

# **Act 129 Statewide Evaluator Annual Report**

Program Year 2: June 1, 2010 – May 31, 2011

*Presented to:*

**Pennsylvania Public Utility Commission**

March 9, 2012

Prepared by The Statewide Evaluation Team:

**GDS Associates, Inc., Nexant, and Mondre Energy**

## Acknowledgements

The Statewide Evaluator (SWE) Team would like to thank the program staff and evaluation contractors at each of the seven Pennsylvania Electric Distribution Companies (EDCs) for their assistance over the past two years in providing data and information to the SWE Team about the costs, participants and savings of the EDC Act 129 programs that have been implemented to-date. The SWE Team especially appreciates the cooperation we have received from the EDCs, their evaluation contractors, and the Energy Association of Pennsylvania, as well as the many suggestions we have received from them to improve and streamline SWE audit and reporting activities. The SWE Team recognizes the long hours that the EDCs' staff have put in during the past two program years to design and launch programs and to monitor their progress.

The SWE Team would also like to thank the Staff of the Pennsylvania Public Utility Commission's (PA PUC, PUC or Commission) Bureau of Technical Utility Services (TUS) for their assistance and support since the beginning of the SWE project in September 2009. The TUS Staff have been instrumental in providing input to the updated Statewide Evaluator *Audit Plan* and in developing efficient processes for the review and approval of interim measure protocols for the Technical Reference Manual.

The findings, conclusions, and recommendations contained in the SWE's Draft Annual Report are the findings, conclusions, and recommendations of the SWE only and, as such, are not necessarily agreed to by the EDCs or the Commission. The Commission, while not adopting the findings, conclusions, and recommendations contained in the SWE's Annual Report, may consider and adopt some or all of them at a later date in appropriate proceedings, such as the annual Technical Reference Manual (TRM) update, Total Resource Cost (TRC) Test Order update, and individual EDC Energy Efficiency and Conservation (EE&C) Plan revision proceedings.

## Table of Contents

<b><u>ACKNOWLEDGEMENTS .....</u></b>	<b><u>I</u></b>
<b><u>TABLE OF CONTENTS.....</u></b>	<b><u>II</u></b>
<b><u>LIST OF ACRONYMS .....</u></b>	<b><u>X</u></b>
<b><u>1 EXECUTIVE SUMMARY .....</u></b>	<b><u>1</u></b>
<b><u>2 ANNUAL REPORT SUMMARY.....</u></b>	<b><u>5</u></b>
2.1 AGGREGATED EDC PORTFOLIO IMPACT SUMMARY .....	5
2.2 STATEWIDE EVALUATOR SUMMARY.....	5
<b><u>3 EDC IMPACT SUMMARIES .....</u></b>	<b><u>7</u></b>
3.1 STATEWIDE SUMMARY .....	7
3.2 DUQUESNE LIGHT .....	9
3.3 PECO .....	11
3.4 PPL.....	12
3.5 FIRST ENERGY COMPANIES .....	14
3.5.1 METROPOLITAN EDISON COMPANY.....	14
3.5.2 PENNSYLVANIA POWER COMPANY .....	16
3.5.3 PENNSYLVANIA ELECTRIC COMPANY .....	18
3.5.4 WEST PENN POWER .....	20
<b><u>4 PROGRAM IMPLEMENTATION AND EVALUATION SUMMARY BY EDC.....</u></b>	<b><u>22</u></b>
<b><u>5 STATUS OF EDC EVALUATION MEASUREMENT &amp; VERIFICATION ACTIVITIES .....</u></b>	<b><u>25</u></b>
5.1 STATUS OF EM&V PLANS .....	25
5.2 STATUS OF EDC MEASUREMENT AND VERIFICATION ACTIVITIES .....	25
5.2.1 DUQUESNE.....	26
5.2.2 PECO.....	29
5.2.3 PPL.....	32
5.2.4 FIRST ENERGY COMPANIES.....	34
5.2.4.1 Met-Ed .....	35

5.2.4.2 Penelec..... 36  
5.2.4.3 Penn Power..... 37  
5.2.5 WEST PENN POWER ..... 38

**6 STATEWIDE EVALUATOR PROGRAM AND EVALUATION SUPPORT ACTIVITIES ..... 41**

**6.1 TECHNICAL WORKING GROUP MEETINGS ..... 41**  
**6.2 STATUS OF TECHNICAL REFERENCE MANUAL UPDATE ..... 42**  
**6.3 INTERIM PROTOCOLS ..... 43**  
**6.4 DEMAND RESPONSE PROTOCOLS ..... 46**  
**6.5 TOTAL RESOURCE COST TEST ISSUES ..... 47**  
**6.6 NET TO GROSS ISSUES ..... 48**  
**6.7 EDC MEETINGS..... 49**

**7 STATEWIDE EVALUATOR AUDIT ACTIVITIES ..... 50**

**7.1 RESIDENTIAL PROGRAM AUDIT ACTIVITIES BY PROGRAM ..... 50**  
7.1.1 ENERGY EFFICIENCY PRODUCTS PROGRAMS..... 50  
7.1.1.1 Duquesne ..... 50  
7.1.1.1.1 Program Impact ..... 50  
7.1.1.2 FirstEnergy ..... 51  
7.1.1.2.1 Program Impact ..... 51  
7.1.1.3 PECO..... 51  
7.1.1.3.1 Program Impact ..... 51  
7.1.1.4 PPL..... 51  
7.1.1.4.1 Program Impact ..... 51  
7.1.2 APPLIANCE RECYCLING PROGRAMS..... 52  
7.1.2.1 Duquesne ..... 52  
7.1.2.1.1 Program Impact ..... 52  
7.1.2.2 FirstEnergy ..... 52  
7.1.2.2.1 Program Impact ..... 52  
7.1.2.3 PECO..... 53  
7.1.2.3.1 Program Impact ..... 53  
7.1.2.4 PPL..... 53  
7.1.2.4.1 Program Impact ..... 53  
7.1.3 LIGHTING PROGRAMS ..... 54  
7.1.3.1 Duquesne ..... 55  
7.1.3.1.1 Program Impact ..... 55  
7.1.3.2 PECO..... 56  
7.1.3.2.1 Program Impact ..... 56

7.1.3.3	PPL.....	57
7.1.3.3.1	Program Impact .....	57
7.1.3.4	FirstEnergy – Met-Ed, Penelec, Penn Power .....	58
7.1.3.4.1	Program Impact .....	58
7.1.3.5	West Penn Power .....	59
7.1.3.5.1	Program Impact .....	59
7.1.4	NEW CONSTRUCTION PROGRAMS .....	59
7.1.4.1	Sample Selection.....	60
7.1.4.2	REM/Rate Usage (kWh) Verification.....	60
7.1.4.3	REM/Rate Demand (kW) Verification .....	60
7.1.4.4	Verification of Construction of Homes .....	60
7.1.4.5	Program Costs.....	61
7.1.4.6	Issues.....	61
<b>7.2</b>	<b>LOW-INCOME PROGRAM AUDIT ACTIVITIES BY EDC .....</b>	<b>62</b>
7.2.1	SITE VISITS .....	62
7.2.1.1	West Penn Power .....	63
7.2.1.2	Duquesne .....	64
7.2.1.3	PECO.....	64
7.2.1.4	PPL.....	64
7.2.1.5	MetEd.....	64
7.2.1.6	Penelec.....	64
7.2.1.7	Penn Power.....	65
7.2.2	DESKTOP AUDITS.....	65
7.2.2.1	Site Visit Reports.....	65
7.2.2.1.1	PPL.....	65
7.2.2.1.2	Penelec.....	65
7.2.2.2	Energy Savings Calculations.....	66
7.2.2.2.1	West Penn Power .....	66
7.2.2.2.2	Duquesne .....	66
7.2.2.2.3	PECO.....	66
7.2.2.3	PPL.....	66
7.2.2.4	Met Ed.....	66
7.2.2.5	Penelec.....	67
7.2.2.6	Penn Power.....	67
7.2.3	PROGRAM COSTS .....	67
7.2.3.1	West Penn Power .....	67
7.2.3.2	Duquesne .....	67
7.2.3.3	PECO.....	68
7.2.3.4	PPL.....	69
7.2.3.5	Met-Ed .....	69
7.2.3.6	Penelec.....	70

7.2.3.7 Penn Power.....	71
<b>7.3 NON-RESIDENTIAL PROGRAM AUDIT ACTIVITIES BY EDC .....</b>	<b>71</b>
7.3.1 SITE-INSPECTION SUMMARY REPORT .....	72
7.3.2 DESKTOP AUDIT SUMMARY REPORT .....	74
7.3.3 DUQUESNE AUDIT REPORT .....	75
7.3.3.1 Review of Savings Database .....	76
7.3.3.2 Review of Project Files .....	77
7.3.3.3 Review of Report Consistency .....	80
7.3.4 PECO AUDIT REPORT .....	82
7.3.4.1 Review of Savings Database .....	83
7.3.4.2 Review of Project Files .....	84
7.3.4.3 Review of Report Consistency .....	86
7.3.5 PPL AUDIT REPORT .....	88
7.3.5.1 Review of Savings Database .....	89
7.3.5.2 Review of Project Files .....	91
7.3.5.3 Review of Report Consistency .....	96
7.3.6 FIRSTENERGY AUDIT REPORT.....	98
7.3.6.1 Review of Savings Database .....	100
7.3.6.2 Review of Project Files .....	103
7.3.6.3 Review of Report Consistency .....	103
7.3.7 WEST PENN POWER AUDIT REPORT .....	105
7.3.7.1 Review of Savings Database .....	106
7.3.7.2 Review of Project Files .....	108
7.3.7.3 Review of Report Consistency .....	111
<b>7.4 DEMAND RESPONSE AUDIT ACTIVITIES.....</b>	<b>112</b>
<b>7.5 TOTAL RESOURCE COST TEST AUDIT BY EDC .....</b>	<b>112</b>
7.5.1 DUQUESNE.....	114
7.5.1.1 Assumptions and Inputs .....	114
7.5.1.2 Avoided Costs of Energy .....	115
7.5.1.3 Avoided Cost of Capacity .....	115
7.5.1.4 Conclusions and Recommendations.....	115
7.5.2 PECO.....	116
7.5.2.1 Assumptions and Inputs .....	116
7.5.2.2 Avoided Costs of Energy .....	117
7.5.2.3 Avoided Cost of Capacity .....	117
7.5.2.4 Conclusions and Recommendations.....	117
7.5.3 PPL.....	118
7.5.3.1 Assumptions and Inputs .....	118
7.5.3.2 Avoided Costs of Energy .....	120
7.5.3.3 Avoided Cost of Capacity .....	120
7.5.3.4 Conclusions and Recommendations.....	120

7.5.4	FIRSTENERGY .....	120
7.5.4.1	Assumptions and Inputs .....	123
7.5.4.2	Avoided Costs of Energy .....	124
7.5.4.3	Avoided Cost of Capacity .....	124
7.5.4.4	Conclusions and Recommendations.....	124
7.5.5	WEST PENN POWER .....	125
7.5.5.1	Assumptions and Inputs .....	125
7.5.5.2	Avoided Costs of Energy .....	126
7.5.5.3	Avoided Cost of Capacity .....	126
7.5.5.4	Conclusions and Recommendations.....	127
<b>8</b>	<b><u>SUMMARY AND RECOMMENDATIONS .....</u></b>	<b><u>128</u></b>
	<b><u>APPENDIX A: FINDINGS FOR NON-RESIDENTIAL SITE INSPECTIONS .....</u></b>	<b><u>129</u></b>
	<b><u>APPENDIX B: GLOSSARY OF TERMS .....</u></b>	<b><u>135</u></b>

**List of Tables**

Table 1-1: EDC Compliance Goal Progress as of the End of Program Year 2 - Summary .....	3
Table 2-1: Summary of EDC Annual Report Impacts – Program Year 2.....	5
Table 3-1: Summary of EDC Energy and Demand Savings .....	7
Table 3-2: Summary of Duquesne Annual Report Impacts.....	9
Table 3-3: Summary of Program Impacts on Gross Reported Portfolio Savings – Duquesne .....	10
Table 3-4: Summary of PECO Annual Report Impacts .....	11
Table 3-5: Summary of Program Impacts on Gross Reported Portfolio Savings – PECO.....	11
Table 3-6: Summary of PPL Annual Report Impacts .....	12
Table 3-7: Summary of Program Impacts on Gross Reported Portfolio Savings – PPL.....	13
Table 3-8: Summary of Met-Ed Annual Report Impacts .....	14
Table 3-9: Summary of Program Impacts on Gross Reported Portfolio Savings – Met-Ed.....	15
Table 3-10: Summary of Penn Power Annual Report Impacts .....	16
Table 3-11: Summary of Program Impacts on Gross Reported Portfolio Savings – Penn Power .....	17
Table 3-12: Summary of Penelec Annual Report Impacts .....	18
Table 3-13: Summary of Impacts on Gross Reported Portfolio Savings – Penelec.....	19
Table 3-14: Summary of West Penn Power Annual Report Impacts .....	20
Table 3-15: Summary of Program Impacts on Gross Reported Portfolio Savings – West Penn Power.....	21
Table 4-1: Summary of Programs Implemented to Date by Duquesne.....	22
Table 4-2: Summary of Programs Implemented to Date by PECO .....	23
Table 4-3: Summary of Programs Implemented to Date by PPL .....	23
Table 4-4: Summary of Programs Implemented to Date by FirstEnergy - Met-Ed, Penelec, PennPower..	24
Table 4-5: Summary of Programs Implemented to Date by FirstEnergy – West Penn Power .....	24
Table 5-1: Duquesne Evaluation Groups.....	26
Table 5-2: Summary of Evaluation Group Realization Rates - Duquesne .....	27
Table 5-3: Summary of Program Realization Rates - Duquesne .....	27
Table 5-4: Summary of Program Realization Rates - PECO .....	29
Table 5-5: Summary of Program Realization Rates - PPL.....	32
Table 5-6: Summary of Evaluation Activities - Met-Ed .....	35
Table 5-7: Summary of Evaluation Activities - Penelec.....	36
Table 5-8: Summary of Evaluation Activities - Penn Power.....	37
Table 5-9: Summary of Evaluation Activities – West Penn Power.....	38
Table 6-1: Residential Interim Measure Protocols Approved.....	44
Table 6-2: Commercial & Industrial Interim Measure Protocols Approved .....	45
Table 6-3: Summary of Demand Response Programs To-Date.....	46
Table 6-4: Line Loss Factor by EDC and Sector .....	47
Table 6-5: Discount Rate by EDC.....	47
Table 7-1: Appliance Recycling Scenario TRM Savings Value .....	52
Table 7-2: PYTD Gross and Verified MWh and MW Savings – Residential CFL Lighting Programs .....	54
Table 7-3: Summary of CFL Program Audit - Duquesne .....	55



Table 7-4: Summary of CFL Program Audit - PECO .....	56
Table 7-5: Summary of CFL Program Audit - PPL .....	57
Table 7-6: Summary of CFL Program Audit – FirstEnergy – Met-Ed, Penelec, Penn Power .....	58
Table 7-7: Summary of CFL Program Audit – West Penn.....	59
Table 7-8: Summary of Residential New Construction Impact - FirstEnergy.....	59
Table 7-9: Summary of Low Income Program Costs and Variance – West Penn Power .....	67
Table 7-10: Summary of Low Income Program Cost Components and Variance – Duquesne.....	68
Table 7-11: Summary of Low Income Program Cost Components - PECO .....	68
Table 7-12: Summary of Low Income Program Costs and Variance – PECO .....	69
Table 7-13: Summary of Low Income Program Costs and Variance – PPL .....	69
Table 7-14: Summary of Low Income Program Costs and Variance – Met-Ed .....	70
Table 7-15: Summary of Low Income Program Costs and Variance – Penelec .....	70
Table 7-16: Summary of Low Income Program Costs and Variance – Penn Power.....	71
Table 7-17: Summary of Commercial and Industrial Site-Visits.....	72
Table 7-18: Duquesne Non-Residential Programs Annual Summary .....	75
Table 7-19: Duquesne Non-Residential Programs Savings Database Summary.....	76
Table 7-20: Duquesne Non-Residential Program Variances .....	77
Table 7-21: Duquesne Comparison of Sample File to Savings Database .....	79
Table 7-22: Sum of Impacts from Duquesne Quarterly Reports .....	81
Table 7-23: Variances between Duquesne Quarterly Reports and PY2 Report .....	82
Table 7-24: PECO Non-Residential Programs Annual Summary .....	83
Table 7-25: PECO Non-Residential Programs Savings Database Summary .....	84
Table 7-26: PECO Non-Residential Program Variances.....	84
Table 7-27: PECO Comparison of Project Files to Savings Database .....	85
Table 7-28: Sum of Impacts from PECO Quarterly Reports .....	87
Table 7-29: Variances between PECO Quarterly Reports and PY2 Report .....	87
Table 7-30: PPL Non-Residential Programs Annual Summary .....	88
Table 7-31: PPL Non-Residential Programs Savings Database Summary .....	90
Table 7-32: PPL Non-Residential Program Variances .....	91
Table 7-33: PPL Commercial Database-Project Files Comparison .....	94
Table 7-34: Sum of Impacts from PPL Quarterly Reports .....	97
Table 7-35: Variances between PPL Quarterly Reports and PY2 Report.....	98
Table 7-36: Met-Ed Non-Residential Programs Annual Summary.....	99
Table 7-37: Penelec Non-Residential Programs Annual Summary .....	99
Table 7-38: Penn Power Non-Residential Programs Annual Summary .....	100
Table 7-39: Met-Ed Non-Residential Programs Savings Database Summary .....	101
Table 7-40: Penelec Non-Residential Programs Savings Database Summary .....	101
Table 7-41: Penn Power Non-Residential Programs Savings Database Summary.....	101
Table 7-42: Met-Ed Non-Residential Program Variances .....	102
Table 7-43: Penelec Non-Residential Program Variances.....	102
Table 7-44: Penn Power Non-Residential Program Variances.....	102

Table 7-45: Sum of Impacts from Met-Ed Quarterly Reports.....	103
Table 7-46: Sum of Impacts from Penelec Quarterly Reports .....	103
Table 7-47: Sum of Impacts from Penn Power Quarterly Reports .....	104
Table 7-48: Variances between Met-Ed Quarterly Reports and PY2 Report.....	104
Table 7-49: Variances between Penelec Quarterly Reports and PY2 Report .....	105
Table 7-50: Variances between Penn Power Quarterly Reports and PY2 Report .....	105
Table 7-51: West Penn Non-Residential Programs Annual Summary .....	106
Table 7-52: West Penn Non-Residential Programs Savings Database Summary.....	107
Table 7-53: West Penn Non-Residential Program Variances.....	107
Table 7-54: West Penn Commercial Database-Project Files Comparison .....	109
Table 7-55: Sum of Impacts from West Penn Quarterly Reports .....	111
Table 7-56: Variances between West Penn Quarterly Reports and PY2 Report .....	111
Table 7-57: Summary of Residential TRC Audit Findings. ....	113
Table 7-58: TRC Benefit-Cost Ratios – Duquesne .....	114
Table 7-59: TRC Benefit-Cost Ratios – PECO .....	116
Table 7-60: TRC Benefit-Cost Ratios – PPL.....	118
Table 7-61: Application of Realization Rate in PPL TRC Model.....	119
Table 7-62: TRC Benefit-Cost Ratios – Met-Ed.....	121
Table 7-63: TRC Benefit-Cost Ratios – Penelec.....	122
Table 7-64: TRC Benefit-Cost Ratios – Penn Power .....	123
Table 7-65: TRC Benefit-Cost Ratios – West Penn Power .....	125

## List of Acronyms

<b>B/C Ratio:</b> Benefit-Cost Ratio	<b>IQ:</b> Incremental Quarterly
<b>C&amp;I:</b> Commercial and Industrial	<b>kW:</b> Kilowatt
<b>CFL:</b> Compact Fluorescent Light	<b>kWh:</b> Kilowatt-Hour <b>M&amp;V:</b> Measurement and Verification
<b>CMP:</b> Custom Measure Protocol	<b>MW:</b> Megawatt
<b>CPITD:</b> Cumulative Program Inception To-Date	<b>MWh:</b> Megawatt-Hour
<b>Cv:</b> Coefficient of Variance	<b>NP:</b> Non-Profit
<b>CSP:</b> Conservation Service Provider	<b>NPV:</b> Net Present Value
<b>The Commission:</b> The Pennsylvania Public Utility Commission	<b>NTG:</b> Net-to-Gross, Net-to-Gross Ratio
<b>DLC:</b> Direct Load Control	<b>PA PUC:</b> Pennsylvania Public Utility Commission
<b>DR:</b> Demand Response	<b>PUC:</b> Se PA PUC
<b>DSM:</b> Demand Side Management	<b>PY:</b> Program Year
<b>EDC:</b> Electric Distribution Company	<b>PYTD:</b> Program Year to Date
<b>EE:</b> Energy Efficiency	<b>RR:</b> Realization Rate
<b>EE&amp;C:</b> Energy Efficiency and Conservation	<b>SEER:</b> Seasonal Energy Efficiency Ratio
<b>EER:</b> Energy Efficient Ratio	<b>SEM:</b> Simple Engineering Model
<b>EER:</b> Energy Efficiency Resource	<b>SSMVP:</b> Site Specific M&V Plan
<b>EFLH:</b> Equivalent Full Load Hours	<b>SWE:</b> Statewide Evaluator
<b>EM&amp;V:</b> Evaluation, Measurement and Verification	<b>SWE Team:</b> Statewide Evaluation Team
<b>EUL:</b> End of Useful Life	<b>TOU:</b> Time of Use
<b>GNP:</b> Government and Non-Profit	<b>TRC:</b> Total Resource Cost Test
<b>HOU:</b> Hours of Use	<b>TRM:</b> Technical Reference Manual
<b>HSPF:</b> Heating Seasonal Performance Factor	<b>TUS:</b> Bureau of Technical Utility Services
<b>HVAC:</b> Heating, Ventilation, and Air Conditioning	<b>TWG:</b> Technical Working Group
<b>IMP:</b> Interim Measure Protocol	<b>VFD:</b> Variable Frequency Drive
<b>IPMVP:</b> International Performance Measurement and Verification Protocol	

*Please see Appendix B for glossary of terms.*

## 1 Executive Summary

The Pennsylvania Public Utility Commission (PA PUC, PUC or Commission) was charged by the Pennsylvania General Assembly pursuant to Act 129 of 2008 (Act 129) with establishing an energy efficiency and conservation (EE&C) program. The seven Electric Distribution Companies (EDCs) subject to Act 129 include<sup>1</sup>: West Penn Power Company d/b/a Allegheny Power (West Penn or West Penn Power);<sup>2</sup> Duquesne Light Company (Duquesne); the FirstEnergy companies – Metropolitan Edison Company (Met-Ed), Pennsylvania Electric Company (Penelec), and Pennsylvania Power Company (Penn Power); PECO Energy Company (PECO), and PPL Electric Utilities (PPL). Stated below is the section of Act 129 that discusses the kWh and kW savings targets to be achieved by May 31, 2011 and by May 31, 2013:

66 Pa. C.S. §§ 2806.1 and 2806.2 – The EE&C program requires each Electric Distribution Company (EDC) with at least 100,000 customers to adopt a plan to reduce energy demand and consumption within its service territory. Each EDC, through its approved plan, is to reduce electric consumption by May 31, 2011, by at least 1% of its expected consumption for June 1, 2009 through May 31, 2010. By May 31, 2013, the total annual consumption is to be reduced by a minimum of 3% of its consumption for June 1, 2009 through May 31, 2010. Also, by May 31, 2013, each covered EDC's peak demand is to be reduced by a minimum of 4.5% of the EDC's annual system peak demand in the 100 hours of highest demand, measured against the EDC's peak demand during the period of June 1, 2007 through September 30, 2007.

