air conditioning associated with the reduction of "waste heat" generated by inefficient lighting fixture.

The above two attributes are considered to be best practices in the evaluation of demand impacts for all lighting measures

Table 16-6 compares several evaluation protocols and technical resource manuals. Starting in 2014, the residential lighting demand reduction evaluation protocols in the PA TRM will be aligned with authoritative sources such as PJM, the Uniform Methods Projects, and, California's Database for Energy Efficiency Resources.

[58] A load shape as discussed in this document can be an End Use Load Shape or a Savings Load Shape. An End Use Load Shape is often normalized and reflects the likelihood that electric energy is utilized in a given hour for an end use. For lighting fixture retrofits, a given End Use Load Shape element is simply the likelihood that the light fixtures are utilized in the corresponding hour. In other words, it is the array of hourly coincidence factors. A Savings Load Shape has unit of energy and is the product of an End Use Load Shape and a connected load reduction. For example, if a 60W residential lamp has a 10% chance of being utilized in the hour ending 6 PM, then the End Use Load Shape element for that hour will be 0.1. If that lamp is replaced with a 15W CFL, then the Savings Load Shape element for that hour is 0.1 × (60 W – 15 W) = 4.5 Watt-hours. Given that the two lamps in this example have comparable light outputs, essentially all of this energy difference ends up in the infrared radiation spectrum, this the term *waste heat*.

Table 16-7. Summary of selected residential lighting evaluation protocols

Evaluation Protocol	Uses Lighting Load Shape?	Use Waste Heat Factor for Demand?
PJM Manual 18b	Yes	Yes
Database for Energy Efficiency Resources (DEER, CA TRM)	Yes	Yes
Regional Technical Forum (RTF)	Yes	Yes, uses DEER simulation results
Uniform Methods Project	Possible	Yes
PA TRM 2009-2013	Yes	No
PA Proposed TRM 2014	Yes	Yes

Met-Ed's evaluation of top 100 hour demand reduction impacts from residential CFLs uses the algorithm from the proposed 2014 PA TRM:

$$\Delta kW_{peak} = [(Watts_{base} - Watts_{CFL}) / 1000] \; X \; (1+IE_{kW}) \; X \; CF \; X \; ISR_{CFL}$$

Definition of Terms

$Watts_{base}$ = Wattage of baseline case lamp/fixture. For general service lamps prior to EISA 2007 standards, use equivalent incandescent bulb wattage. For general service lamps past EISA 2007 standards, use new standards to determine wattage.

$Watts_{CFL}$ = *Wattage of CFL*

IE_{kW} =*HVAC Interactive Effect for demand*

ISR_{CFL} = *In-service rate per CFL*

CF = *Demand Coincidence Factor*

Table 16-8. Summary of CFL Demand Reduction Calculation

Component	Type	Value	Sources
$Watts_{base}$	Variable	No change from TRM methods	
$Watts_{CFL}$	Variable	No change from TRM methods	Data Gathering
IF_{kW}	Variable	36%	Energy Plus simulations, diversified and calibrated to Met-Ed cooling End Use Load Shapes
ISR_{CFL}	Fixed	No change from Phase I TRM value of 84%	
CF	Fixed	11.82%	NMR/GDS/RLW NE 2009 Metering Study

CFL Load Shape

Several residential lighting metering studies were studied to find an appropriate end use load shape for residential CFLs. The studies are summarized below.

2009 Northeast Metering Study by NMR, RLW, and GDS

This study[59] metered 157 homes (657 loggers) in four states. The very large sample size enables the establishment of separate shapes for June, July, and August. It is noteworthy that this is the study that is cited for the 2.8 hours per day hours of use in the 2013 PA TRM and in the proposed 2014 TRM.

CA 2005 and 2010 CFL Metering Studies by KEMA and Cadmus

The residential lighting load shape has been metered extensively in the California CFL studies of 2005 and 2010. The 2005 study[60] installed meters in 375 homes while the 2010 study[61] installed meters in over

[59] *Residential Lighting Markdown Impact Evaluation* Nexus Market Research, RLW Analytics, and GDS Associates, http://www.env.state.ma.us/dpu/docs/electric/09-64/12409nstrd2ae.pdf

[60] *CFL Metering Study, Final Report* Prepared for PG&E, SGH&E, and SCE by KEMA.

[61] *Final Evaluation Report: Upstream Lighting Program Volume 1* Prepared for the CPUC Energy Division by KEMA

1200 homes. The load shape from the 2008 study is published in the report and is also available through California's DEER database. The sinusoidal fit that depicts the seasonality in CFL utilization is available from the 2010 metering study, but the report does not include an hourly load shape.

DEER 2008 Load Shape

The DEER 2008 CFL load shape results from adding heating and waste heat factors (IE_{kW}) to the KEMA 2005 load shape. Though inclusion of waste heat factor does boost peak demand savings by approximately 37%, the HCIF factors in DEER are specific to California's air conditioning stock and climate. It is not assumed that the same HCIF can be applied to PA, although independent simulations and engineering calculations show that the IE_{kW} will result in a similar increase in peak demand reductions for Met-Ed participants during the top 100 hours in 2012.

Combination of the 2005/2010 Load Shapes by ADM

ADM has constructed a load shape that combines the hourly characteristics from the KEMA 2005 study with the sinusoidal profile taken from the KEMA 2010 report. The sinusoidal seasonal profile tends to increase usage in winter, and decrease usage in summer. The 2010 study shows lower lighting utilization in the summer period than the 2005 study. However, both studies support similar coincidence factors provided the load shapes are scaled to the same annual hours of use. This savings profile is essentially identical to the KEMA 2005 savings profile as far as summer top 100 hours impacts are concerned.