In order to fulfill this obligation, on January 16, 2009, the Commission entered an Implementation Order at Docket No. M-2008-2069887. As part of the Implementation Order and Act 129, the Commission sought a Statewide Evaluator (SWE or SWE Team) to evaluate the EDCs' EE&C programs. GDS Associates, partnered with Nexant and Mondre Energy, was retained as the PA SWE to fulfill requirements of the Implementation Order and Act 129. The SWE Team is contracted to monitor and verify EDC data collection, quality assurance processes and performance measures, by customer class. The SWE Team has other contractual obligations, including reviewing the Technical Reference Manual (TRM) information and savings values and developing recommendations for possible revisions and additions.

This report is the second annual report from the SWE Team to the PA PUC. This report provides detailed information on the findings of the SWE Team's Program Year Two (PY2) audit activities of the Act 129 EE&C programs implemented by seven EDCs in Pennsylvania. PY2 started June 1, 2010 and ended May 31, 2011. The PY2 evaluation includes:

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<sup>1</sup> EDCs within the state of Pennsylvania with over 100,000 customer are subject to the energy efficiency targets outlined in Act 129.

<sup>2</sup> While West Penn Power has since merged with the First Energy Companies, it will be referred to as a separate company for purposes of this report.

- An analysis of plan and program impacts (demand and energy savings) and cost-effectiveness,
- A report of results, and recommendations for program and plan improvements,
- Recommendations for improvements to the TRM, and
- Recommendations relating to changes proposed by some of the EDCs to their EE&C plans.

Contents of this report address:

- The status of programs (Section 2),
- Discussion of the SWE's methodology and approach to developing its findings and recommendations relative to processes and reported values (Section 3),
- Key qualitative findings and recommendations related to programs and measurement and verification (M&V) processes based on observations, site visits with EDCs and other field work (Section 4),
- Findings and recommendations related to evaluation, measurement and verification (EM&V) processes and practices by program and EDC (Section 5),
- Quantitative findings and recommendations by program and EDC, including recommendations for the upgrade of the TRM (Section 6),
- A summary of findings and recommendations (Section 7), and
- A List of Acronyms (beginning of document) and a Glossary of Terms (Appendix B).

Overall, while the SWE Team identified minor errors in the kWh and kW savings that were reported for some of the EDCs for PY2, the errors were very small (less than 1% of reported savings<sup>3</sup>). When errors have been identified by the SWE Team relating to PY2 program savings, the EDCs corrected them and these corrections are reflected in the PY2 savings numbers reported by the EDCs to the Commission.

The SWE Team would like to thank all of the EDCs and the PA PUC staff for providing their feedback and comments on draft versions of site-reports and audit findings, which have been incorporated in to this draft SWE Annual Report. Their edits and recommendations have helped to clarify and improve this report. The SWE Team, the PA PUC staff, the EDCs and the EDC evaluation contractors have worked hard to develop a solid foundation for the EM&V of the Act 129 energy efficiency and demand response programs. The SWE Team anticipates that improvements will continue to be made to the Statewide Evaluation audit processes, and we appreciate the support and responsiveness of the EDCs and their evaluation contractors.

As of May 31, 2011, the seven EDCs have collectively saved over 2,044,765 MWh and 297.01 MW.<sup>4</sup> These savings are attributable to 91 EE&C programs implemented by the seven EDCs and evaluated in PY2. The SWE Team and the EDCs expect that the annual savings will only grow as additional programs are implemented, existing programs mature, and evaluation findings and best-practices are

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<sup>3</sup> This is considered acceptable by the SWE Team and is typical of industry best practices.

<sup>4</sup> Savings represent gross energy and demand savings achieved to-date.

incorporated into program delivery. The following table provides a status update on each EDC's progress towards reaching its 2011 and 2013 savings targets as of the end of PY2 on May 31, 2011.

**Table 1-1: EDC Compliance Goal Progress as of the End of Program Year 2<sup>5</sup> - Summary**

<b>% of Target Achieved</b>	<b>Statewide</b>	<b>Duquesne</b>	<b>PECO</b>	<b>Penelec</b>	<b>Penn Power</b>	<b>PPL</b>	<b>Met-Ed</b>	<b>West Penn Power</b>
% of 2011 Energy Savings Target	158%	119.5%	221.7%	128.0%	139.6%	133.3%	122.2%	43.2%
% of 2013 Energy Savings Target	53%	39.8%	73.9%	42.7%	46.5%	44.4%	40.7%	14.4%
% of 2013 Demand Reduction Target	28%	17.3%	42.0%	20.5%	16.4%	22.1%	19.7%	9.7%

In PY2, the SWE Team conducted an audit of the following general program categories and evaluations performed by the EDCs' EM&V contractors:

- Residential Programs:
  - Compact Fluorescent Lighting Programs,
  - Appliance Recycling Programs,
  - Efficient Equipment Programs,
  - New Construction, and
  - Low-Income Programs.
- Non-Residential Programs:
  - Commercial and Industrial (C&I) Equipment, For-Profit,
  - C&I Equipment, Non-Profit and Government,
  - C&I Performance Contracting, and
  - Conservation Voltage Reduction.

A comprehensive list of programs evaluated is contained in Section 3 of this report.

Based upon PY2 audit findings and a review of the up-to-date impact evaluations, the SWE recommends the following:<sup>6</sup>

- The PY2 kWh and kW savings numbers provided in the EDC PY2 annual reports should be accepted by the Commission.
- The SWE Team, the PUC's Technical Utility Services (TUS) staff and the EDCs should continue to work together during PY3 to develop the incremental cost data base for all energy efficiency measures included in the Act 129 energy efficiency programs.
- The SWE Team, the PUC's TUS staff and the EDCs should continue to develop Guidance Memos to address detailed technical issues that arise in PY3 relating to the development and reporting of kWh and kW savings and Total Resource Cost test calculations.

<sup>5</sup> Percentage of compliance target achieved calculated using verified Cumulative Program/Portfolio Inception to Date values divided by compliance target value.

<sup>6</sup> These recommendations are based on SWE findings that are summarized in greater detail throughout this Annual Report.

- The SWE Team, the PUC's TUS staff and the EDCs should review the findings from EDC process and impact evaluations at the next SWE program evaluation workshop to continue the process of reviewing and modifying Act 129 programs to ensure that they are as effective as possible.

The remainder of the SWE Annual Report submitted to the PA PUC is structured to provide the following:

- An analysis and assessment of each EDC's plan and program expenditures;
- An analysis of each EDC's protocol for M&V of energy savings attributable to its plan, in accordance with the Commission adopted TRM and approved custom measure protocols (CMPs);
- An analysis of the cost-effectiveness of each EDC's expenditures in accordance with the Commission adopted TRC Test Order;
- Identification of best practices;
- A review of Pennsylvania TRM information and savings values with suggestions for possible revisions and additions;
- A review of the TRC Test calculation procedures included in the Commission's 2009 and 2011 TRC Orders with suggestions for possible revisions and additions; and
- A review of any proposed revisions and updates to EDC EE&C plans.

This report also explains where kWh and kW savings calculations need to be revised based upon the SWE audit findings, and summarizes the revisions needed to the TRM in order to provide more accurate and reliable calculations of kWh and kW savings by each EDC. It is the SWE Team's recommendation in this Annual Report that the verified savings reported by the EDCs in their respective PY2 Annual Reports remain as filed and that no revisions to the savings for PY2 are required. The SWE Team has provided suggestions in this report for refining savings calculations and program implementation designs going forward, but the impacts on PY2 savings are minimal and fall within the acceptable range of variance expected for the verified Act 129 kWh and kW savings.<sup>7</sup> Based on the SWE Team findings and EDC corrections, PY2 reported and verified savings will not be adjusted by the SWE.

The findings, conclusions, and recommendations contained in the SWE's Annual Report are the findings, conclusions, and recommendations of the SWE only and, as such, are not necessarily agreed to by the EDCs or the Commission. The Commission, while not adopting the findings, conclusions, and recommendations contained in the SWE's Annual Report, may consider and adopt some or all of them at a later date in appropriate proceedings, such as the annual TRM update, Total Resource Cost (TRC) Test Manual update, and individual EDC EE&C Plan revision proceedings.

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<sup>7</sup> The industry standard for variance is typically  $\pm 10\%$  variance at a 90% confidence level.

## 2 Annual Report Summary

The following sections present a summary of the EDC program impacts and Statewide Evaluator (SWE) activities completed to date.

### 2.1 Aggregated EDC Portfolio Impact Summary

Table 2-1 presents the seven EDCs' aggregated Program Year to Date (PYTD) reported savings, as well as aggregated PYTD verified, gross MWh and MW impacts. All savings reported in this report as "MWh" or "kWh" represent the annualized energy savings values per the TRM and compliance targets.

For PY2, the Act 129 program Total Resource Cost Test (TRC) benefits for all seven EDCs combined outweigh program TRC costs by a ratio of 3.59 to 1.

**Table 2-1: Summary of EDC Annual Report Impacts – Program Year 2**

	<b>PYTD Reported Gross Impact</b>	<b>PYTD Verified Impact</b> <sup>[a]</sup>	<b>PYTD Net Impact</b> <sup>[b]</sup>
Total Energy Savings (MWh)	1,857,944	1,792,790	1,792,790
Total Demand Reduction (MW)	287.33	275.64	275.64
TRC Benefits (\$) <sup>[c]</sup>	N/A	\$1,615,397,980	N/A
TRC Costs (\$) <sup>[d]</sup>	N/A	\$517,547,424	N/A
TRC Benefit-Cost Ratio <sup>[e,f]</sup>	N/A	3.59	N/A
CO <sub>2</sub> Emissions Reduction <sup>[g]</sup> (Tons)	1,504,935	1,452,160	1,452,160

**NOTES:**

[a] Adjusted by applying realization rate determined by independent EM&V contractor to the Portfolio PYTD Reported Gross Impact, which is calculated by aggregating Program PYTD Verified Impacts. Program PYTD Verified Impacts are calculated by multiplying Program PYTD Reported Gross Impacts by program realization rates.

[b] Adjusted by applying net-to-gross ratio to the Portfolio PYTD Verified Impact, which is calculated by aggregating Program Net Impacts. Program Net Impacts are calculated by multiplying Program PYTD Verified Impacts by program Net-to-Gross ratios. Net-to-Gross ratio is 1.0 for Program Year 2.

[c] Avoided supply costs, taking into account line loss factors, 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. Subject to TRC Order.

[d] Costs paid by the program administrator and participants plus the increase in supply costs for any period when load is increased. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.

[e] These TRC ratios are calculated according to the PUC's 2009 and 2011 TRC Orders

[f] This ratio is calculated by dividing the TRC benefits for all seven EDCs combined by the TRC costs for all seven EDCs combined.

[g] 8.1x10<sup>-4</sup> metric tons of CO<sub>2</sub> per kWh (EPC's eGRID2007 Version 1.1, RFCE Region annual non-baseload CO<sub>2</sub> output emissions rate, year 2005 data).

### 2.2 Statewide Evaluator Summary

Below is a summary of the audit activities undertaken by the SWE Team during Program Year 2 (PY2).

The SWE has reviewed the EDC PY2 Annual Reports for completeness against the requirements of the SWE *Audit Plan*. The SWE reviewed the available PYTD gross impacts, interim verified impacts and



interim net impacts for each EDC as well as all EDC calculations for TRC ratios for PY2. The SWE Team audit activities and findings related to the savings reported in the EDCs' quarterly reports can be found in Section 7 of this report.

A summary of the SWE Team findings includes the following:

- During the course of conducting audit activities for PY2, the SWE Team found minor calculation and data entry errors for a number of EDC programs. When such minor calculation or data entry errors were identified, the SWE Team notified the EDC where the issue existed. Each EDC then corrected such calculation and data entry errors where appropriate.
- For this report, the SWE Team has provided suggestions for refining savings calculations and program implementation designs going forward, but the impacts on PY2 savings are minimal and fall within the acceptable range of variance expected for the verified Act 129 kWh and kW savings. Based on the SWE Team findings and EDC corrections, PY2 reported and verified savings will not be adjusted by the SWE Team.
- This report also explains where kWh and kW savings calculations needed to be revised based upon the SWE audit findings, and summarizes the revisions that will be needed to the TRM in order to provide more accurate and reliable calculations of kWh and kW savings by each EDC.
- It is the SWE Team's recommendation in this Annual Report that the verified savings reported by the EDCs in their respective PY2 Annual Reports remain as filed.

Key SWE Team activities during the PY2 time period included the following:

- Weekly Team Meetings with Technical Utility Services (TUS) Staff
- Bi-Weekly Team Meetings with EDC Evaluation Teams<sup>8</sup>
- Technical Working Group (TWG) Meetings<sup>9</sup>
- Annual Audit Plan Update – Submitted February 28, 2011
- 2012 Technical Reference Manual (TRM) – Order adopted December 15, 2011.
- Total Resource Cost (TRC) Test Order Update – Order adopted July 28, 2011.
- Desk Audits for the following residential programs:
  - CFL Residential Lighting Programs
  - Appliance Recycling Programs
  - Efficient Products Programs
  - Residential New Construction Programs
  - Low income programs
- 152 Low-Income site visits
- 97 Commercial & Industrial site inspection: 65 ride-alongs and 41 independent site visits
- Verification of program kWh and kW savings calculations for all programs
- Verification of EDC calculations of TRC test benefit-cost ratios for PY2

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<sup>8</sup> EDC evaluation teams typically include a representative(s) from both the EDC and their EM&V contractor.

<sup>9</sup> TWG members include TUS staff, the SWE team, EDC representatives, EDC EM&V contractor representative, and Pennsylvania Energy Association representatives.

### 3 EDC Impact Summaries

The following tables summarize the current savings for each EDC; each table includes a column that presents the reported impacts as a percentage of the 2011 and 2013 total EDC savings targets during PY2. The “% of 2011 Energy Savings Target Achieved” is based on the verified savings through May 31, 2011.

#### 3.1 Statewide Summary

The following table contains a summary of the energy and demand savings impacts of each EDC during PY2:

**Table 3-1: Summary of EDC Energy and Demand Savings<sup>10</sup>**

	Statewide	Duquesne	PECO	Penelec	Penn Power	PPL	Met-Ed	West Penn
Program Year to Date (PYTD) Reported Gross <sup>11</sup> Energy Savings (MWh)	<b>1,857,944</b>	168,856	732,226	180,470	62,780	452,070	171,282	90,260
PYTD Verified <sup>12</sup> Energy Savings (MWh)	<b>1,792,790</b>	164,848	713,313	171,396	61,036	425,208	169,421	87,568
Cumulative Program Inception to Date (CPITD) Reported Gross Energy Savings (MWh)	<b>2,140,931</b>	172,433	889,859	194,047	68,971	533,526	185,929	96,166
CPITD Verified Energy Savings (MWh)	<b>2,073,981</b>	168,336	873,192	184,261	66,630	509,361	181,681	90,520
<b>% of 2011 Energy Savings Target Achieved</b>	<b>N/A</b>	<b>119.5%</b>	<b>221.7%</b>	<b>128.0%</b>	<b>139.6%</b>	<b>133.3%</b>	<b>122.2%</b>	<b>43.2%</b>
<b>% of 2013 Energy Savings Target Achieved</b>	<b>N/A</b>	<b>39.8%</b>	<b>73.9%</b>	<b>42.7%</b>	<b>46.5%</b>	<b>44.4%</b>	<b>40.7%</b>	<b>14.4%</b>
PYTD Reported Gross Demand Reduction (MW)	<b>287.33</b>	19.09	138.70	23.87	6.91	63.30	22.16	13.30
PYTD Verified Demand Reduction (MW)	<b>275.65</b>	18.50	136.70	20.82	6.82	58.32	22.29	12.20
CPITD Reported Gross Demand Reduction (MW)	<b>311.26</b>	20.12	151.20	25.30	7.35	69.46	23.53	14.30
CPITD Verified Demand Reduction (MW)	<b>302.44</b>	19.50	149.20	22.10	7.20	65.64	23.50	12.70
<b>% of 2013 Demand Reduction Target</b>	<b>N/A</b>	<b>17.3%</b>	<b>42.0%</b>	<b>20.5%</b>	<b>16.4%</b>	<b>22.1%</b>	<b>19.7%</b>	<b>9.7%</b>

#### Cumulative Portfolio Energy Impacts

- The CPITD reported gross energy savings is 2,140,931 MWh.
- The CPITD verified energy savings is 2,073,981 MWh.

<sup>10</sup> All savings are reported at the customer meter.

<sup>11</sup> Gross savings represent change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated.

<sup>12</sup> Verified gross savings is calculated by applying the realization rate to reported gross impacts. Realization rate is a term used in several contexts in the development of reported program savings. The primary applications include the ratio of project tracking system savings data (e.g. initial estimates of project savings) to savings (a) adjusted for data errors and (b) that incorporate evaluated or verified results of the tracked savings.

### **Portfolio Demand Reduction<sup>13</sup>**

- The CPITD reported gross demand reduction is 311.26 MW.
- The CPITD verified demand reduction is 302.44 MW.

### **Low Income Sector**

- The number of measures offered to the Low-Income Sector comprises 24% of the total number of measures offered through all programs.
- The CPITD reported gross energy savings for low-income sector programs is 212,048 MWh.
- The CPITD verified energy savings for low-income sector programs is 208,797 MWh.

### **Government and Non-Profit Sector**

- The CPITD reported gross energy savings for government and non-profit sector programs is 227,235 MWh.
- The percentage of CPITD reported gross energy savings for the government and non-profit programs is 10.6% of the total statewide portfolio of savings.
- The CPITD verified energy savings for government and non-profit sector programs is 201,569 MWh.

### **PY2 portfolio highlights:**

- The PYTD reported gross energy savings is 1,857,944 MWh.
- The PYTD verified energy savings is 1,792,790 MWh.
- The PYTD reported gross demand reduction is 287.33 MW.
- The PYTD verified demand reduction is 275.65 MW.

The PYTD reported participation is 1,639,670 participants.<sup>14</sup>

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<sup>13</sup> Demand reduction to include both the demand savings from the installation of energy efficiency measures and the demand reduction associated with demand response programs.

<sup>14</sup> Statewide participants are based upon the participant numbers reported by each EDC. Most EDCs excluded the number of CFL bulbs distributed from their participants count, while; the other EDCs estimated the number of bulbs per participant and included that estimate in their totals. Participants may not be unique in that one customer may participate in several programs and thus would be counted as multiple participants for program tracking purposes.

### 3.2 Duquesne Light

**Table 3-2: Summary of Duquesne Annual Report Impacts**

	<b>PYTD Reported Gross Impact</b>	<b>PYTD Verified Impact<sup>[a]</sup></b>	<b>PYTD Net Impact<sup>[b]</sup></b>	<b>Savings Achieved as % of Targets<sup>[e]</sup></b>
Total Energy Savings (MWh)	168,856	164,848	164,848	120%
Total Demand Reduction (MW)	19.09	18.50	18.50	17%
TRC Benefits (\$) <sup>[c]</sup>	N/A	\$109,665,642	N/A	N/A
TRC Costs (\$) <sup>[d]</sup>	N/A	\$30,038,448	N/A	N/A
TRC Benefit-Cost Ratio	N/A	3.70	N/A	N/A
CO <sub>2</sub> Emissions Reduction <sup>[f]</sup> (Tons)	136,773	133,527	133,527	N/A

**NOTES**

[a] Adjusted by applying realization rate determined by independent EM&V contractor to the Portfolio PYTD Reported Gross Impact, which is calculated by aggregating Program PYTD Verified Impacts. Program PYTD Verified Impacts are calculated by multiplying Program PYTD Reported Gross Impacts by program realization rates.

[b] Adjusted by applying net-to-gross ratio to the Portfolio PYTD Verified Impact, which is calculated by aggregating Program Net Impacts. Program Net Impacts are calculated by multiplying Program PYTD Verified Impacts by program Net-to-Gross ratios. Net-to-Gross ratio is 1.0 for Program Year 2.

[c] Avoided supply costs, taking into account line loss factors, 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. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.

[d] Costs paid by the program administrator and participants plus the increase in supply costs for any period when load is increased. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.

[e] MWh targets for 2011. MW targets for 2013. Savings based on CPITD verified savings.

[f] 8.1x10<sup>-4</sup> metric tons of CO<sub>2</sub> per kWh (EPC's eGRID2007 Version 1.1, RFCE Region annual non-baseload CO<sub>2</sub> output emissions rate, year 2005 data).

Duquesne reported gross energy savings for 18 programs. The following table provides a breakdown of the contribution of each program’s gross energy savings towards the PY2 CPITD portfolio savings:

**Table 3-3: Summary of Program Impacts on Gross Reported Portfolio Savings – Duquesne**

<b>Program:</b>	<b>Percent of CPITD Gross MWh Savings Portfolio</b>
<b>Residential: Energy Efficiency (EE) Program (Upstream Lighting)</b>	22.01%
<b>Public Agency/Non-Profit</b>	16.06%
<b>Primary Metals EE</b>	12.55%
<b>Office Building - Large – EE</b>	10.60%
<b>Chemical Products EE</b>	8.70%
<b>Residential: Low Income EE (Upstream Lighting)</b>	8.45%
<b>Mixed Industrial EE</b>	4.00%
<b>Retail Stores - Small EE</b>	3.65%
<b>Residential: Appliance Recycling</b>	3.52%
<b>Residential: EE Program (REEP): Rebate Program</b>	2.69%
<b>Residential: School Energy Pledge</b>	2.14%
<b>Retail Stores - Large EE</b>	1.39%
<b>Commercial Sector Umbrella EE</b>	1.21%
<b>Residential: Low Income EE</b>	1.06%
<b>Office Building - Small – EE</b>	1.02%
<b>Healthcare EE</b>	0.60%
<b>Industrial Sector Umbrella EE</b>	0.35%

### 3.3 PECO

**Table 3-4: Summary of PECO Annual Report Impacts**

	<b>PYTD Reported Gross Impact</b>	<b>PYTD Verified Impact<sup>[a]</sup></b>	<b>PYTD Net Impact<sup>[b]</sup></b>	<b>Savings Achieved as % of 2011 Targets<sup>[e]</sup></b>
Total Energy Savings (MWh)	732,226	713,313	713,313	221%
Total Demand Reduction (MW)	138.70	136.70	136.70	42%
TRC Benefits (\$) <sup>[c]</sup>	N/A	\$749,046,000	N/A	N/A
TRC Costs (\$) <sup>[d]</sup>	N/A	\$150,293,000	N/A	N/A
TRC Benefit-Cost Ratio	N/A	4.98	N/A	N/A
CO <sub>2</sub> Emissions Reduction <sup>[f]</sup> (Tons)	593,103	577,784	557,784	N/A
<b>NOTES:</b>				
[a] Adjusted by applying realization rate determined by independent EM&V contractor to the Portfolio PYTD Reported Gross Impact, which is calculated by aggregating Program PYTD Verified Impacts. Program PYTD Verified Impacts are calculated by multiplying Program PYTD Reported Gross Impacts by program realization rates.				
[b] Adjusted by applying net-to-gross ratio to the Portfolio PYTD Verified Impact, which is calculated by aggregating Program Net Impacts. Program Net Impacts are calculated by multiplying Program PYTD Verified Impacts by program Net-to-Gross ratios. Net-to-Gross ratio is 1.0 for Program Year 2.				
[c] Avoided supply costs, taking into account line loss factors, 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. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.				
[d] Costs paid by the program administrator and participants plus the increase in supply costs for any period when load is increased. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.				
[e] MWh targets for 2011. MW targets for 2013. Savings based on CPITD verified savings.				
[f] 8.1x10 <sup>-4</sup> metric tons of CO <sub>2</sub> per kWh (EPC's eGRID2007 Version 1.1, RFCE Region annual non-baseload CO <sub>2</sub> output emissions rate, year 2005 data).				

PECO reported gross energy savings for 8 programs. The following table provides a breakdown of the contribution of each program's gross energy savings towards the PY2 CPITD portfolio savings:

**Table 3-5: Summary of Program Impacts on Gross Reported Portfolio Savings – PECO**

<b>Program:</b>	<b>Percent of CPITD Gross MWh Savings Portfolio</b>
Smart Lighting Discounts Program	36.24%
Conservation Voltage Reduction	36.00%
Smart Equipment Incentives – Commercial & Industrial (C&I)	11.20%
Smart Equipment Incentives - Government/Non-Profit	4.96%
Smart Home Rebates Program	4.91%
Smart Appliance Recycling Program	3.42%
Low-Income Energy Efficiency Program	3.15%
Smart Construction Incentives	0.12%

**3.4 PPL**

**Table 3-6: Summary of PPL Annual Report Impacts**

	<b>PYTD Reported Gross Impact</b>	<b>PYTD Verified Impact<sup>[a]</sup></b>	<b>PYTD Net Impact<sup>[b]</sup></b>	<b>Savings Achieved as % of 2011 Targets<sup>[e]</sup></b>
Total Energy Savings (MWh)	452,070	425,208	425,208	133%
Total Demand Reduction (MW)	63.60	58.32	58.32	22%
TRC Benefits (\$) <sup>[c]</sup>	N/A	\$370,636,979	N/A	N/A
TRC Costs (\$) <sup>[d]</sup>	N/A	\$214,671,053	N/A	N/A
TRC Benefit-Cost Ratio	N/A	1.73	N/A	N/A
CO <sub>2</sub> Emissions Reduction <sup>[f]</sup> (Tons)	366,177	344,418	344,418	N/A
<b>NOTES:</b>				
[a] Adjusted by applying realization rate determined by independent EM&V contractor to the Portfolio PYTD Reported Gross Impact, which is calculated by aggregating Program PYTD Verified Impacts. Program PYTD Verified Impacts are calculated by multiplying Program PYTD Reported Gross Impacts by program realization rates.				
[b] Adjusted by applying net-to-gross ratio to the Portfolio PYTD Verified Impact, which is calculated by aggregating Program Net Impacts. Program Net Impacts are calculated by multiplying Program PYTD Verified Impacts by program Net-to-Gross ratios. Net-to-Gross ratio is 1.0 for Program Year 2.				
[c] Avoided supply costs, taking into account line loss factors, 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. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.				
[d] Costs paid by the program administrator and participants plus the increase in supply costs for any period when load is increased. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.				
[e] MWh targets for 2011. MW targets for 2013. Savings based on CPITD verified savings.				
[f] 8.1x10 <sup>-4</sup> metric tons of CO <sub>2</sub> per kWh (EPC's eGRID2007 Version 1.1, RFCE Region annual non-baseload CO <sub>2</sub> output emissions rate, year 2005 data).				

PPL reported gross energy savings for 11 programs. The following table provides a breakdown of the contribution of each program's gross energy savings towards the PY2 CPITD portfolio savings:

**Table 3-7: Summary of Program Impacts on Gross Reported Portfolio Savings – PPL**

<b>Program:</b>	<b>Percent of CPITD Gross MWh Savings Portfolio</b>
<b>Compact Fluorescent Lighting Campaign</b>	38.96%
<b>Efficient Equipment Incentive Program - C&amp;I Lighting</b>	32.86%
<b>Efficient Equipment Incentive Program</b>	12.57%
<b>Appliance Recycling</b>	6.36%
<b>Custom Incentive Program</b>	3.03%
<b>Customer Education and Behavior</b>	2.38%
<b>Renewable Energy Program</b>	2.10%
<b>Low-Income WRAP</b>	1.17%
<b>E-Power Wise Program</b>	0.33%
<b>Residential Energy Assessment and Weatherization</b>	0.16%
<b>HVAC Tune-Up Program</b>	0.09%



### 3.5 First Energy Companies

The following sections contain information on savings and programs implemented by the FirstEnergy Companies. While the FirstEnergy Companies have implemented many similar programs, their individual achievements are slightly different as demonstrated by the various levels of savings and percent of those savings achieved by each particular program.

#### 3.5.1 Metropolitan Edison Company

**Table 3-8: Summary of Met-Ed Annual Report Impacts**

	PYTD Reported Gross Impact	PYTD Verified Impact <sup>[a]</sup>	PYTD Net Impact <sup>[b]</sup>	Savings Achieved as % of 2011 Targets <sup>[e]</sup>
Total Energy Savings (MWh)	171,282	169,421	169,421	122%
Total Demand Reduction (MW)	22.16	22.29	22.29	41%
TRC Benefits (\$) <sup>[c]</sup>	N/A	\$151,115,458	N/A	N/A
TRC Costs (\$) <sup>[d]</sup>	N/A	\$42,789,583	N/A	N/A
TRC Benefit-Cost Ratio	N/A	3.53	N/A	N/A
CO <sub>2</sub> Emissions Reduction <sup>[f]</sup> (Tons)	138,738	137,231	137,231	N/A
<b>NOTES:</b>				
[a] Adjusted by applying realization rate determined by independent EM&V contractor to the Portfolio PYTD Reported Gross Impact, which is calculated by aggregating Program PYTD Verified Impacts. Program PYTD Verified Impacts are calculated by multiplying Program PYTD Reported Gross Impacts by program realization rates.				
[b] Adjusted by applying net-to-gross ratio to the Portfolio PYTD Verified Impact, which is calculated by aggregating Program Net Impacts. Program Net Impacts are calculated by multiplying Program PYTD Verified Impacts by program Net-to-Gross ratios. Net-to-Gross ratio is 1.0 for Program Year 2.				
[c] Avoided supply costs, taking into account line loss factors, 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. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.				
[d] Costs paid by the program administrator and participants plus the increase in supply costs for any period when load is increased. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.				
[e] MWh targets for 2011. MW targets for 2013. Savings based on CPITD verified savings.				
[f] 8.1x10 <sup>-4</sup> metric tons of CO <sub>2</sub> per kWh (EPC's eGRID2007 Version 1.1, RFCE Region annual non-baseload CO <sub>2</sub> output emissions rate, year 2005 data).				

Met-Ed reported gross energy savings for 14 programs. The following table provides a breakdown of the contribution of each program’s gross energy savings towards the PY2 CPITD portfolio savings:

**Table 3-9: Summary of Program Impacts on Gross Reported Portfolio Savings – Met-Ed**

<b>Program:</b>	<b>Percent of CPITD Gross MWh Savings Portfolio</b>
<b>C/I Performance Contracting/Equipment</b>	21.38%
<b>EE Products</b>	20.72%
<b>Home Energy Audits</b>	15.95%
<b>Energy Audit, Assessment and Equipment Rebate</b>	11.92%
<b>Remaining Government/Non-Profit</b>	10.52%
<b>Appliance Turn-In</b>	9.09%
<b>EE HVAC</b>	2.53%
<b>Street Lighting</b>	2.26%
<b>WARM Programs</b>	2.01%
<b>Multiple Family</b>	1.55%
<b>Industrial Motors and VSD</b>	1.27%
<b>Non-Profit</b>	0.40%
<b>New Construction</b>	0.39%
<b>Whole Building</b>	0.02%

3.5.2 **Pennsylvania Power Company**

**Table 3-10: Summary of Penn Power Annual Report Impacts**

	PYTD Reported Gross Impact	PYTD Verified Impact <sup>[a]</sup>	PYTD Net Impact <sup>[b]</sup>	Savings Achieved as % of 2011 Targets <sup>[e]</sup>
Total Energy Savings (MWh)	62,780	61,036	61,036	140%
Total Demand Reduction (MW)	6.91	6.82	6.82	16%
TRC Benefits (\$) <sup>[c]</sup>	N/A	\$51,254,658	N/A	N/A
TRC Costs (\$) <sup>[d]</sup>	N/A	\$14,033,845	N/A	N/A
TRC Benefit-Cost Ratio	N/A	3.65	N/A	N/A
CO <sub>2</sub> Emissions Reduction <sup>[f]</sup> (Tons)	50,852	49,439	49,439	N/A

**NOTES:**

[a] Adjusted by applying realization rate determined by independent EM&V contractor to the Portfolio PYTD Reported Gross Impact, which is calculated by aggregating Program PYTD Verified Impacts. Program PYTD Verified Impacts are calculated by multiplying Program PYTD Reported Gross Impacts by program realization rates.

[b] Adjusted by applying net-to-gross ratio to the Portfolio PYTD Verified Impact, which is calculated by aggregating Program Net Impacts. Program Net Impacts are calculated by multiplying Program PYTD Verified Impacts by program Net-to-Gross ratios. Net-to-Gross ratio is 1.0 for Program Year 2.

[c] Avoided supply costs, taking into account line loss factors, 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. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.

[d] Costs paid by the program administrator and participants plus the increase in supply costs for any period when load is increased. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.

[e] MWh targets for 2011. MW targets for 2013. Savings based on CPITD verified savings.

[f] 8.1x10<sup>-4</sup> metric tons of CO<sub>2</sub> per kWh (EPC's eGRID2007 Version 1.1, RFCE Region annual non-baseload CO<sub>2</sub> output emissions rate, year 2005 data).

Penn Power reported gross energy savings for 14 programs. The following table provides a breakdown of the contribution of each program’s gross energy savings towards the PY2 CPITD portfolio savings:

**Table 3-11: Summary of Program Impacts on Gross Reported Portfolio Savings – Penn Power**

<b>Program:</b>	<b>Percent of CPITD Gross MWh Savings Portfolio</b>
EE Products	27.82%
C/I Performance Contracting/Equipment	20.66%
Energy Audit, Assessment and Equipment Rebate	14.73%
Remaining Government/Non-Profit	12.70%
Home Energy Audits	10.70%
Appliance Turn-In	5.97%
WARM Programs	3.17%
Multiple Family	1.46%
EE HVAC	1.08%
Industrial Motors and Variable Speed Drives (VSD)	0.82%
New Construction	0.38%
Street Lighting	0.36%
Non-Profit	0.13%
Whole Building	0.02%

3.5.3 **Pennsylvania Electric Company**

**Table 3-12: Summary of Penelec Annual Report Impacts**

	<b>PYTD Reported Gross Impact</b>	<b>PYTD Verified Impact<sup>[a]</sup></b>	<b>PYTD Net Impact<sup>[b]</sup></b>	<b>Savings Achieved as % of 2011 Targets<sup>[e]</sup></b>
Total Energy Savings (MWh)	180,470	171,396	171,396	128%
Total Demand Reduction (MW)	23.87	20.82	20.82	21%
TRC Benefits (\$) <sup>[c]</sup>	N/A	\$142,731,019	N/A	N/A
TRC Costs (\$) <sup>[d]</sup>	N/A	\$47,781,324	N/A	N/A
TRC Benefit-Cost Ratio	N/A	2.99	N/A	N/A
CO <sub>2</sub> Emissions Reduction <sup>[f]</sup> (Tons)	146,181	138,831	138,831	N/A

**NOTES:**

[a] Adjusted by applying realization rate determined by independent EM&V contractor to the Portfolio PYTD Reported Gross Impact, which is calculated by aggregating Program PYTD Verified Impacts. Program PYTD Verified Impacts are calculated by multiplying Program PYTD Reported Gross Impacts by program realization rates.

[b] Adjusted by applying net-to-gross ratio to the Portfolio PYTD Verified Impact, which is calculated by aggregating Program Net Impacts. Program Net Impacts are calculated by multiplying Program PYTD Verified Impacts by program Net-to-Gross ratios. Net-to-Gross ratio is 1.0 for Program Year 2.

[c] Avoided supply costs, taking into account line loss factors, 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. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.

[d] Costs paid by the program administrator and participants plus the increase in supply costs for any period when load is increased. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.

[e] MWh targets for 2011. MW targets for 2013. Savings based on CPITD verified savings.

[f] 8.1x10<sup>-4</sup> metric tons of CO<sub>2</sub> per kWh (EPC's eGRID2007 Version 1.1, RFCE Region annual non-baseload CO<sub>2</sub> output emissions rate, year 2005 data).

Penelec reported gross energy savings for 14 programs. The following table provides a breakdown of the contribution of each program’s gross energy savings towards the PY2 CPITD portfolio savings:

**Table 3-13: Summary of Impacts on Gross Reported Portfolio Savings – Penelec**

<b>Program:</b>	<b>Percent of CPITD Gross MWh Savings Portfolio</b>
EE Products	20.42%
Energy Audit, Assessment and Equipment Rebate	18.01%
C/I Performance Contracting/Equipment	17.67%
Home Energy Audits	13.77%
Remaining Government/Non-Profit	13.44%
Appliance Turn-In	7.92%
Multiple Family	2.60%
WARM Programs	2.59%
Industrial Motors and VSD	2.06%
EE HVAC	0.62%
Street Lighting	0.50%
Non-Profit	0.27%
New Construction	0.11%
Whole Building	0.01%

3.5.4 West Penn Power

Table 3-14: Summary of West Penn Power Annual Report Impacts

	PYTD Reported Gross Impact	PYTD Verified Impact <sup>[a]</sup>	PYTD Net Impact <sup>[b]</sup>	Savings Achieved as % of 2011 Targets <sup>[e]</sup>
Total Energy Savings (MWh)	90,260	87,568	87,568	43%
Total Demand Reduction (MW)	13.30	12.20	12.20	10%
TRC Benefits (\$) <sup>[c]</sup>	N/A	\$40,948,224	N/A	N/A
TRC Costs (\$) <sup>[d]</sup>	N/A	\$17,940,171	N/A	N/A
TRC Benefit-Cost Ratio	N/A	2.30	N/A	N/A
CO <sub>2</sub> Emissions Reduction <sup>[f]</sup> (Tons)	73,111	70,930	70,930	N/A

**NOTES:**

[a] Adjusted by applying realization rate determined by independent EM&V contractor to the Portfolio PYTD Reported Gross Impact, which is calculated by aggregating Program PYTD Verified Impacts. Program PYTD Verified Impacts are calculated by multiplying Program PYTD Reported Gross Impacts by program realization rates.

[b] Adjusted by applying net-to-gross ratio to the Portfolio PYTD Verified Impact, which is calculated by aggregating Program Net Impacts. Program Net Impacts are calculated by multiplying Program PYTD Verified Impacts by program Net-to-Gross ratios. Net-to-Gross ratio is 1.0 for Program Year 2..

[c] 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. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.

[d] Costs paid by the program administrator and participants plus the increase in supply costs for any period when load is increased. These numbers are calculated according to the PUC's 2009 and 2011 TRC Orders.

[e] MWh targets for 2011. MW targets for 2013. Savings based on CPITD verified savings.

[f] 8.1x10<sup>-4</sup> metric tons of CO<sub>2</sub> per kWh (EPC's eGRID2007 Version 1.1, RFCE Region annual non-baseload CO<sub>2</sub> output emissions rate, year 2005 data).