EMPower MD Residential Lighting Load Shape by Cadmus and Navigant

This study occurred in two waves, with 61 homes metered in June through October 2010 and 70 homes metered in June-September 2011. A total of 377 lighting loggers provided data for this study. Although the study is nearby and recent (and results in more than 3 hours/day CFL usage), it is by far the smallest study in terms of sample size.

The four available load shapes are summarized in *Table 16-9* below.

Table 16-9. Summary of relevant residential lighting load shapes

Load Shape Source	# Homes/# Loggers	Average Top 100 Coincidence Factor for 5 EDCs	Notes
DEER 2008 (J.J. Hirsch)	375/983	15.47%	IF_{kW} added by DOE2 simulations
Northeast 2009 (NMR/GDS/RLW)	157/657	11.84%	No IF_{kW}; Source for 2.8 hours/day in 2013 TRM
CA 2005 (KEMA/Cadmus)	375/983	11.28%	No IF_{kW}
EMPower MD (Navigant/Cadmus)	131/377	8.60%	No IF_{kW}

Met-Ed uses the load shape from the NMR/GDS/RLW metering study from 2009 because it is based on a large and reputable metering study and because the data collection was recent and in a geographical area that is more closely aligned with Pennsylvania.

Met-Ed Specific Waste Heat Factor

The incremental demand reductions from cooling interaction are an important aspect of the overall CFL impacts. In CA, the DEER database update team has devoted considerable resources to calibrated simulations in DOE2. These simulations predict a 37% increase in demand reductions due to the interaction between lighting and cooling in the residential sector.

ADM developed a prototypical single family residence energy simulation in the EnergyPlus simulation framework. The prototypical model was developed based on data collected by the statewide evaluator (SWE) and presented in the *Pennsylvania Statewide Residential End-Use and Saturation Study*. Additional parameters were informed by the *Buildings Energy Data Book,* which is maintained by the US Department of Energy, and the residential prototypical models published by EnergyPlus. In addition to the data sources mentioned above, ADM utilized in-situ operating data for 16,000 participants in Met-Ed's residential demand reduction program to calibrate the prototypical model. Table 16-10 summarizes the main simulation inputs used in the residential prototypical model.

Table 16-10. Summary of ADM Simulation Inputs

Parameter	Value	Source
A/C Efficiency (SEER)	10.65	SWE Baseline Study (average for FirstEnergy EDCs)*
Wall Insulation R-Value	R-15	SWE Baseline Study (average for FirstEnergy EDCs)
Roof Insulation R-Value	R-26	SWE Baseline Study (average for FirstEnergy EDCs)
Floor Insulation R-Value	R-16	SWE Baseline Study (average for FirstEnergy EDCs)
Aspect Ratio	1.8:1	Residential EnergyPlus models developed for www.energycodes.gov
Square Footage	1,946	SWE Baseline Study (average for FirstEnergy EDCs)
Number of Occupants	2.4	SWE Baseline Study (average for FirstEnergy EDCs)
CFL Power Density	2 W/m^2	Engineering assumption based on experience*
Equipment Power Density	7 W/m^2	Engineering assumption based on experience*
Ventilation	Natural	Engineering assumption. **
Note that in large part the absolute magnitude of these parameters is less important than the shape of their hourly schedules (as it is the schedules that in large part dictate the end-use's coincidence with the air-conditioning equipment).		

Ventilation in the model is provided by windows opening when OA enthalpy is less than indoor enthalpy, the system is not running, and the OA temperature is within an appropriate range.

Although there is a single prototype, ADM achieved diversification by using several alternative HVAC and occupancy schedules, while keeping the cooling energy usage profile calibrated to primary data collected from Met-Ed's IDER program participants. The Energy Plus simulation engine is capable of performing hourly, and sub-hourly calculations. Hourly resolution is needed to characterize the dynamic nature of the waste heat interactive effect. The IF_{kW} factor, as determined by Energy Plus, is not a scalar multiplier, but is rather an hourly vector. This vector is combined with the CFL load shape to develop the top 100 hour impacts for residential lighting.

Calculation of Incremental Savings from CFL Impact Assessment

To calculate the full contribution of residential CFLs to the top 100 hour compliance goal, all verified demand reductions from residential programs are multiplied by the ratio of the new coincidence factor (adjusted down to 15% for simplicity, which includes IF_{kW}) to the TRM's CF. The top 100 hour contributions from programs involving CFLs are reflected in the corresponding evaluated program results.

APPENDIX B: CFL Cross-Sector Sales

Impact of Cross Sector Sales

It is well known and reasonable that some CFLs in the upstream programs are purchased and installed in nonresidential settings. As a result, these CFLs experience higher annual hours of use and higher peak demand impacts. ADM conducted a "random digit dial" (RDD) telephone survey for residential customers to assess the impact of cross sector sales.

The extrapolation from the residential surveys is straightforward. Out of 827 respondents (12,232 CFLs over the last two years), 23 reported installing a total of (579) CFLs in commercial settings. The fraction of CFLs that are installed in commercial settings is 579/12,232=4.89.

There are incremental demand reductions and incremental energy savings associated with the crossover of CFLs from the residential sector to the nonresidential sector. Met-Ed has not reported revised energy savings impacts for cross sector sales at this time. However, recognition of cross sector sales is necessary to report the full demand reduction impact of the upstream residential CFLs during the top 100 hours of 2012. The demand coincidence factor for CFLs rebated in the upstream program that crossed over to the nonresidential sector is 54%, and is taken from the PY3 metering and evaluation effort for nonresidential CFLs. Additionally, based on the facility types that the CFLs were reported to be installed in the surveys, ADM determined that at least 72% of the CFLs were installed in air conditioned spaces. The 2012 TRM's demand interactive factor IF_{kW} (34%) as listed in Table 3-5 is applied to this portion of the CFLs.