West Penn reported gross energy savings for 12 programs. The following table provides a breakdown of the contribution of each program’s gross energy savings towards the PY2 CPITD portfolio savings:

**Table 3-15: Summary of Program Impacts on Gross Reported Portfolio Savings – West Penn Power**

<b>Program:</b>	<b>Percent of CPITD Gross MWh Savings Portfolio</b>
<b>Compact Fluorescent Lighting (CFL) Rewards Program</b>	30.08%
<b>Government/Non-Profit Lighting Efficiency Program</b>	14.18%
<b>Residential Home Performance Program</b>	13.92%
<b>Residential Energy Star and High Efficiency Appliance Program</b>	13.69%
<b>Commercial Products Efficiency Program</b>	11.05%
<b>Residential Low Income Home Performance Check-up Audit &amp; Appliance Replacement Program</b>	7.02%
<b>Custom Applications Program</b>	4.15%
<b>Custom Technology Appliances Program</b>	2.61%
<b>Residential Whole Home Appliance Efficiency Program (Residential HVAC Efficiency Program)</b>	2.20%
<b>Commercial and Industrial Drives Program</b>	1.01%
<b>Residential Low Income Joint Utility Usage Management Program</b>	0.09%
<b>Commercial HVAC Efficiency Program</b>	<0.01%



#### 4 Program Implementation and Evaluation Summary by EDC

The following table contains a summary for each EDC of programs reporting participation and savings to-date, programs reporting verified savings, and programs to be implemented or with no reported savings by each EDC. Programs “implemented” include only those programs with reported gross impacts; “evaluated” programs include programs with verified impacts.

**Table 4-1: Summary of Programs Implemented to Date by Duquesne**

<b><i>Programs Reporting Verified Savings:</i></b>
<ul style="list-style-type: none"><li>• Residential: Energy Efficiency (EE) Program (REEP): Rebate Program</li><li>• Residential: EE Program (Upstream Lighting)</li><li>• Residential: School Energy Pledge</li><li>• Residential: Appliance Recycling</li><li>• Residential: Low Income EE</li><li>• Residential: Low Income EE (Upstream Lighting)</li><li>• Commercial Sector Umbrella EE<ul style="list-style-type: none"><li>○ Retail Stores – Small – EE</li><li>○ Retail Stores – Large – EE</li><li>○ Office Building – Large – EE</li><li>○ Office Building – Small – EE</li><li>○ Government &amp; Non-Profit EE</li><li>○ Healthcare EE</li></ul></li><li>• Industrial Sector Umbrella EE<ul style="list-style-type: none"><li>○ Chemical Products EE</li><li>○ Mixed Industrial EE</li><li>○ Primary Metals EE</li></ul></li></ul>
<b><i>Programs to be Implemented or with No Reported Savings:</i></b>
<ul style="list-style-type: none"><li>• <i>None reported</i></li></ul>

**Table 4-2: Summary of Programs Implemented to Date by PECO**

<ul style="list-style-type: none"><li>• Low-Income Energy Efficiency Program</li><li>• Smart Lighting Discounts Program</li><li>• Smart Appliance Recycling Program</li><li>• Smart Home Rebates Program</li><li>• Smart Equipment Incentives – Commercial and Industrial (C&amp;I)</li><li>• Smart Equipment Incentives – Government/Non-Profit</li><li>• Smart Construction Incentives</li><li>• Conservation Voltage Reduction</li></ul>
<b><i>Programs to be Implemented or with No Reported Savings:</i></b>
<ul style="list-style-type: none"><li>• Residential Direct Load Control</li><li>• Commercial Direct Load Control</li><li>• Residential New Construction</li><li>• Demand-Response Aggregator Contracts</li><li>• Distributed Resources</li><li>• Residential Whole Home Performance</li><li>• Permanent Load Reduction</li></ul>

**Table 4-3: Summary of Programs Implemented to Date by PPL**

<b><i>Programs Reporting Verified Savings:</i></b>
<ul style="list-style-type: none"><li>• Appliance Recycling Program</li><li>• Compact Fluorescent Lighting Campaign</li><li>• Custom Incentive Program</li><li>• Energy Efficiency Behavior &amp; Education Program</li><li>• Efficiency Equipment Incentive Program<ul style="list-style-type: none"><li>○ Efficiency Equipment Incentive Program (C&amp;I Lighting)</li></ul></li><li>• E-Power Wise Program</li><li>• Low-Income WRAP</li><li>• Renewable Energy Program</li><li>• HVAC Tune-Up Program</li><li>• Home Assessment &amp; Weatherization Program</li></ul>
<b><i>Programs to be Implemented or with No Reported Savings:</i></b>
<ul style="list-style-type: none"><li>• Direct Load Control Program</li><li>• Load Curtailment Program</li></ul>

**Table 4-4: Summary of Programs Implemented to Date by FirstEnergy - Met-Ed, Penelec, PennPower**

<b><i>Programs Reporting Verified Savings:</i></b>
<ul style="list-style-type: none"><li>• Home Energy Audits</li><li>• Appliance Turn-In</li><li>• EE HVAC</li><li>• EE Products</li><li>• New Construction</li><li>• Whole Building</li><li>• Multiple Family</li><li>• WARM Programs</li><li>• Energy Audit, Assessment and Equipment Rebate</li><li>• C/I Performance Contracting/Equipment</li><li>• Industrial Motors and VSD</li><li>• Street Lighting</li><li>• Non-Profit</li><li>• Remaining Government/Non-Profit</li></ul>
<b><i>Programs to be Implemented or with No Reported Savings:</i></b>
<ul style="list-style-type: none"><li>• Demand Reduction</li><li>• PJM Demand Response</li></ul>

**Table 4-5: Summary of Programs Implemented to Date by FirstEnergy – West Penn Power**

<b><i>Programs Reporting Verified Savings:</i></b>
<ul style="list-style-type: none"><li>• Compact Fluorescent Lighting (CFL) Rewards Program</li><li>• Residential Energy Star and High Efficiency Appliance Program</li><li>• Residential Home Performance Program</li><li>• Residential Whole Home Appliance Efficiency Program</li><li>• Residential Low Income Home Performance Check-Up Audit &amp; Appliance Replacement Program</li><li>• Residential Low Income Joint Utility Usage Management Program</li><li>• Governmental/Non-Profit Lighting Efficiency Program</li><li>• Commercial HVAC Efficiency Program</li><li>• Commercial and Industrial Drives Program</li><li>• Commercial Products Efficiency Program</li><li>• Custom Technology Applications Program</li><li>• Custom Applications Program</li></ul>
<b><i>Programs to be Implemented or with No Reported Savings:</i></b>
<ul style="list-style-type: none"><li>• Critical Peak Rebate (CPR) Rate</li><li>• Customer Resources Demand Response Program</li><li>• Distributed Generation Program</li><li>• Time of Use (TOU) with Critical Peak Pricing Rebate</li><li>• Customer Load Response Program</li></ul>

## **5 Status of EDC Evaluation Measurement & Verification Activities**

This section briefly addresses the activities undertaken by the EDCs in terms of developing and implementing evaluation, measurement and verification (EM&V) plans and protocols.

### **5.1 Status of EM&V Plans**

As per the guidelines outlined in the Statewide Evaluator (SWE) *Audit Plan*, the SWE Team has reviewed EM&V Plans submitted by the EDCs to verify that the plans comply with the Technical Reference Manual (TRM) and Total Resource Cost (TRC) Orders and meet the minimum evaluation requirements set forth in the *Audit Plan*. The *Audit Plan* provided an outline for the evaluation framework expectations and guidelines necessary to address the following research objectives:

- Determine Realization Rates for Gross Savings;
- Determine Net to Gross (NTG) Ratios;<sup>15</sup>
- Determine Method for Calculating Savings; and
- Set acceptable levels of Rigor, Precision and Bias for measurement and verification (M&V) activities.

No new EM&V Plans were submitted for review in Program Year 2 (PY2).

### **5.2 Status of EDC Measurement and Verification Activities**

The following sections provide a summary of M&V activities performed by each EDC based upon the details provided in each EDC's annual report and from information gathered through SWE data requests and audits.

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<sup>15</sup> Currently, the NTG Ratio is set at 1.0 until further direction by the Commission.

5.2.1 **Duquesne**  
**Impact Evaluation**

Duquesne evaluated their programs according to the following evaluation groups:

**Table 5-1: Duquesne Evaluation Groups**

<b>Evaluation Group</b>	<b>Included Sub Program</b>
<b>Residential: Appliance Recycling Program (RARP)</b>	Single program group
<b>Residential: Low Income Energy Efficiency Program (LEEP)</b>	Single program group
<b>Residential: Energy Efficiency Rebate Program (REEP)</b>	Single program group
<b>Residential: School Energy Pledge Program (SEP)</b>	Single program group
<b>Upstream Lighting Program</b>	1)Residential Upstream Lighting 2)Low Income Upstream Lighting
<b>Commercial</b>	1)Umbrella 2)Small Office 3)Large Office 4)Health Care 5)Retail 6)Government/Non-Profit
<b>Industrial</b>	1)Umbrella 2)Primary Metals 3)Chemical Products 4)Mixed Industrials

A summary of the evaluation group sample size and realization rates resulting from the PY2 impact evaluation activities are presented in the following table:

**Table 5-2: Summary of Evaluation Group Realization Rates<sup>16</sup> - Duquesne**

Program	PY2 Participant Sample	Realization Rate – Energy	Realization Rate - Demand
Residential Sector	341	0.97	0.96
Non-Residential Sector	98	0.98	0.97
Residential: EE Rebate	82	0.97	0.97
Residential: School Energy Pledge	81	0.61	0.70
Residential: Appliance Recycling	104	1.00	1.00
Residential: Low Income EE	74	0.98	0.89
Commercial Program	68	0.99	0.97
Industrial Program	30	0.97	0.98
<b>TOTAL PORTFOLIO</b>	<b>439</b>	<b>0.98</b>	<b>0.97</b>

A summary of the program specific energy and demand realization rates resulting from the impact evaluation activities conducted for projects implemented in PY2 are presented in the following table:

**Table 5-3: Summary of Program Realization Rates - Duquesne**

Program	Realization Rate – Energy	Realization Rate - Demand
Residential: EE Program (REEP): Rebate Program	0.72	0.81
Residential: EE Program (Upstream Lighting)	1.00	1.00
Residential: School Energy Pledge	0.61	0.70
Residential: Appliance Recycling	1.00	1.00
Residential: Low Income EE	0.81	0.92
Residential: Low Income (Upstream Lighting)	1.00	0.89
Commercial Sector Umbrella EE	0.99	0.97
Healthcare EE	0.99	0.97
Industrial Sector Umbrella EE	0.97	0.98
Chemical Products EE	0.97	0.98
Mixed Industrial EE	0.97	0.98
Office Building – Large – EE	0.99	0.97
Office Building – Small – EE	0.99	0.97
Primary Metals EE	0.97	0.98
Government & Non-Profit EE	0.99	0.97
Retail Stores – Small – EE	0.99	0.97
Retail Stores – Large – EE	0.99	0.97
<b>TOTAL PORTFOLIO</b>	<b>0.98</b>	<b>0.97</b>

**Process Evaluation**

Process evaluations for each of the six evaluation program groups included the following activities as described in Duquesne’s PY2 Annual Report:

<sup>16</sup> This table provides a summary of realization rates by evaluation group and not by program. Per Duquesne’s EM&V Plan, certain programs are grouped based on shared characteristics in order to cost-effectively evaluate Duquesne’s portfolio of programs. For more information regarding Duquesne’s evaluation process and the translation of evaluation activities to program specific realization rates, please see Duquesne’s PY2 Annual Report.

- Review of program documentation available from Public Utility Commission filings.
- Review of program-specific information on Duquesne's website.
- Interviews with Duquesne program staff.
- Review of marketing materials supplied by Duquesne or its Contract Service Providers (CSPs).
- Review of program logic model supplied in Duquesne's EM&V Plan.
- Conduct an analysis of results from program participant surveys conducted during verification of the quarterly savings.
- Review of program performance as reported in Duquesne's database and tracking system, including review of the tracking system itself.

5.2.2 PECO

**Impact Evaluation**

A summary of the energy and demand realization rates resulting from the impact evaluation activities conducted for projects implemented in PY2 are presented in the following table:

**Table 5-4: Summary of Program Realization Rates - PECO**

Program	PY2 Participant Sample	Realization Rate – Energy	Realization Rate - Demand
Low-Income Energy Efficiency Program	25	1.00	1.00
Smart Lighting Discounts Program	N/A	1.00	1.00
Smart Appliance Recycling Program	16,771	1.00	1.00
Smart Home Rebates Program	204	1.00	1.00
Smart Equipment Incentives-C&I	39	0.86	1.01
Smart Equipment Incentives-Government / Non-Profit	24	0.87	0.72
Smart Construction Incentives <sup>17</sup>	N/A	N/A	N/A
Conservation Voltage Reduction	83	1.00	1.00
Residential Direct Load Control	N/A	N/A	N/A
Commercial Direct Load Control	N/A	N/A	N/A
<b>TOTAL PORTFOLIO</b>	<b>17,146</b>	<b>0.97</b>	<b>0.99</b>

**Process Evaluation**

The following is a summary of the process evaluation activities conducted by PECO in PY2 as indicated in PECO’s PY2 Annual Report:

**Smart Lighting Discounts Program:** Data collection methods used in the process evaluation included the following elements: in-store intercept surveys conducted in March and April 2011, in-depth interviews conducted in March and April 2011 with internal program staff, program implementer staff (implementation contractor: Ecos), and trade allies (Lighting Manufacturers and Participating Corporate Retailers), and a general population telephone survey conducted in April 2011.

**Low-Income Energy Efficiency Program:** Process evaluation activities consisted primarily of in-depth interviews with utility and implementation contractor staff, and telephone surveys.

**Smart Appliance Recycling Program:** Phone survey data was used to support the process element of the Smart Appliance Recycling Program evaluation. A phone survey of a sample of 100 Q1 and Q2 participants was conducted in February 2011 and was repeated in July 2011. Findings from the nonparticipant survey were also be used to assess program awareness, determine reasons for nonparticipation, and gather suggestions for how to improve the program.

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<sup>17</sup> Due to limited participation in PY2, PECO did not conduct an impact evaluation for the Smart Construction Incentives Program. Only four new construction projects were completed in PY2. Savings from these projects will be verified along with those of additional projects completed in PY3.



**Smart Home Rebates Program:** Process evaluation included a review of program planning, design, outreach, and implementation based on review of program data and interviews with program staff, implementers, trade allies, and participating customers. In addition, there was a comprehensive audit of the program databases.

**Commercial and Industrial Smart Equipment Incentives Program:** The analysis segment of the process evaluation and analysis for PY2 is ongoing; however, all data collection is complete. Process evaluation efforts included two participant Computer Assisted Telephone Interview (CATI) surveys, one for customers completing primarily lighting projects (31 completed), and another for non-lighting projects (28 completed). Twelve (12) participating and six (6) non-participating trade ally surveys were also completed. Finally, several in-depth interviews were completed with PECO program management staff and the CSP implementation staff. The participant surveys will be used to estimate program free ridership levels and spillover levels, along with more qualitative analyses such as assessing standard process topics focusing on satisfaction and program delivery issues. Most process activities were completed in collaboration with the Government and Nonprofit program evaluation as the programs were implemented jointly.

**Government and Non-Profit Smart Equipment Incentives Program:** Process evaluation in PY2 was conducted jointly with the C&I Smart Equipment Incentives Program and included in-depth interviews with program staff and 12 participating and 6 non-participating trade allies. Sample design and updates of the survey instruments were performed, and surveys for the 45 participants (CATI surveys) were conducted for 27 lighting projects and 18 non-lighting projects in the government, institutional and nonprofit sector. Analysis is underway. The participant CATI interviews assessed standard process topics focusing on satisfaction and program delivery issues.

**Conservation Voltage Reduction (CVR) Program:** The process evaluation covering PY2 focused on two key areas: (1) review of customer complaints related to service quality and (2) telephone surveys with a sample of those on affected feeders. The analysis of customer complaint data and the telephone surveys was conducted in October-November 2011.

**Direct Load Control Program:** In the third quarter of PY2, the process evaluation was completed for both the residential and commercial programs based on telephone interviews conducted with a sample of residential and commercial participants and in-depth interviews with implementers. The focus of the surveys was on process issues related to marketing, enrollment procedures and equipment installation. A total of 69 residential program participants were interviewed for this study on a number of topics including reasons for participating in the program, marketing issues, and satisfaction with the Residential A/C Saver program, program improvements, air conditioning hours of use and thermostat control, acceptance of alternative incentive structures, participation in other smart saver programs, and an organizational description of program participants.

**Smart Construction Incentives Program:** The primary objectives of this evaluation were to determine key process-related program strengths and weaknesses and identify ways in which the program could be

improved. Navigant's evaluation method consisted of in-depth face-to-face and phone interviews with PECO program management and KEMA, PECO's implementation contractor, staff.

5.2.3 PPL

**Impact Evaluation**

A summary of the energy and demand realization rates resulting from the impact evaluation activities conducted for projects implemented in PY2 are presented in the following table:

**Table 5-5: Summary of Program Realization Rates - PPL**

Program	PY2 Participant Sample	Realization Rate – Energy	Realization Rate - Demand
Appliance Recycling Program	Census record review 276 surveys	1.00	1.00
Compact Fluorescent Lighting Campaign	Census record review 284 surveys	1.00	1.00
Custom Incentive Program	42 (including 36 large projects and 6 small) 20 surveys	1.04	0.69
Energy Efficiency Behavior & Education Program	320 surveys	1.05	N/A
Efficient Equipment Incentive Program	Residential sector: 222 Records review 224 surveys Nonresidential sector: 75 site-visits verified 214 measures 549 record reviews 99 surveys	0.84	0.84
Efficient Equipment Incentive Program (C&I Lighting)	100 site visits (projects) 179 record reviews 116 phone surveys	0.92	0.87
E-Power Wise Program	Census database 140 record reviews - enrollment forms 143 phone surveys 851 mail in surveys	0.82	0.74
Low-Income WRAP	Census to identify duplicates 45 in-depth	0.99	0.99
Renewable Energy Program	108 site visits 202 record reviews 118 surveys	1.15	1.00
HVAC Tune-Up Program	13 projects reviewed with engineering analysis 32 units spot metered 10 site visits 10 contractor interviews	1.00	1.00
Home Assessment & Weatherization Program	68 surveys 25 record reviews	0.80	0.90
<b>TOTAL PORTFOLIO</b>	1,422 records reviewed 1,634 phone surveys conducted 346 site visits	0.95	0.90

The totals for PPL Electric's EM&V verification activities summarized in the table above are discussed in detail in the PY2 Annual report, Appendix L, Table L-1: PY2 Participation and EM&V Activity Summary.

In addition to the records reviewed shown in the table above, the census of records were reviewed in the following databases: Appliance Recycling; CFL Campaign; Energy Efficiency Behavior & Education; EPowerWise; and WRAP (to identify duplicates). The number of site visits shown in this table is underreported for the Custom Incentive Program. The total only includes the projects included in the verification sample in PY2. Only one site visit is counted here per project; multiple site visits can be conducted for the Custom Incentive Program.

### **Process Evaluation**

The *PPL Electric Implementation of Act 129 Energy Efficiency & Conservation Plan, Program Year One Process Evaluation* was submitted on September 15, 2010. The PY2 process evaluation report was completed concurrently with PPL's PY2 Annual Report. A summary of the findings presented in the evaluation reported are presented below:

- PPL is well positioned to meet its September 2012 and May 2013 compliance targets. However, it is likely not possible to achieve the compliance targets within the customer sector proportions (savings and costs) estimated in the EE&C Plan.
- To meet the 3% energy reduction compliance target, PPL should revise its EE&C Plan to reduce projected savings from the small C&I sector and increase projected savings from the residential and/or large C&I sectors.
- Results from the residential and large C&I sectors are ahead of the plan. Results from the low-income and institutional (government and non-profit) sectors are on target. Results from the small C&I sector are behind the plan.
- PPL developed a good infrastructure supported by appropriately allocated internal and external resources. Internal processes were designed to integrate across programs and delivery functions to facilitate program implementation effectively.
- Customers are generally satisfied with the programs.
- PPL successfully implemented changes to the TRM, custom measure protocols, the *Audit Plan*, and market conditions into its programs, systems and processes. The processes to identify, scope, approve, and implement these changes were much more costly, formal and time consuming than PPL expected.
- Uncertainty about post-2013 EE&C requirements influences PPL's short-term and long-term decisions. Therefore, PPL should continue to work with the Commission, other EDCs, and other stakeholders to define the post-2013 EE&C targets and rules by mid-2012. Uncertainty influences these types of decisions:
  - Whether PPL should exceed savings targets in the current planning cycle, or will that jeopardize future compliance?
  - How best to manage staffing levels, development, and retention.
  - Should PPL invest in long-term improvements to systems and processes?

- How best to plan and market programs when customers sense no urgency.
- Whether to extend programs during the current planning cycle to avoid or decrease periods in which there are no programs.
- How best to perform operational planning, such as load and revenue forecasting.
- Whether to introduce new technologies now in preparation for the post-2013 programs.
- Continue to promote the Direct Discount delivery mechanism and recruit additional trade allies. This mechanism helps small C&I customers quickly implement projects with no paperwork and little upfront investments.
- Continue to develop ways to identify government and non-profit sector customers and to reach small C&I customers with appropriate and compelling marketing, and identifying efficiency measures that are appropriate for these customers.
- Retailers are excited about the program's CFL recycling component and recycling bins were located in approximately 40 participating stores. Information about both the mercury content in CFLs and the CFL recycling best practices is available to customers on PPL's Website and in brochures and posters used at community and retailer give-away events.
- Develop an online dashboard in the Custom program to allow customers to see their projects' progress.
- Develop a formal, streamlined application process for landlord-tenant projects, where thorough data collection and tracking ensure accurate reporting.

#### 5.2.4 **First Energy Companies**

##### **Process Evaluation**

As indicated in Met-Ed's, Penelec's, and PennPower's respective PY2 Annual Report, the PY2 process evaluation efforts included the following:

- Review of the measures and program delivery mechanisms in the Companies' plan portfolios;
- Interviews with the EDC's internal staff and CSP staff;
- Drafting of process evaluation plans for all programs;
- Creation of logic models for each program; and
- Identification of researchable issues for each program.

The process evaluation also resulted in immediate feedback to FirstEnergy Companies regarding the following items:

- Review of rebate forms to ensure that proper data fields are collected and documented;
- Review of various program tracking systems;
- Review of ability to evaluate the program, with specific suggestions that will increase the ease with which certain programs can be evaluated; and Projections of energy savings achievements by May 31, 2011 for key programs, and projections of potential energy savings under alternate scenarios that involve program modifications.

**5.2.4.1 Met-Ed**  
**Impact Evaluation**

A summary of the energy and demand realization rates resulting from the impact evaluation activities conducted for projects implemented in PY2 are presented in the following table:

**Table 5-6: Summary of Evaluation Activities - Met-Ed**

<b>Program</b>	<b>PYTD Participant Sample</b>	<b>Realization Rate – Energy</b>	<b>Realization Rate - Demand</b>
<b>Demand Reduction<sup>1</sup></b>	N/A	N/A	N/A
<b>Home Energy Audits</b>	322	0.98	0.57
<b>Appliance Turn-In</b>	70	1.00	1.00
<b>EE HVAC</b>	72	1.26	1.56
<b>EE Products</b>	269	0.99	0.97
<b>New Construction</b>	18	0.78	0.68
<b>Whole Building</b>	18	0.93	1.00
<b>Multiple Family</b>	29	1.01	1.00
<b>WARM Programs</b>	146	1.03	0.99
<b>Energy Audit, Assessment and Equipment Rebate</b>	34	0.97	1.26
<b>C/I Performance Contracting/Equipment</b>	22	1.05	1.19
<b>Industrial Motors and VSD</b>	4	0.58	1.02
<b>PJM Demand Response</b>	N/A	N/A	N/A
<b>Street Lighting</b>	19	1.00	N/A
<b>Non-Profit</b>	8	0.86	0.98
<b>Remaining Government/Nonprofit</b>	88	0.89	0.68
<b>TOTAL PORTFOLIO</b>	1,119	0.99	1.01
Notes:			
1. Demand Reduction programs will not go into effect until the summer of 2012, therefore no evaluation have been conducted to-date.			

**5.2.4.2 Penelec**  
**Impact Evaluation**

A summary of the energy and demand realization rates resulting from the impact evaluation activities conducted for projects implemented in PY2 are presented in the following table:

**Table 5-7: Summary of Evaluation Activities - Penelec**

<b>Program</b>	<b>PYTD Participant Sample</b>	<b>Realization Rate – Energy</b>	<b>Realization Rate - Demand</b>
<b>Demand Reduction<sup>1</sup></b>	N/A	N/A	N/A
<b>Home Energy Audits</b>	316	1.02	0.61
<b>Appliance Turn-In</b>	70	1.00	1.00
<b>EE HVAC</b>	48	0.96	1.11
<b>EE Products</b>	344	1.00	1.02
<b>New Construction</b>	9	0.73	0.80
<b>Whole Building</b>	3	1.00	1.00
<b>Multiple Family</b>	28	1.02	1.00
<b>WARM Programs</b>	146	0.94	0.91
<b>Energy Audit, Assessment and Equipment Rebate</b>	37	1.03	0.98
<b>C/I Performance Contracting/Equipment</b>	22	0.99	1.02
<b>Industrial Motors and VSD</b>	4	0.71	0.93
<b>PJM Demand Response</b>	N/A	N/A	N/A
<b>Street Lighting</b>	20	0.97	N/A
<b>Non-Profit</b>	18	0.57	0.49
<b>Remaining Government/Nonprofit</b>	88	0.67	0.55
<b>TOTAL PORTFOLIO</b>	1,125	0.95	0.87
Notes:			
1. Demand Reduction programs will not go into effect until the summer of 2012, therefore no evaluation have been conducted to-date.			

**5.2.4.3 Penn Power**

**Impact Evaluation**

A summary of the energy and demand realization rates resulting from the impact evaluation activities conducted for projects implemented in PY2 are presented in the following table:

**Table 5-8: Summary of Evaluation Activities - Penn Power**

<b>Program</b>	<b>PYTD Participant Sample</b>	<b>Realization Rate – Energy</b>	<b>Realization Rate - Demand</b>
<b>Demand Reduction<sup>1</sup></b>	N/A	N/A	N/A
<b>Home Energy Audits</b>	211	0.99	0.56
<b>Appliance Turn-In</b>	70	1.00	1.00
<b>EE HVAC</b>	47	1.20	1.56
<b>EE Products</b>	127	1.00	1.05
<b>New Construction</b>	19	0.83	0.84
<b>Whole Building</b>	2	1.00	1.00
<b>Multiple Family</b>	29	1.01	1.00
<b>WARM Programs</b>	146	0.96	0.89
<b>Energy Audit, Assessment and Equipment Rebate</b>	30	1.07	1.06
<b>C/I Performance Contracting/Equipment</b>	16	0.91	1.13
<b>Industrial Motors and VSD</b>	3	1.14	0.86
<b>PJM Demand Response</b>	N/A	N/A	N/A
<b>Street Lighting</b>	18	1.00	N/A
<b>Non-Profit</b>	2	0.41	0.63
<b>Remaining Government/Nonprofit</b>	71	0.85	0.85
<b>TOTAL PORTFOLIO</b>	791	0.97	0.99
Notes:			
1. Demand Reduction programs will not go into effect until the summer of 2012, therefore no evaluation have been conducted to-date.			



5.2.5 **West Penn Power**

**Impact Evaluation:**

A summary of the energy and demand realization rates resulting from the impact evaluation activities conducted for projects implemented in PY2 are presented in the following table:

**Table 5-9: Summary of Evaluation Activities – West Penn Power**

Program	PYTD Participant Sample	Realization Rate – Energy	Realization Rate - Demand
Compact Fluorescent Lighting (CFL) Rewards Program	1,675	1.00	1.00
Residential Energy Star and High Efficiency Appliance Program	12,243	1.00	1.00
Residential Home Performance Program	8,446	0.93	0.93
Residential Whole Home Appliance Efficiency Program	1,043	1.00	1.00
Residential Low Income Home Performance Check-Up Audit & Appliance Replacement Program	2,093	1.00	0.73
Residential Low Income Joint Utility Management Program	71	0.91	0.68
Governmental/Non-Profit Lighting Efficiency Program	557	0.81	0.82
Commercial HVAC Efficiency Program	2	1.21	1.19
Commercial Products Efficiency Program	112	0.98	0.94
Custom Technology Applications Program	N/A	0.99	0.96
Custom Applications Program	N/A	1.15	0.99
Commercial and Industrial Drives Program	N/A	0.85	0.83
<b>TOTAL PORTFOLIO</b>	26,242	Not applicable	Not applicable

**Process Evaluation**

**CFL Rewards Program:** PY2 design changes actively addressed participation barriers found in PY1. Participants were largely satisfied with the program; 84% of participations rated the programs as an 8 or above on a 1 to 10 scale.

**Residential Energy Star and High Efficiency Appliance Program:** A key program improvement in PY2 was the addition of promotional partnerships with retailers to promote appliances eligible for the Program. Another notable change was the addition of program qualified recyclers to provide customers with more convenient retailer recycling options.

**Residential Home Performance Program:** Participant survey findings showed that the On-line Audit tool was an effective tool for referring customers to other Watt Watchers programs. The most common programs customers participated in as a result of completing the On-Line Audit were the ES Appliances and CFL Rewards programs. Findings from both the Online Analyzer and CFL giveaway events demonstrated that about 75% of bulbs received through the program were installed in the home and about 90% of the installed CFLs replaced incandescent bulbs.

**Residential Low Income Home Performance Check-up Audit and Appliance Replacement Program:** Participant and contractor surveys indicated high satisfaction with the program and West Penn Power. The participant surveys revealed that auditors were providing information as intended and designed by the program. Participants, for the most part, verified receiving the measures claimed by the program.

However, it was noted that the program could benefit from more consistent direct installation of kit materials.

**Residential Low Income Joint Utility Usage Management Program:** The process evaluation revealed that the JUUMP Program is experiencing institutional barriers to delivery – in large part inhibited by requirements Columbia Gas must adhere to in its program delivery. It was also noted that the check-up component of the program could provide an opportunity for the program to influence energy conservation behaviors or further energy efficiency purchases. Evaluators also commented that the audit documentation may provide non-tracked savings that, in time, may be able to be claimed by the program based on auditor information and recommendations. Participants, for the most part, were very satisfied with the services they received through this program.

**Governmental/School/Non-Profit Portfolio Program:** In PY2 the program primarily focused its outreach efforts to the lighting trade on major distributors, and did not widely engage installation contractors. Expanding outreach to installation contractors is one area for growth, as several installation contractors called for increased communications from the program. Feedback from all trade allies suggested that budget constraints and the struggling economy remain among the most pressing barriers to participating. In addition, several trades reported that while many institutional customers were aware that the West Penn Power rebate programs exist, a general lack of knowledge of program requirements is a barrier to participation. Participating customers and trade allies expressed high satisfaction overall, especially regarding their interactions with program staff. Participating customers were also highly satisfied with the performance of program equipment. Overall, the program's realization rate is acceptable compared to the EM&V Team's experience for similar programs nationwide. The main drivers of the downward verified savings adjustments were based on the accuracy of verified fixture codes, pre and post installed fixture counts, applied interactive factors, building space types in which bulbs were installed, and stored (rather than installed) fixtures, as well as, lower installation rates for the free giveaway component of the program.

**Commercial HVAC Efficiency Program:** Interviews with HVAC trade allies indicate the need for program outreach to support the PY3 HVAC program offering. Interviewed trade allies were not aware of West Penn Power HVAC commercial offerings.

**Commercial Products Efficiency Program:** In PY2 the program successfully built relationships with major lighting distributors, but there remain opportunities for the program to expand outreach to trade allies in PY3, especially to lighting installation contractors. Feedback from all trade allies suggests that budget constraints and the struggling economy remain amount the most pressing barriers to participating. Participating customers and trade allies expressed high satisfaction overall, especially regarding their interactions with program staff. Despite the Realization Rates for PY2 being close to 1.0, evaluators identified some opportunities for improvement and issues to be made aware of to ensure good realization rates continue going forward.

**Custom Technology Applications Program & Custom Applications Program:** The Custom Technologies Applications Program is picking up a number of the large commercial lighting projects that were

expected to be covered under the Commercial Products Efficiency Program. The decision was made to include them as Custom Programs due to M&V requirements of the SWE. In general, the requirement to not shift funds between programs has caused issues for Program Managers and for evaluation budgets that were based on a much smaller number of Custom projects. Finally, the biggest issue has been the SWE requirements for on-site data collection. A third-party M&V implementation contractor is used by the program manager to conduct any on-site data collection to meet SWE requirements. These have typically only included pre-installation, particularly for larger commercial projects. Given that all of these projects are included in the Custom Program category because of the use of the M&V contractor, there is additional burden on the program budget.

**Commercial and Industrial Drives Program:** The realization rate (ratio of calculated to verified savings) for the program are decent. The realization rate is primarily being driven downward by one project that had incorrectly calculated reported savings relative to TRM procedures.

## 6 Statewide Evaluator Program and Evaluation Support Activities

As part of the Statewide Evaluator (SWE) audit activities, the members of the SWE Team met with each EDC to review current program implementation and evaluation activities and to address any pressing issues. Currently, the SWE Team holds bi-weekly teleconferences with each EDC to discuss current and planned measurement and verification (M&V) activities, to schedule upcoming site-visits and audit activities, and to address any unresolved questions or issues that may arise throughout the evaluation process. An update on each of these activities is provided in the following sections.

### 6.1 Technical Working Group Meetings

The technical working group meetings are attended by representative from the following:

- Technical Utility Services (TUS) Staff
- SWE team
- EDCs
- EDC Evaluation, Measurement and Verification (EM&V) contractors and
- Pennsylvania Energy Association

The SWE Team held the following Technical Working Group (TWG) meetings during Program Year 2 (PY2).

- June 3, 2010 – General TWG Meeting
- June 4, 2010 – C&I TRM TWG Meeting
- June 11, 2010 – Demand Response TWG Meeting
- July 29, 2010 – Demand Response TWG Meeting
- September 2, 2010 – General TWG Meeting
- September 17, 2010 – General TWG Meeting
- November 16, 2010 – General TWG Meeting and Evaluation Best Practices Workshop
- February 14, 2011 – General TWG Meeting
- February 28, 2011 – General TWG Meeting
- March 14, 2011 – General TWG Meeting
- March 15, 2011 – Demand Response TWG Meeting
- April 27, 2010 - General TWG Meeting
- May 23, 2011 – Evaluation Best Practices Workshop
- May 24, 2011 – General TWG Meeting

The focus of each TWG meeting varied depending on the interests and needs of the parties in attendance. The following topics were discussed at one or more TWG meetings::

- Interim and Technical Reference Manual (TRM) measures savings protocols;
- Total Resource Cost (TRC) assumptions and calculation methods;
- Demand Response M&V protocols;
- Program reporting guidelines;
- Program implementation and evaluation best practices;
- Audit Plan updates;
- Guidance Memos regarding
  - Custom Measure Process,

- Sampling Resolutions,
- Calculating Coincident Demand for Non-Weather Dependent Measures,
- Reporting Timing Issues,
- Clarification for Meter Level and System Level Savings,
- Treatment of LED Lighting, and
- Clarification of SWE Site Inspections;
- Baseline Study methodologies and assumptions, and
- Potential Study methodologies and assumptions.

## **6.2 Status of Technical Reference Manual Update**

In accordance with previous Commission Orders, the TRM was updated for PY4, effective June 1, 2012 to May 31, 2013 (2012 TRM). The EDCs and other interested parties proposed revisions to existing TRM measures based on PY2 findings and observations. New protocols not in the TRM were also submitted for review via the interim measure protocol process (see Section 6.3). The SWE in collaboration with the PA PUC staff, EDCs and their EM&V contractors identified specific areas of improvement to the TRM for both commercial and residential protocols. The 2012 TRM Final Order (with the manual and appendices) was approved at the Public Meeting held on December 15, 2011.

Residential changes include, but are not limited to, the following:

- Heating, ventilation and air conditioning (HVAC) issues include providing additional guidance on usage of algorithms for different measures, addition of heating and cooling subscripts for capacity and equivalent full load hour terms for clarity, removal of proper sizing and quality installation measures, developing stipulated values for furnace high efficiency fan measure.
- Refrigerator/Freezer Recycling and Replacement issues include modifying subscripts for terms in algorithms for clarity, modifying the applicability of the protocol to include both residential and non-residential sectors and to account for savings in cases where the replacement unit is either ENERGY STAR or non-ENERGY STAR qualified.
- Lighting issues include providing additional guidance on the use of appropriate baseline wattage for general service lamps pre- and post-Energy Independence and Security Act (EISA) 2007 standards.
- Appliances issues include updating deemed values for refrigerators and freezers based on latest ENERGY STAR calculators and expanding the clothes washer measure by adding deemed values for different combinations of water heater and dryer types.
- Definition issues include clarifying energy efficiency rating terms.

Commercial and industrial changes include, but are not limited to, the following:

- Hours of use issues include clarifying appropriate use of stipulated values and logging, defining acceptable methodologies for determining alternate hours of use in ex ante and ex post cases, expanding the building type table along with hours of use (HOU) and coincidence factor values, and clarifying requirements for “other” category.

- TRM Appendix C issues include providing additional guidance on usage of TRM Appendix C (procedure for exceptional cases), addition of new fixture codes, custom coincidence factors and controls options, and other minor programming corrections. Additionally, the TRM language has been updated to better support TRM Appendix C.
- Baseline issues include clarifying the use of code standards to determine the baseline condition for commercial protocols and addition of lighting power densities using American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) methodology for exterior lighting in case of new construction projects
- Motors and drives issues include clarifying the appropriate use of stipulated values and metering, expanding the ESF and DSF table with additional baseline cases, and other minor programming corrections and revising definitions in TRM Appendix D.
- HVAC and Chiller issues include modifying baseline for ground source heat pumps (GSHP), groundwater source heat pumps, and water source heat pumps, clarifying the use of Seasonal Energy Efficiency Ratio (SEER) and Energy Efficiency Ratio (EER) for calculating the energy and peak demand savings for air conditioning and air source heat pump units less than 65,000 BtuH, addition of EFLH values for Allentown and addition of zip code mapping table to assign each zip code to a particular city.
- Definition issues include clarifying “load factor,” “coincidence factor,” “early replacement,” “replace on burnout,” “EER,” “SEER,” Heating Seasonal Performance Factor (HSPF) terms and addition of temperature ranges to identify the appropriate interactive factor value.

### **6.3 Interim protocols**

For measures not already in the TRM that are suitable for deemed or partially deemed savings, EDCs may use interim measure protocols (IMPs) to determine savings prior to adoption via the formal TRM process. The SWE Team approves protocols for use after a collaborative and iterative review process with the TWG. In order to effectively allocate resources, the TWG focused on “priority 1 measures,” which were considered to be the measures most likely to contribute immediate savings to the EDC portfolios. Since the first round of IMPs were approved in 2010, the SWE Team and EDCs have developed 13 residential and 21 commercial IMPs. All IMPs approved on 9/16/2011 and 9/23/2011 were included in the 2012 TRM update. All other protocols will be submitted for the 2013 TRM update.

Table 6-1 summarizes the residential protocols completed and under review that will be included in the TRM update for 2012. Table 6-2 summarizes the commercial protocols completed and under review that will be included in the TRM update for 2012.

**Table 6-1: Residential Interim Measure Protocols Approved**

<b>Category</b>	<b>Protocol</b>	<b>Approval Date</b>
<b>POOL PUMPS</b>	Pool Pump Load Shifting	9/16/2011
	Pool Pump with Variable Frequency Drive (“VFD”) Motor and Load Shifting	
	Pool Pump with VFD Motor	
	High Efficiency Two-Speed Pool Pump	
<b>HOME ELECTRONICS</b>	ENERGY STAR Office Equipment	9/16/2011
<b>LIGHTING</b>	ENERGY STAR Light-Emitting Diodes (“LED”)	9/16/2011
	Residential Occupancy Sensors	
	Holiday Lights	
	Low-Income Lighting	
<b>APPLIANCES</b>	Appliance Recycling and Replacement with non-ENERGY STAR Refrigerators	9/23/2011
	ES Compact Refrigerators	11/3/2011
	ES Water Coolers	11/3/2011
<b>WATER HEATING</b>	Water Heater Tank Wrap	9/16/2011

**Table 6-2: Commercial & Industrial Interim Measure Protocols Approved**

<b>Category</b>	<b>Protocol</b>	<b>Approval Date</b>
<b>HVAC</b>	Ductless Mini-Split Heat Pumps – Commercial <5.4 tons	9/16/2011
	Small C&I Heating, Ventilation and Air Conditioning (“HVAC”) Refrigerant Charge Correction	
	Geothermal Heat Pumps	
	ENERGY STAR Room Air Conditioner	
<b>LIGHTING</b>	Exterior Lighting for New Construction	9/23/2011
	LED Channel Signage	9/16/2011
<b>APPLIANCES</b>	Office Equipment - Network Power Management Enabling	9/16/2011
	ENERGY STAR Electric Steam Cooker	
	ENERGY STAR Clothes Washer	
<b>REFRIGERATION</b>	Refrigeration – Night Covers for Display Cases	9/16/2011
	Refrigeration – Strip Curtains for Walk-In Freezers and Coolers	
	Refrigeration – Auto Closers	
	Refrigeration – Door Gaskets for Walk-In Coolers and Freezers	
	Refrigeration – Suction Pipes Insulation	
	Refrigeration – Evaporator Fan Controller	
	Refrigeration – Special Doors with Low or No Anti-Sweat Heat for Low Temp Case	
	Floating Head Pressure Control	11/15/2011
<b>WATER HEATING</b>	Electric Resistance Water Heaters	9/16/2011
	Heat Pump Water Heaters	
	Low Flow Pre-Rinse Sprayers	



### 6.4 Demand Response Protocols

The SWE Team provided a Demand Response survey to all EDCs regarding the status of program development and implementation. The SWE Team also discussed the various demand response audit activities that could be expected from the SWE Team for audits during the summer of 2012.

The following table provides an overview of the EDC Demand Response programs and activities pre-2012:

**Table 6-3: Summary of Demand Response Programs To-Date**

EDC	Program Name	Program Type	Sector	Pre-2012 Activities	Test Data Available?
<b>West Penn Power</b>					
	Critical Peak Rebate Rate	Peak Rebate	Res	Pilot/Test Only	No
	TOU w/Critical Peak Rate	Peak Tariff Rate	Res	Pilot/Test Only	No
	Cust Resources DR	CSP Load Curtailment	Large C&I	Pilot/Test Only	No
	Cust Load Response	WPP Load Curtailment	Large C&I	Pilot/Test Only	No
	Distributed Generation	Distributed Generation	Large C&I	Pilot/Test Only	No
<b>Duquesne</b>					
	Direct Load Control	DLC, AC Water Heaters	RES	Pilot/Test Only	No
	Direct Load Control	Direct Load Control, AC	Small C&I	Pilot/Test Only	No
	Large CSP	Load Curtailment	Large C&I	Pilot/Test Only	No
<b>FirstEnergy</b>					
	Res Demand Reduction	DLC, CAC Two Way Com	Res	Pilot/Test Only	No
	Mandatory Program,	Load Curtailment	C&I	Pilot/Test Only	No
	Voluntary Program	Load Curtailment	C&I	Unknown	No
	FE as CSP	Load Curtailment	C&I	Unknown	No
<b>PPL</b>					
	Direct Load Control	Direct Load Control	Res, C&I	Pilot/Test Only	No
	Load Curtailment	Load Curtailment	C&I	No	No
<b>PECO</b>					
	Res Direct Load Control	Direct Load Control	Res	Pilot	Yes
	C&I Direct Load Control	Direct Load Control	C&I	Unknown	No
	DR Aggregation (PJM DR)	Load Curtailment	C&I	Unknown	No
	Distributed Resources	Distributed Generation	C&I	No	No
	Permanent Load Reduction	Permanent Load Reduction	C&I	No	No
	CVR Energy/Demand	Custom, Voltage Reduction	Res and C&I	2010 Pilot	Yes

### 6.5 Total Resource Cost Test Issues

There are several common assumptions in any TRC model which play a significant role in the benefit-cost ratio calculation. These include the line loss factor, discount rate, and avoided electricity and other fuel costs. Additional details specific to each EDC are presented in Section 7.5.

Line loss factors are presented for each EDC by sector in Table 6-4. PPL is the only EDC whose TRC line loss factor varies by sector. Increasing the line loss factor will increase the benefits associated with a program, and therefore larger line loss factors will result in higher benefits and higher TRC ratios. EDCs were directed to use line loss factors as filed in their original EE&C plans. Moving forward, the SWE recommends that line loss factors taken from more recently filed reports be used to reflect the most accurate representation of benefits and cost-effectiveness ratios.

**Table 6-4: Line Loss Factor by EDC and Sector**

EDC	Residential	Commercial	GNP	Industrial
Duquesne	7.00%	7.00%	7.00%	7.00%
Met-Ed	11.00%	11.00%	11.00%	11.00%
Penelec	11.00%	11.00%	11.00%	11.00%
Penn Power	11.00%	11.00%	11.00%	11.00%
PECO	7.10%	7.10%	7.10%	7.10%
PPL	8.33%	8.33%	8.33%	4.12%
West Penn	11.00%	11.00%	11.00%	11.00%
<b>Average</b>	<b>9.49%</b>	<b>9.49%</b>	<b>9.49%</b>	<b>8.89%</b>

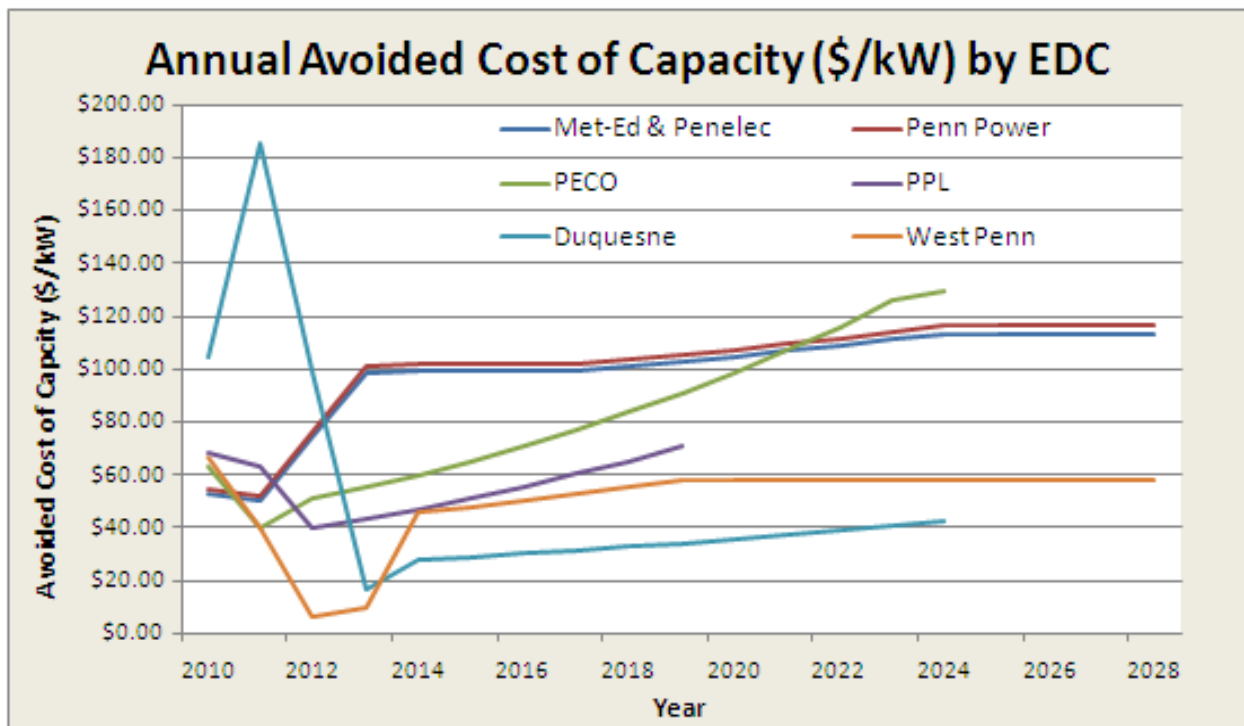
The nominal discount rate is another underlying assumption that has a considerable effect on the final TRC ratio. In a TRC test, the discount rate reflects the utility cost associated with borrowing capital. The discount rates, along with the average across the seven EDCs are shown in Table 6-5.

**Table 6-5: Discount Rate by EDC**

EDC	Discount Rate
Duquesne	6.90%
Met-Ed	7.92%
Penelec	7.92%
Penn Power	7.92%
PECO	7.45%
PPL	8.00%
West Penn	9.03%
<b>Average</b>	<b>7.88%</b>

Avoided cost of capacity benefits, or the TRC benefits associated with peak demand savings, is another area that contained significant variation between EDCs. Figure 6-1 shows the annual avoided cost of capacity for each of the EDCs. No value is assigned to the cost of capacity for Duquesne because the avoided cost of energy filed by Duquesne in its EE&C plan included the cost of capacity, so a separate calculation is not needed to account for capacity benefits. PPL’s TRC model does not include estimates for avoided cost of capacity beyond 2020 because the energy futures used to determine avoided energy cost included the cost of capacity. Figure 6-1 also shows significant variation between the annual values EDCs associate with not having to expand generation capacity. The variation in avoided capacity costs leads to significant differences in the financial benefits attributed to measures which reduce peak demand.

Figure 6-1: Avoided Cost of Capacity Forecast by EDC



### 6.6 Net to Gross Issues

The SWE Team prepared a white paper – *Net Savings: An Overview* – that was distributed to the EDCs in October 2011. The paper defined the basis for determining net savings of energy efficiency and demand response programs, and outlined policy options for the PA PUC. This paper also provided information on how other states use net to gross ratios for reporting of program savings. Net to gross refers to the comparison of net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts.

The term “net savings” refers to savings that are attributable to the Act 129 energy efficiency and demand response programs that would not have occurred in the absence of these programs. Initially, the issue of *net savings* in the evaluation of the EE&C programs was postponed. According to the

*Implementation of Act 129 of 2008 – 2009 Total Resource Cost (TRC) Test Order* (Docket No. M-2009-2108601), the Commission decided that the evaluations “shall go forward without a NTG<sup>[18]</sup> ratio (and adjustment) for the first year.”<sup>19</sup>

One purpose of this white paper was to define the factors that differentiate net and gross impacts and explain the issues associated with and the general approaches to calculating net savings, conducting net-to-gross (NTG) studies, and computing net-to-gross ratios (NTGR).

The SWE Team recommended that NTG studies be conducted for Act 129 EE&C programs for the purposes of acquiring data to improve program planning, effectiveness and electricity savings. The SWE Team recommended using verified gross savings, however, to set kWh and kW savings goals and to determine whether those goals have been attained. The SWE Team did not recommend using net savings to determine if program goals have been attained, or to determine if a utility should get a financial incentive reward or penalty. The SWE Team circulated this white paper for comment and plans to issue a final version of this paper during 2012.

The SWE Team completed a second white paper on methods used to determine net-to-gross ratios in January 2012. This paper is titled “*Net to Gross Study Methods: Review and Recommendations.*” This white paper provides an overview of the various methodologies employed to determine net savings and NTG ratios. This paper will be completed in PY3 and will include recommendations and guidelines outlining the preferred NTG study methods for each type of EE&C program implemented by the seven EDCs.

## **6.7 EDC Meetings**

The SWE Team held bi-weekly teleconferences with each of the EDCs during PY2 to discuss on-going and/or emerging issues. Some of the topics discussed during these bi-weekly teleconferences included:

- Interim measures and proposed deemed savings values;
- Proper use of TRM deemed savings values for such measures as refrigerator recycling;
- Sample sizes for statistically significant evaluations by program type and projected impact;
- TRC calculations and assumptions;
- Demand response programs and audit activities;
- NTG studies and results;
- Process evaluation findings;
- Development of random samples for the SWE residential and commercial baseline studies; and
- Methodology to be used for the statewide energy efficiency potential study.

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<sup>18</sup> NTG: Net-to-Gross.

<sup>19</sup> The NTG factor was set as 1.0 until further direction is provided by the PUC.

## **7 Statewide Evaluator Audit Activities**

During Program Year 2 (PY2), the Statewide Evaluation (SWE) Team traveled to each EDC and to specific project sites to conduct on-site audits of various programs implemented in PY2. Additionally, the SWE Team conducted desktop audits for various programs. An update on each of these activities is provided in the following sections.

### **7.1 Residential Program Audit Activities by Program**

The SWE Team audited the high-impact energy efficiency programs in PY2. The activities conducted and the findings and recommendations from the audits are outlined in the following sections.

#### **7.1.1 Energy Efficiency Products Programs**

Energy efficiency products programs include programs which offer rebates for ENERGY STAR or high-efficiency appliances. All of the eligible measures for these programs have deemed savings values. The SWE Team reviewed the program databases to verify the accuracy of a sample of measures rebated against rebate applications, verified total measure counts as reported in the annual report, and verified measures savings assumptions per TRM deemed savings values. The SWE Team did not conduct site-visit verification of the measures purchased under this program as this type of program is a straightforward rebate program. The findings from the SWE Team audit of each EDC's respective energy efficiency products program are presented in the following sections.

##### **7.1.1.1 Duquesne**

###### **7.1.1.1.1 Program Impact**

In order to audit Duquesne's REEP Program (Duquesne's Residential Efficient Equipment Rebate program) for PY2, the SWE requested samples of Duquesne's customer rebate applications and corresponding database entries. The SWE then checked these participants' rebate applications against the Duquesne database. The SWE found that all participants sampled had active Duquesne accounts and all measures that were rebated were on the approved list. Each measure could either be found in the energy catalog (which required the participant to submit an application and receipt) or was a part of a Duquesne approved kit energy efficiency (in which case Niagara invoices to Duquesne were cross-checked with shipping receipts and payment vouchers.)

In the samples from PY2 the SWE found a few minor quality control errors that were reported to Duquesne in the quarterly reports. For example, in the check for quarter one, the SWE found one customer with two appliances (refrigerator and dehumidifier) on his rebate application but a corresponding receipt for only one of these appliances (the refrigerator). Duquesne only had a record of the refrigerator in their database despite the fact that two appliance were indicated on the initial rebate application. Starting in the later part of PY2, the SWE informed Duquesne that the SWE would be choosing the sample from Duquesne's residential database. This will give the SWE a higher level of confidence in the random sample audited.

### **7.1.1.2 FirstEnergy**

#### **7.1.1.2.1 Program Impact**

In order to audit FirstEnergy's Efficient Equipment Rebate program for PY2, the SWE requested samples of Met-Ed's customer rebate applications and corresponding database entries on a quarterly basis. The SWE then checked these participants' rebate applications against the FirstEnergy database.

For quarter one of PY2, the requested information from Met-Ed, Penelec, and Penn Power was provided too late to be included in the first quarter report. However, the FirstEnergy Companies have consistently provided the information to the SWE from PY2Q2 onward. In the samples from PY2 the SWE found that FirstEnergy is following up with customers if they do not properly complete the rebate application for the program. For example, the SWE found that one of the original rebate applications was rejected and then resubmitted by the customer as it was missing the sales receipt. FirstEnergy sent a letter back to this customer, the customer resubmitted the application with the required receipt and FirstEnergy then rebated the customers. Starting in the later part of PY2 the SWE informed FirstEnergy that the SWE would be choosing the sample from FirstEnergy's residential database. This will give the SWE a higher level of confidence in the random sample.

### **7.1.1.3 PECO**

#### **7.1.1.3.1 Program Impact**

In order to audit PECO's Efficient Equipment Rebate program for PY2, the SWE requested samples of PECO's customer rebate applications and corresponding database entries on a quarterly basis. The SWE then checked these participants' rebate applications against the PECO database.

In the samples from PY2 the SWE found that PECO is following up with customers if they do not properly complete the rebate application for the program. For example, the SWE found that several original customer rebate applications were rejected and then resubmitted by the customers as the rebate applications were missing the sales receipt. PECO sent a letter back to these customers (included in the rebate application file), the customers resubmitted the applications with the required receipt and PECO then rebated the customers. Starting in the later part of PY2 the SWE informed PECO that the SWE would be choosing the sample from PECO's residential database. This will give the SWE a higher level of confidence in the random sample.

### **7.1.1.4 PPL**

#### **7.1.1.4.1 Program Impact**

In order to audit PPL's Efficient Products Program for PY2, the SWE requested samples of PPL's customer rebate applications and corresponding database entries. The SWE then checked these participant's rebate applications against the PPL database. There were no major quality control issues found in any of the SWE samples from PPL. Starting in the later part of PY2 the SWE informed PPL that the SWE would be choosing the sample from PPL's residential database. This will give the SWE a higher level of confidence in the random sample.

### 7.1.2 Appliance Recycling Programs

The appliance recycling programs include those programs for which a contract service provider (JACO, the vendor for all PA EDCs' Appliance Recycling Programs) removes older, inefficient appliances from the home; in about thirty percent of the scenarios in PY2, the appliance is then replaced with a high-efficiency model. For JACO to recycle the appliance, the contractor must first verify that the appliance is in working order and therefore will generate energy savings once it is removed from the home.

Below is a table summarizing the TRM values of the appliance recycling scenarios:

**Table 7-1: Appliance Recycling Scenario TRM Savings Value**

Measure	kWh Savings	kW Savings	Coincidence Factor
Refrigerator/Freezer Retirement	1,728	0.24	0.62
Room AC Retirement	164-353 <sup>20</sup>	0.34	0.58

#### 7.1.2.1 Duquesne

##### 7.1.2.1.1 Program Impact

To audit DLC's program, the SWE requested samples of DLC's JACO Work Orders and corresponding database entries. The SWE then checked the database entries for these participants and verified them against the individual database entries for each customer from JACO. For each participant, the SWE verified that number and type of appliances removed was consistent across both databases. The SWE Team observed that all participants' data was consistent in both DLC and JACO's databases. DLC is using the updated values for energy savings of replaced and retired refrigerators. (See Table 7-1 above.)

#### 7.1.2.2 FirstEnergy

##### 7.1.2.2.1 Program Impact

To audit FirstEnergy's program, the SWE requested samples of FirstEnergy's JACO Work Orders and corresponding database entries. The SWE then checked the database entries for these participants and verified them against the individual database entries for each customer from JACO, the vendor for all PA EDCs' Appliance Recycling programs. For each participant, the SWE verified that number and type of appliances removed was consistent across both databases. The SWE Team observed that all participants' data was consistent in both FirstEnergy and JACO's databases. FirstEnergy is using the updated values for energy savings of replaced and retired refrigerators. (See Table 7-1 above.)

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<sup>20</sup> The kWh savings for Room Air Conditioner Retirement vary by city ranging from 164 kWh to 353 kWh. The following describes the kWh savings by city for Room AC Retirement. Erie: 164 kWh; Scranton: 213 kWh; Williamsport: 225; Pittsburgh: 251 kWh; Allentown: 268 kWh; Harrisburg: 318 kWh; Philadelphia: 353 kWh.

### **7.1.2.3 PECO**

#### **7.1.2.3.1 Program Impact**

To audit PECO's program, the SWE requested samples of PECO's JACO Work Orders and corresponding database entries. The SWE then checked the database entries for these participants and verified them against the individual database entries for each customer from JACO, the vendor for all PA EDCs' Appliance Recycling programs. For each participant, the SWE verified that the number and type of appliances removed were consistent across both databases. The SWE Team observed that all participants' data was consistent in both PECO's and JACO's databases. PECO is using the updated values for energy savings of replaced and retired refrigerators. (See Table 7-1 above.)

### **7.1.2.4 PPL**

#### **7.1.2.4.1 Program Impact**

To audit PPL's program, the SWE requested samples of PPL's JACO Work Orders and corresponding database entries. The SWE then checked the database entries for these participants and verified them against the individual database entries for each customer from JACO, the vendor for all PA EDCs' Appliance Recycling programs. For each participant, the SWE verified that number and type of appliances removed was consistent across both databases. The SWE Team observed that all participants' data was consistent in both PPL and JACO's databases. PPL is using the correct values for energy savings of retired refrigerators/freezers. (See Table 7-1 above.)



### 7.1.3 Lighting Programs

Lighting programs include programs which either:

- (a) Buy-down the cost of CFLs,
- (b) Give-away CFLs, or
- (c) Offer rebates for the purchase of CFLs.

All of the eligible measures for these programs have deemed savings values. The SWE Team reviewed the program databases to verify the accuracy of a sample of measures rebated against invoices, verified total measure counts as reported in the EDCs' respective annual report, and verified measures savings assumptions per TRM deemed savings values. No on-site inspections were conducted as the lighting programs are primarily upstream programs, which means that actual customer accounts cannot be associated with the bulbs purchased. Additionally, the savings algorithm inputs used to estimate CFL savings, including installation rates, are stipulated in the TRM. The findings from the SWE Team audit of each EDC's respective lighting program are presented in the following sections.

The following table contains a summary of the program year-to-date savings impacts from each EDC's respective residential CFL lighting program:

**Table 7-2: PYTD Gross and Verified MWh and MW Savings – Residential CFL Lighting Programs**

EDC	Program	PY2 Gross Energy Savings (MWh)	% of PY2 Portfolio Gross Energy Savings	PY2 Gross Demand Reduction (MW)	% of PY2 Portfolio Gross Demand Reduction
Duquesne	Upstream Lighting	52,533	31%	3.16	17%
PECO	Smart Lighting	189,248	26%	11.20	8%
PPL	CFL Campaign	146,000	32%	8.71	14%
Met-Ed	EE Products <sup>21</sup>	34,678	20%	2.12	10%
Penelec	EE Products <sup>22</sup>	35,279	20%	1.99	8%
Penn Power	EE Products <sup>23</sup>	15,555	25%	0.83	12%
West Penn Power	CFL Rewards Program	28,849	32%	1.60	12%

To audit these programs, the SWE Team conducted the following activities:

- Verified the number of bulbs reported;

<sup>21</sup> CFL measures and savings are included as part of the EE Products Program. The data presented in this table pertains to the EE Products Program in its entirety and is not specific to the CFL portion.

<sup>22</sup> CFL measures and savings are included as part of the EE Products Program. The data presented in this table pertains to the EE Products Program in its entirety and is not specific to the CFL portion.

<sup>23</sup> CFL measures and savings are included as part of the EE Products Program. The data presented in this table pertains to the EE Products Program in its entirety and is not specific to the CFL portion.

- Verified the savings protocol utilized to report kWh and kW savings;
- Verified the baseline assumptions utilized to calculate savings; and
- Verified the bulbs tracked against invoices received.

To verify each of these aspects, the SWE Team reviewed those values reported in the PY2 Annual Reports to the data tracked in each EDC’s database and tracking system. The findings from these activities are presented in the following sections.

### 7.1.3.1 Duquesne

#### 7.1.3.1.1 Program Impact

The following table contains a summary of the SWE Team audit findings and recommendations:

**Table 7-3: Summary of CFL Program Audit - Duquesne**

Category:	PY2 Report:	Database:	Notes:
<b>No. Bulbs</b>	Bulb-Count (PY2) • 1,103,170	Bulb-Count (IQ) • 428,998	<ul style="list-style-type: none"> <li>• IQ total bulb counts were verified for as part of the Residential Energy Efficiency Program (REEP) – Upstream Lighting and the Low Income Energy Efficiency Program (LIEEP) – Upstream Lighting. The LIEEP count is based on a percentage of total PY2 upstream sales.</li> <li>• No issues identified.</li> </ul>
<b>Gross Energy Savings</b>	MWh (PY2) • 52,533	MWh (IQ) • 19,617	<ul style="list-style-type: none"> <li>• Savings verified for both the REEP and LIEEP – Upstream Lighting program savings.</li> <li>• No issues identified.</li> </ul>
<b>Gross Demand Reduction</b>	MW (PY2) • 3.16	MW (PY2) • 1.17	<ul style="list-style-type: none"> <li>• Demand reduction verified for both the REEP and LIEEP – Upstream Lighting program savings.</li> <li>• No issues identified.</li> </ul>
<b>Use of 2010 TRM Protocols</b>	• N/A	• All savings calculated in accordance with the TRM protocols.	• No issue identified.
<b>Baseline Assumptions</b>	• N/A	• All assumptions are valid.	• No issues identified.
<b>Invoice Review</b>	• N/A	• No issues were identified.	• A total of 20 individual invoices were reviewed in PY2; several minor issues were identified and resolved with Duquesne.

**7.1.3.2 PECO**

**7.1.3.2.1 Program Impact**

The following table contains a summary of the SWE Team audit findings and recommendations:

**Table 7-4: Summary of CFL Program Audit - PECO**

<b>Category:</b>	<b>PY2Q4 Report:</b>	<b>Database:</b>	<b>Notes:</b>
<b>No. Bulbs</b>	Bulb-Count (IQ) • 1,075,859	Bulb-Count (IQ) • 1,075,953	• Bulb counts reported matched the bulb counts in the PY2Q4 database except for POS purchases.
<b>Gross Energy Savings</b>	MWh (IQ) • 51,316	MWh (IQ) • 51,316	• Gross energy savings reported matched the actual energy savings in the PY2Q4 database except for POS purchases.
<b>Gross Demand Reduction</b>	MW (IQ) • 3.0	MW (IQ) • 2.79	• The reported demand reduction is a rounded value of the demand reduction tracked in the database. The SWE Team does not recommend any adjustments to the reported value, but recommends that PECO increase the granularity of their reported demand reduction to match that tracked in their database.
<b>Use of 2010 TRM Protocols</b>	• N/A	• All savings calculated in accordance with the TRM protocols.	• Minor variances between calculated and database reported savings found; these are likely the result of rounding errors. • Total differences are less than 1% of reported savings; no action required to correct these differences.
<b>Baseline Assumptions</b>	• N/A	• All assumptions are valid.	• No issues identified.
<b>Invoice Review</b>	• N/A	• No issues were identified.	• PECO provided a sample of invoices; the SWE Team reviewed a sample of five. No issues were identified.

**7.1.3.3 PPL**

**7.1.3.3.1 Program Impact**

The following table contains a summary of the SWE Team audit findings and recommendations:

**Table 7-5: Summary of CFL Program Audit - PPL**

<b>Category:</b>	<b>PY2Q3 Report:</b>	<b>Database:</b>	<b>Notes:</b>
<b>No. Bulbs</b>	Bulb-Count (IQ) • 651,357	Bulb-Count (IQ) • 651,357	• No issues identified.
<b>Gross Energy Savings</b>	MWh (IQ) • 31,077	MWh (IQ) • 31,077	• No issues identified.
<b>Gross Demand Reduction</b>	MW (IQ) • 1.85	MW (IQ) • 1.71	• The reported demand reduction is 8% higher than that tracked in the database. This is because the reported demand reductions in the database are not grossed-up to reflect T&D losses. As noted in the PY2 annual report, this gross-up is performed during the impact evaluation and included in “reported savings.” For more clarity, it will be classified as an “ex ante adjustment” in future reports.
<b>Use of 2010 TRM Protocols</b>	• N/A	• All savings calculated in accordance with the TRM protocols.	• No issues identified.
<b>Baseline Assumptions</b>	• N/A	• All assumptions are valid.	• No issues identified.
<b>Invoice Review</b>	• N/A	• No issues were identified.	• PPL provided all Q4 CFL invoices; the SWE Team reviewed a sample of six. No issues were identified.

**7.1.3.4 FirstEnergy – Met-Ed, Penelec, Penn Power**

7.1.3.4.1 Program Impact

The following table contains a summary of the SWE Team audit findings and recommendations:

**Table 7-6: Summary of CFL Program Audit – FirstEnergy – Met-Ed, Penelec, Penn Power**

Category:	PY2Q3 Report:	Database:	Notes:
<b>No. Bulbs</b>	Participants (IQ) <ul style="list-style-type: none"> <li>• Met-Ed: 156,545</li> <li>• Penelec: 153,473</li> <li>• Penn Power: 36,498</li> <li>• Total:</li> </ul>	Bulb-Count (IQ) <ul style="list-style-type: none"> <li>• Met-Ed: 156,545</li> <li>• Penelec: 153,473</li> <li>• Penn Power: 36,948</li> </ul>	<ul style="list-style-type: none"> <li>• The SWE Team was unable to verify the IQ participant counts reported in the EDCs' respective PY2Q3 reports. The total bulbs distributed, via POS and Give-away Events, are noted in the "Database" column of this table.</li> <li>• The SWE Team recommends that FirstEnergy clearly identify the source of their CFL participant counts reported in future reports.</li> <li>• <i>Note: FirstEnergy reports CFL savings as part of their larger Efficient Equipment Program.</i></li> </ul>
<b>Gross Energy Savings</b>	MWh (IQ) <ul style="list-style-type: none"> <li>• N/A</li> </ul>	MWh (IQ) <ul style="list-style-type: none"> <li>• Met-Ed: 17,535</li> <li>• Penelec: 18,020</li> <li>• Penn Power: 5,381</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Note: FirstEnergy reports CFL savings as part of their larger Efficient Equipment Program.</i></li> </ul>
<b>Gross Demand Reduction</b>	MW (IQ) <ul style="list-style-type: none"> <li>• N/A</li> </ul>	MW (IQ) <ul style="list-style-type: none"> <li>• Met-Ed: 0.92</li> <li>• Penelec: 0.95</li> <li>• Penn Power: 0.28</li> </ul>	<ul style="list-style-type: none"> <li>• <i>Note: FirstEnergy reports CFL savings as part of their larger Efficient Equipment Program.</i></li> </ul>
<b>Use of 2010 TRM Protocols</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• All savings calculated in accordance with the TRM protocols.</li> </ul>	<ul style="list-style-type: none"> <li>• No issues identified.</li> </ul>
<b>Baseline Assumptions</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• All assumptions are valid.</li> </ul>	<ul style="list-style-type: none"> <li>• No issues identified.</li> </ul>
<b>Invoice Review</b>	<ul style="list-style-type: none"> <li>• N/A</li> </ul>	<ul style="list-style-type: none"> <li>• No issues identified.</li> </ul>	<ul style="list-style-type: none"> <li>• FirstEnergy provided all Q4invoices. The SWE Team reviewed a sample of seven; no issues were identified.</li> </ul>

**7.1.3.5 West Penn Power**

**7.1.3.5.1 Program Impact**

The following table contains a summary of the SWE Team audit findings and recommendations:

**Table 7-7: Summary of CFL Program Audit – West Penn**

Category:	PY2Q3 Report:	Energy Savings Calculator:	Database:	Notes:
<b>No. Bulbs</b>	IQ • 47,561	Bulb-Count (IQ) • 144,216	Bulb-Count (IQ) • 144,216	<ul style="list-style-type: none"> <li>The SWE Team verified the POS bulbs as these comprised the bulk of the CFL Program measure installations.</li> <li>West Penn Power reports participants in their report instead of bulb-counts. The participant counts for the Point of Sale Program are estimated. All other CFL distribution channels have support documentation that was provided to SWE. .</li> </ul>
<b>Gross Energy Savings</b>	MWh (IQ) • 10,100	MWh (IQ) • 10,101	MWh (IQ) • N/A	• No issue identified.
<b>Gross Demand Reduction</b>	MW (IQ) • 0.5	MW (IQ) • 0.55	MW (IQ) • N/A	• No issue identified.
<b>Use of 2010 TRM Protocols</b>	• N/A	• All savings calculated in accordance with the TRM protocols.	• All savings calculated in accordance with the TRM protocols.	• No issue identified.
<b>Baseline Assumptions</b>	• N/A	• All assumptions are valid.	• All assumptions are valid.	• No issues identified.
<b>Invoice Review</b>	• N/A	• N/A	• No issues identified.	• West Penn Power provided all Q4 invoices for POS purchases; the SWE Team reviewed a sample of five. No issues were identified.

**7.1.4 New Construction Programs**

MetEd, Penelec, and Penn Power were the only EDCs with active Residential New Construction Programs in PY2. The contribution of the programs to total portfolio savings is shown below:

**Table 7-8: Summary of Residential New Construction Impact - FirstEnergy**

EDC	No. Participants	Gross Claimed Savings (MWh)	% of Total Claimed Savings
<b>Met Ed</b>	228	720	0.4%
<b>Penelec</b>	36	217	0.1%
<b>Penn Power</b>	126	264	0.4%

Given the very small relative size of these programs, the SWE performed a desktop audit. This audit consisted of verifying REM/Rate models for both load and usage and checking of Performance Systems Development (PSD) QA/QC reports when available. PSD is the EDCs’ program implementer. REM/Rate is accredited Home Energy Ratings (HERS) software that meets applicable Mortgage Industry National Home Energy Rating System Standards. The basis against which savings were calculated can be found in Section 3 of the 2010 TRM (Residential New Construction). Additionally, “Premise ID” numbers (unique

to each property) and builder certificates were reviewed for the sampled homes as a check on actual construction.

#### **7.1.4.1 Sample Selection**

ADM Associates (ADM) is the EDCs' EM&V evaluator. ADM stratified the homes into four groupings for each EDC based on kWh savings. The SWE found the stratification acceptable. From these four strata, ADM picked a sample for its audit. PSD independently picked 10% of the total homes for each EDC from a variety of builders and raters for its QA/QC audit.

For the SWE audit, two homes were selected from each ADM stratum, where the strata were defined by kWh savings. Where possible, the SWE selected homes that were audited by either ADM or PSD, not both, and additionally selected homes from a variety of builders. For homes in the ADM sample, the SWE checked ADM's verification work and for homes in the PSD sample, the SWE independently checked the REM/Rate model outputs. Since there were very few homes in the Penelec program, many of the homes were audited by both PSD and ADM. Therefore, only one home in the SWE sample for Penelec is from the PSD sample.

#### **7.1.4.2 REM/Rate Usage (kWh) Verification**

In order to produce kWh and kW savings, REM/Rate needs a baseline home. Per ADM, FirstEnergy supplied the reference values in the 2010 TRM to the Architectural Energy Corporation (AEC) for incorporation into REM/Rate as a "FE PA Reference Home." ADM prepared an Excel spreadsheet of its EM&V results for the program which the SWE reviewed. It verified the consistency of the inputs in REM/Rate with the 2010 TRM as well as the consistency between the baseline and as-built homes. It additionally calculated for reasonableness of loads and Coefficients of Performance (COPs) generated by REM/Rate. The SWE ran the REM/Rate models for each home within its sample and either cross-checked ADM's EM&V or PSD's sample results.

The findings from the SWE sample were consistent with the realization rates reported by ADM. Therefore, the SWE recommends no adjustment to the reported verified energy (kWh) savings.

#### **7.1.4.3 REM/Rate Demand (kW) Verification**

The next step in the desktop audit process involved verification of reported kW savings. The 2010 TRM contains an algorithm for calculating kW savings using data from REM/Rate reports and other sections of the 2010 TRM for Lighting and Appliances and Ventilation Equipment. The demand savings reported by the EDCs were not based on the TRM. However, in reviewing the 2010 TRM protocol, the SWE determined that there is insufficient information in the REM/Rate inputs and outputs to use the TRM protocol. Based on sample calculations performed using a part of the TRM algorithm, the programs' reported demand savings appear conservative, reasonable and acceptable.

#### **7.1.4.4 Verification of Construction of Homes**

For the programs financial incentive to be given to a builder, a REM/Rate Model, builder's certificate, and "Premise ID" number must be reviewed by PSD. PSD also produces QA/QC audit reports as previously discussed. The SWE reviewed all of these documents and determined that all homes were

constructed to the standards of the program. One home failed its initial QA/QC report, but the problems were addressed to satisfy the program requirements.

#### **7.1.4.5 Program Costs**

Incentives are given based on the amount by which a home exceeds efficiency standards. The SWE compared the incentive values reported by each EDC in the data provided for the audit to the incentives reported in the PY2 Annual Reports. The annual reports for Met-Ed and Penn Power were consistent with the audit data. The annual report for Penelec was not consistent; the amount of incentives given in the annual report was significantly higher than the amount of incentives from the audit data. This was due to a difference between the time frame of the data provided by the audit and the data for the annual report. These timing issues will be trued-up in subsequent reporting periods.

#### **7.1.4.6 Issues**

Through discussions with ADM, the SWE identified two systematic issues with the REM/Rate model that were reflected in the realization rates reported for each EDC. The first issue was that a ceiling fan was present in the baseline home but not in the as-built home. Savings were being claimed for the lack of a fan in the as-built home. This resulted in a subtraction from gross savings equal to the kWh of the ceiling fan reported by REM/Rate. Going forward, AEC (REM/Rate vendors) are implementing a fix.

The second issue was that REM/Rate had problems modeling ground-source heat pumps. It did not take into account the energy consumption of the air handling unit and well pumps associated with a ground-source system and therefore overestimated the COP and energy efficiency ratio (EER) of the total system. To account for this issue, ADM used an extrinsic calculation that de-rated the REM/Rate reported Heating COPs and Cooling EERs by a calculated factor of 0.8. The claimed savings were then reduced accordingly. The SWE reviewed the formulas used to perform the extrinsic calculations and found an error in the de-rating of the Cooling EER – the REM/Rate reported value was not multiplied by a factor of 0.8. This error did not lead to significant changes in the reported realization rates (less than 1.5% per home); when weighted to the entire sample, the errors in the reported realization rate amounted to less than one percent.

Additionally, there was a difference between savings reported by PSD and verified by the SWE regarding auxiliary heating in gas-heated homes. AEC changed the way that REM/Rate internally generated equipment in the reference home between the time that PSD reported savings and the SWE evaluated the REM/Rate results. This created a disparity between the values reported by PSD and the values generated in REM/Rate by the SWE. The national standard for HERS ratings set by RESNET (Residential Energy Services Network) is to use the most up-to-date software at the time of construction to rate the home. Since PSD followed this standard when reporting their savings, the SWE recommends no adjustments to the reported energy savings.



## **7.2 Low-Income Program Audit Activities by EDC**

### **7.2.1 Site Visits**

This section summarizes initial observations, findings and recommendations issued to each individual EDC as a result of site inspections and database verification of PY2 low-income programs. These inspections were conducted as part of the SWE's responsibility to audit the EDC low-income portfolios. The goal of the site visits was to spot check the programs and provide qualitative feedback to EDCs to improve programs, where necessary. The SWE did not complete a statistically significant number of site visits and therefore the quantitative results of the site visits did not result in adjustments to installation rates. Particularly in the case of measures with low installation rates, as deemed in the TRM, the results of ten site visits may not represent actual installation rates. EDCs have received Site-Visit Summary Reports and have responded to comments and recommendations to improve implementation and evaluation of their low-income portfolios.

The SWE conducted site visit inspections of five (West Penn Power, Penn Power, Duquesne, PECO, Met-Ed) of the seven currently active low-income energy efficiency programs. These site visits were conducted throughout PY2. The purpose of these site visits was to verify that the number and type of energy efficiency measure listed in each EDC's database for their low income program participants were installed and operational, and to verify that the energy efficiency measure information in each utility's database was accurate.

The audit of the remaining two (PPL, Penelec) currently active low-income energy efficiency programs consisted of a desktop review of site visit reports compiled by each EDC or its EM&V evaluator. PPL completed over 900 site visits and the SWE determined that a desk review of reports was a better use of resources than conducting additional SWE site visits. Similarly, Penelec was also able to provide site visit reports compiled by its evaluator, which were used to supplant SWE site visits. The SWE made the determination that these site visit reports were sufficient after finding that the rigor of the visits and quality of the reports met the SWE's needs and that previous SWE site visit findings closely aligned with EDC findings.

The site-visits were coordinated between the SWE representative and either an EDC representative or the EDC evaluation implementation contractor. To improve the efficiency of this process, some site visits were conducted concurrent with the EDC's own evaluation efforts. The SWE targeted completion of 10 site-visits per EDC per quarter. It conducted less where the total sample size was too small to schedule enough willing participants. In total, 152 site-visits were conducted of low-income program participant installations.

One major reason for conducting the site visits is to verify the installation of each line item in the contractor invoices or work orders provided to the SWE. Some EDCs (PPL, PECO, FirstEnergy) conducted a direct install program where the efficiency measures were to be installed on an as-needed basis. In this instance, the invoices should accurately reflect the quantities and types of measures installed. In another delivery approach, the West Penn Power and Duquesne low-income programs distributed 'energy efficiency kits' to program participants rather than directly installing the devices. FirstEnergy also sent kits to customers that were income qualified, but failed to make the underlying WARM program usage threshold.

Where possible, the SWE compared the site inspection observations and each EDC's set of invoices with the EDC's "Program Tracking" database. Each EDC provided database extracts or remote access to its data tracking and reporting systems.

The qualitative results of the SWE's on-site visits were based on visual observations and questions directed to the householder. The official list of energy efficiency measures to be checked at each participant location was developed well in advance of the on-site inspection. The SWE Team found that the inspection results could be affected by a customer's level of awareness and his/her ability to recall the location of non-program related CFLs.

During the site-visits, SWE representative found issues related to what was installed and the resulting amount of savings. The common issues identified during site-visit verification of all EDC Low Income Programs are:

- Incorrect CFL counts;
- Difficulty in accurately identifying which CFLs were installed by the EDC as part of the Act 129 program; and
- Faucet aerators, LED night lights and furnace whistles distributed in energy efficiency kits have very low installation rates. While these measures are very cost-effective the SWE found that one of the major hindrances to higher installation rates was lack of education as to how the measures should be installed and the energy saving function they serve.

The specific issues identified during the latest set of EDC customer site-visits are recorded in the following list. Issues highlighted in earlier site visit findings summary reports from PY2 that have since been resolved are not included in this list. Please note that at the time of this publication, some of these issues may already be resolved as the SWE Team provided detailed findings and recommendations to each EDC in a site visit report and EDCs have been working to make program improvements.

#### **7.2.1.1 West Penn Power**

The 37 site visits to West Penn Power's low-income program participants raised the following outstanding issues for the low-income energy efficiency program:

- Instances where CFLs are not being directly installed by the contractor, but are instead being left behind with the customer and the customer never installs the lamps.
- Instances where the number of showerheads installed was less than the number claimed for electric water heating customers.
- Faucet aerators and low-flow showerheads being distributed to non-electric water heating customers. West Penn Power made a change to claim savings by itemized measure as opposed to an entire energy efficiency kit beginning in November 2010. Since this change was made the SWE still found several instances where savings were being claimed for these measures for customers with non-electric water heating; however, the EM&V contractor took this into account in the realization rate.
- Instances where the quantity of a given measure reported by the contractor as installed did not match what was recorded in the database. This was not a recurring issue, but the SWE found some instances where measures reported by the contractor left with the customer were claimed in the data tracking as installed.

### **7.2.1.2 Duquesne**

The 40 site visits to Duquesne's low-income program participants raised the following issues for the low-income energy efficiency program:

- Instances where the number of CFLs and LED night lights installed differed from the number recorded in the work order/invoice. Some customers still had CFLs and night lights in the kits they were given.
- The SWE found 25 percent of PY2Q4 installations inspected had furnace whistles installed. Some customers reported that they did not know what the furnace whistle was, did not know how to use it, or the whistle did not fit.

### **7.2.1.3 PECO**

The 41 site visits to PECO's low-income program participants raised the following issues for the low-income energy efficiency program:

- Instances where the CFL work order quantity, wattage, and location differed from what was found on the site visit. The SWE understands that PECO and its implementation contractor cannot control participant actions and that bulbs may be moved or removed by the customer; however, there was at least one case of the PY2Q4 installations inspected where some bulbs were left with a customer instead of being installed by the contractor as reported.

### **7.2.1.4 PPL**

The SWE did not complete site inspections of PPL's low-income program in PY2. PPL completed 967 site visits in PY2 and, after a review of sample reports, the SWE agreed to complete a desk review of site visit reports completed by a third party contractor rather than conduct additional site visits. Given the rigor of PPL's low-income program site inspection process, the SWE determined a desk review to be a better use of the SWE's resources. Findings from the desk review can be found in Section 7.2.2.

### **7.2.1.5 MetEd**

The 22 site visits to MetEd's low-income program participants raised the following issues for the low-income energy efficiency program:

- Distributed energy efficiency kits had low installation rates for nightlights (36 percent), faucet aerators (38 percent), and furnace whistles (0 percent). Met-Ed had similar findings based on its own site surveys and adjusted its installation rates accordingly.
- Some weatherization measures (particularly caulking) were not completed properly or completed at all.
- There were some cases where only 1 of 2 smart strips were being used, possibly because a customer only had a need for one yet was given two anyway. Met-Ed had similar findings as the SWE and assumed a 40 percent installation rate for this measure.

### **7.2.1.6 Penelec**

No SWE site visits were conducted of Penelec's low-income energy efficiency program. Penelec was able to provide evaluator site visit reports and surveys that were sufficient to conduct a desk review in lieu of SWE site visits. The findings from this review can be found in Section 7.2.2.

### **7.2.1.7 Penn Power**

The 12 site visits to Penn Power's low-income program participants raised the following issues for the low-income energy efficiency program:

- In many instances, the contractor was leaving CFL bulbs and smart power strips with the customer rather than installing them. It was brought to the SWE's attention that the contractor doing many of the audits and installations was in the process of leaving the program and therefore did not keep good records of the audits.
- In a few instances, the state-funded Lead Abatement program contractor removed work done through the WARM Plus program.
- In some instances, the smart power strips were removed post-installation because they provided inconvenience to the customer.
- It is difficult to tell the difference between the Act 129 CFL Bulbs and non-Act 129 CFL bulbs. This evaluation difficulty, however, is not uniquely associated with Penn Power's energy efficiency efforts.

### **7.2.2 Desktop Audits**

The following section contains the SWE's desktop review of site visit reports completed by EDCs for which the SWE did not conduct independent site inspections.

#### **7.2.2.1 Site Visit Reports**

##### **7.2.2.1.1 PPL**

PPL provided a sample of site visit reports for the SWE's review. The review resulted in the following recommendations:

- PPL reviewed individual site inspections reports and a QA/QC process is in place to make process improvements. The Act 129 EM&V CSP reviews a sample of the site visit reports during verification activities. However, PPL does not prepare a summary report cataloging all site visit findings and recommendations into one report. The SWE recommends that site inspection report findings and recommendations be summarized periodically in a report. This report should be submitted to the SWE for review.

##### **7.2.2.1.2 Penelec**

The SWE supplanted on-site visits with a desk review of eight site visit reports compiled by Penelec's evaluator for the WARM Plus program. The SWE compared customer invoices to evaluator site reports and checked completeness and rigor of the site reports. No issues were found with these site visit reports.

The SWE also reviewed findings and recommendations from 70 telephone surveys conducted for the Low-Income Low Use ("LILU") program. The results from these surveys factored into Penelec's impact evaluation for this program. The findings and recommendations document detailed how the surveys were conducted, questions asked, responses, installation rates, and a variety of other relevant information. No variances or inconsistencies were found between within this report or between the report and the PY2 annual report. Similarly, The SWE reviewed findings and recommendations from 70

telephone surveys conducted for the WARM Extra Measures program and also found no issues or variances.

### **7.2.2.2 Energy Savings Calculations**

To supplement the site visits and field work on the low income program, the SWE verified the savings calculations for each EDC's program using a measure verification table. The SWE totaled all installed low income measures within kits per EDC and multiplied these figures by their stipulated TRM savings. (For example, an installed faucet aerator saves 61 kwh/year according to the TRM. Thus an EDC should use this value multiplied by the number of program participants to find the total energy savings.) Using this table the SWE was able to see that the calculations done by each EDC for low income programs are consistent with the SWE's findings. The review also consisted of verification that each EDC that utilized a custom approach approved by the PA PUC to evaluate savings used the correct savings values. The following reviews how savings are determined by each EDC for their low-income programs with the findings or installation rates used in the impact evaluation.

#### **7.2.2.2.1 West Penn Power**

The PY2 savings for the Home Check-Up and Appliance Replacement Program and the Joint Utility Usage Management Program are based on a combination of TRM deemed values and impact evaluation.

#### **7.2.2.2.2 Duquesne**

The PY2 savings for LIEEP are determined using a combination of TRM deemed savings values by measure and impact evaluation to determine appropriate installation rates.

#### **7.2.2.2.3 PECO**

Savings for LEEP are determined by assessing participation in the program and calculate savings using distinct approaches depending on the measures implemented (LEEP audits, additional CFL bulbs installed, refrigerator replacements, or custom projects). TRM deemed savings and statistical billing analysis is used depending on approach.

### **7.2.2.3 PPL**

The Act 129 PY1 and PY2 savings are reported using evaluated savings, deemed by job type, as reported in the WRAP 2008 Annual Report submitted to and approved by the PA PUC. Savings for the E-Power Wise program are reported using a combination of TRM deemed values and impact evaluation.

### **7.2.2.4 Met Ed**

The ex-ante energy savings for the WARM Plus program are based on the impact evaluation of the 2008 and 2009 WARM program, by job type, which employed a statistical billing analysis.

The ex-ante energy savings from the WARM Extra Measures program are based on a combination of deemed TRM values by measure and impact evaluation.

The ex-ante energy savings from the LILU program are based on a combination of deemed TRM values by measure and impact evaluation.

**7.2.2.5 Penelec**

The ex-ante energy savings for the WARM Plus program are based on the impact evaluation of the 2008 and 2009 WARM program, by job type, which employed a statistical billing analysis.

The ex-ante energy savings from the WARM Extra Measures program are based on a combination of deemed TRM values by measure and impact evaluation.

The ex-ante energy savings from the LILU program are based on a combination of deemed TRM values by measure and impact evaluation.

**7.2.2.6 Penn Power**

The ex-ante energy savings for the WARM Plus program are based on the impact evaluation of the 2008 and 2009 WARM program, by job type, which employed a statistical billing analysis.

The ex-ante energy savings from the WARM Extra Measures program are based on a combination of deemed TRM values by measure and impact evaluation.

The ex-ante energy savings from the LILU program are based on a combination of deemed TRM values by measure and impact evaluation.

**7.2.3 Program Costs**

**7.2.3.1 West Penn Power**

West Penn Power submitted cost data for both the Home Check-Up program and Joint Utility Usage Management Program (“JUUMP”). This data was compared with the annual report and no variances were found.

Table 7-9 shows the total program costs per quarter and for PY2 as reported in each respective quarterly report and in the annual report. The variance column is the difference of the sum of the quarterly report figures and what was reported for total costs in the annual report. This difference was due to a late accrual that was not captured in the quarterly reports, but was correctly reported in the Annual Report.

**Table 7-9: Summary of Low Income Program Costs and Variance – West Penn Power**

	Q1	Q2	Q3	Q4	Annual	Variance
<b>Home Check Up</b>	\$378,601	\$645,641	\$856,308	\$1,257,931	\$3,196,981	-\$58,500
<b>JUUMP</b>	\$47,100	\$171,836	\$51,626	\$116,296	\$386,858	\$0

**7.2.3.2 Duquesne**

Duquesne submitted a workbook that included cost data for all low-income jobs completed during PY2. No variances were found with Duquesne’s total participant incentives calculation in this workbook and the total cost figures listed in the annual report for the low-income program.

Table 7-10 shows the total program cost components less participant costs per quarter and for PY2 as reported in each respective quarterly report and in the annual report. The variance column is the

difference of the sum of the quarterly report figures and what was reported for program year costs in the annual report. The minor variance in incentive costs is due to the rounding.

Total program costs could not be compared between the quarterly reports and the annual report because participant costs are only reported in the annual report. These participant costs are the incremental costs associated with low-income customer participation in various other programs (lighting, appliances, etc.) and therefore accounted for in the low-income program.

**Table 7-10: Summary of Low Income Program Cost Components and Variance – Duquesne**

	Q1	Q2	Q3	Q4	Annual	Variance
<b>Incentives</b>	\$6,017	\$4,716	\$102,294	\$326,466	\$439,492	\$1
<b>Implementation Costs</b>	\$25,224	\$131,376	\$35,452	\$94,236	\$286,288	\$0
<b>EDC Evaluation Costs</b>		\$5,581	\$5,766	\$11,970	\$23,317	\$0
<b>SWE Audit Costs</b>	\$15,599		\$15,735		\$31,334	\$0
<b>Participant Cost (after incentives)</b>	Not reported				\$418,181	-
<b>Total</b>					\$1,198,612	\$1

**7.2.3.3 PECO**

PECO supplied two workbooks that detailed cost data for LEEP. One workbook submitted to the SWE for review contained all program TRC data inputs, assumptions and calculations per program in one tab and a second tab compiled the data inputs in the first tab and determined the financial benefits associated with each program. This workbook listed costs for the low-income program as a single program level cost. Disaggregating this figure is difficult because the source of the data is listed as a PECO employee. A second TRC workbook was provided that disaggregated total program costs as shown in Table 7-11.

**Table 7-11: Summary of Low Income Program Cost Components - PECO**

	PYTD
Participants	18,133
Incentives	\$4,719,000
Promotions and Education	\$31,000
Vendor Admin	\$830,000
Other (Admin Labor & Umbrella Costs)	\$326,000
M&V	\$162,000
<b>Total Costs</b>	<b>\$6,068,000</b>

However, it is difficult to review the incentive assumptions and calculations because supporting measure and job level cost documentation was not provided. Customers did not receive a monetary incentive to have the measures installed, but rather incentives are assumed to be the purchase cost of all measures installed by the contractor. Based on a footnote in the annual report the “Vendor Admin” costs are the contractor implementation costs.

Table 7-12 shows the total program costs per quarter and for PY2 as reported in each respective quarterly report and in the annual report. The variance column is the difference of the sum of the quarterly report figures and what was reported for total costs in the annual report. The incentive costs for this program were reported as \$0 in the annual report.

**Table 7-12: Summary of Low Income Program Costs and Variance – PECO**

	Q1	Q2	Q3	Q4	Annual	Variance
<b>Total Costs</b>	\$1,164,000	\$1,471,000	\$1,624,000	\$1,662,000	\$6,068,000	-\$147,000

**7.2.3.4 PPL**

PPL supplied cost information for both the WRAP and E-Power Wise low-income programs. WRAP is a home weatherization program and E-Power Wise is a distributed energy efficiency kit program. In accordance with the annual report template, costs for each respective program were listed as a single aggregated value (“management” costs) that included the costs of implementation, management, and oversight.

Table 7-13 shows the total program costs per quarter and for PY2 as reported in each respective quarterly report and in the annual report. The variance column is the difference of the sum of the quarterly report figures and what was reported for total costs in the annual report. The incentive costs for this program were reported as \$0 in the annual report. The variance shown in Table 7-13 is likely related to timing differences between EEMIS and accounting data because some transactions have been paid (recorded in the accounting system) but not yet recorded in EEMIS. There are no rebates or customer incentives in these low income programs, although PPL classified the cost of goods and services provided to customers for free as “incentives” in EEMIS through PY2. Starting in PY3 Q3, PPL will classify those costs as “management/CSP Costs”. The cost totals for the quarterly reports were based on incentive values in EEMIS plus the accounting system for other cost categories. However, the cost total for the annual report used the accounting system as the source of all reported costs. Therefore, because of the timing differences between EEMIS and the accounting system, the quarterly costs will not add to the annual cost. The annual cost is correct.

**Table 7-13: Summary of Low Income Program Costs and Variance – PPL**

	Q1	Q2	Q3	Q4	Annual	Variance
<b>WRAP</b>	\$616,136	\$3,904,247	\$2,286,381	\$2,444,061	\$9,437,875	-\$187,050
<b>E-Power Wise</b>	\$142,762	\$155,388	\$19,939	\$63,309	\$362,099	\$19,299

**7.2.3.5 Met-Ed**

Cost data for each FirstEnergy operating company was submitted in a workbook. The SWE reviewed these cost calculations and the quarterly and annual reports to ensure consistency. Table 7-14 reviews both incentive costs and total program costs for all three Met-Ed low-income programs as reported in the quarterly and annual reports. PY2 costs as reported in the annual report were then compared against the workbook submitted by FirstEnergy in order to locate the source of any variances. The variance column represents the sum of the costs from each quarter as reported in the respective quarterly report minus program year costs reported in the annual report.



**Table 7-14: Summary of Low Income Program Costs and Variance – Met-Ed**

	Q1	Q2	Q3	Q4	Annual	Variance
<b>Incentives</b>	\$99,611	\$184,698	\$459,127	\$247,782	\$991,218	\$0
<b>Implementation Costs</b>	\$45,625	\$96,281	-\$3,658	\$43,599	\$181,847	\$0
<b>EDC Evaluation Costs</b>	\$14,457	\$15,060	\$32,934	\$12,418	\$74,869	\$0
<b>SWE Audit Costs</b>	\$4,249	\$1	\$4,249	\$0	\$8,499	\$0
<b>Total Costs</b>	\$163,942	\$296,040	\$492,651	\$303,799	\$1,256,433	-\$1

Incentive costs were the program direct install and delivery costs for all three Met-Ed low-income programs. This was reported as a single lump sum and was not able to be disaggregated to ensure cost calculations were performed correctly because supporting job cost information was not provided.

**7.2.3.6 Penelec**

FirstEnergy submitted to the SWE low-income program costs data for each operating company. The SWE reviewed these cost calculations, assumptions, and the quarterly and annual reports to ensure consistency. Table 7-15 reviews both incentive costs and total program costs for all three Penelec low-income programs as reported in the quarterly and annual reports. PY2 costs, as reported in the annual report, were compared against the workbook submitted by FirstEnergy in order to locate the source of any variances. The variance column represents the sum of the costs from each quarter as reported in the respective quarterly report minus program year costs reported in the annual report.

**Table 7-15: Summary of Low Income Program Costs and Variance – Penelec**

	Q1	Q2	Q3	Q4	Annual	Variance
<b>Incentives</b>	\$135,602	\$351,058	\$555,317	\$415,390	\$1,457,367	\$0
<b>Implementation Costs</b>	\$34,832	\$110,096	-\$12,577	\$47,716	\$180,067	\$0
<b>EDC Evaluation Costs</b>	\$16,046	\$11,125	\$9,499	\$10,812	\$47,483	-\$1
<b>SWE Audit Costs</b>	\$5,412	\$1	\$5,412	\$0	\$10,824	\$1
<b>Total Costs</b>	\$191,892	\$472,280	\$557,650	\$473,918	\$3,153,108	-\$1,457,368

Incentive costs, which are reported quarterly, are program direct install and delivery costs for the WARM programs. For TRC purposes, incentive costs are reported as participant cost on an annual basis in Penelec’s PY2 Annual Report. These incentive/participant costs were reported as a single lump sum and could not be disaggregated to ensure cost calculations were performed correctly because supporting job cost information was not provided. The SWE will request this information going forward.

As noted in Table 7-15, Penelec overstated program year costs for PY2. Direct install/direct delivery costs of low-income programs were inadvertently double counted as both an incentive cost and a participant cost. Penelec has corrected this error going forward. When correcting for this error there was no variance between the quarterly and annual reports other than a minor difference due to rounding.

The workbook submitted by FirstEnergy indicated that the program year costs for Penelec were \$1,561,264, which is \$134,476 less than the sum of the columns Q1 through Q4. The difference is likely due to a reporting lag or adjustments.

**7.2.3.7 Penn Power**

FirstEnergy submitted to the SWE low income program costs data for each operating company. The SWE reviewed these cost calculations, assumptions, and the quarterly and annual reports to ensure consistency. Table 7-16 reviews both incentive costs and total program costs for all three Penn Power low-income programs as reported in the quarterly and annual reports. PY2 costs, as reported in the annual report, were compared against the workbook submitted by FirstEnergy in order to locate the source of any variances. The variance column represents the sum of the costs from each quarter as reported in the respective quarterly report minus program year costs reported in the annual report.

**Table 7-16: Summary of Low Income Program Costs and Variance – Penn Power**

	Q1	Q2	Q3	Q4	Annual	Variance
<b>Incentives</b>	\$11,872	\$67,952	\$309,232	\$114,987	\$504,042	\$1
<b>Implementation Costs</b>	\$12,412	\$19,790	\$10,874	\$12,732	\$55,808	\$0
<b>EDC Evaluation Costs</b>	\$4,288	\$2,817	\$922	\$2,608	\$10,634	\$1
<b>SWE Audit Costs</b>	\$578	\$0	\$578	\$0	\$1,157	-\$1
<b>Total Costs</b>	\$29,150	\$90,559	\$321,606	\$130,327	\$1,075,683	-\$504,041

Incentive costs, which are reported quarterly, are program direct install and delivery costs for the WARM programs. For TRC purposes, incentive costs are reported as participant cost on an annual basis in Penn Power’s PY2 Annual Report. These incentive/participant costs were reported as a single lump sum and could not be disaggregated to ensure cost calculations were performed correctly because supporting job cost information was not provided. The SWE will request this information going forward.

As noted in Table 7-16, Penn Power overstated program year costs for PY2. Direct install/direct delivery costs of low-income programs were inadvertently double counted as both an incentive cost and a participant cost. Penn Power has corrected this error going forward. When correcting for this error there was no variance between the quarterly and annual reports other than a minor difference due to rounding.

The workbook submitted by FirstEnergy indicated that the program year costs for Penn Power were \$528,617, which is \$43,475 less than the sum of the columns Q1 through Q4. This difference is likely due to a reporting lag or adjustments.

**7.3 Non-Residential Program Audit Activities by EDC**

The following sections summarize the audit activities conducted by the SWE Team during PY2 for non-residential energy efficiency programs. The purpose of the audit activities is to ensure proper implementation of EDC EE&C programs and evaluation of such programs in a manner consistent with the *Audit Plan*. This enables the establishment of common metrics that can be used to make accurate comparisons between EDC programs. The audit activities consisted mainly of desktop audits and site

inspections to check reporting mechanics, database management, TRM usage, evaluator activities, TRC calculations, and engineering calculations of kWh and kW savings.

### 7.3.1 Site-Inspection Summary Report

As a part of SWE audit activities, the SWE conducted site inspections for projects participating in non-residential EE&C programs. Two types of site inspections were conducted – ride-alongs and independent. During PY2, the SWE completed 97 inspections, as shown in the table below. The proposed plan for ride-along and independent inspections was to complete ride-along and independent inspections at a 1:1 ratio. However, because independent inspections are conducted after all EDC evaluation activities are complete, time constraints restricted our ability to complete all inspections in the appropriate ratio as planned. For some EDCs, we compensated the lack of independent inspections with additional ride-along inspections (Duquesne and PPL).

**Table 7-17: Summary of Commercial and Industrial Site-Visits**

<b>EDC</b>	<b>Ride-Along Inspections</b>	<b>Independent Inspections</b>	<b>Total Inspections</b>
<b>Duquesne</b>	10	5	15
<b>PECO</b>	15	16	31
<b>PPL</b>	17	0 <sup>24</sup>	17
<b>FirstEnergy</b>	9	11	20
<b>West Penn</b>	5	9	14
<b>Total</b>	<b>56</b>	<b>41</b>	<b>97</b>

During ride-along inspections, where the SWE accompanied the EDC evaluator, the SWE verified that the EDC evaluators were using Pennsylvania standard conventions when performing evaluation activities. This included checking for adherence to the TRM or site specific measurement and verification plans. Following the visits, the SWE reviewed the EDC evaluators' site reports to ensure that critical site findings were identified and savings calculations were appropriate and accurate. Ride-along inspections were selected as a subsample of the EDC evaluators' samples, which were selected independently of the EDCs. During independent inspections, where the SWE inspected projects that were not verified by the EDC evaluator, the SWE independently selected projects and verified the project installation and calculated the project savings.

For both types of visits, the SWE issued site inspection reports (SIRs) to the EDCs and their evaluators. The evaluators reviewed the reports and provided comments. When necessary, the evaluators revised their savings calculations and the SWE subsequently revised the SIRs to reflect the changes. In many

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<sup>24</sup> Due to time and budgetary constraints and the high number of ride-along inspections completed for PPL, the SWE Team did not complete the planned independent inspections for PPL projects. Nevertheless, based on findings from ride-along inspections, the SWE Team was able to confirm the EDC evaluator findings without conducting additional independent site inspections.

cases, SWE SIRs resulted in both quantitative and qualitative modifications to evaluation procedures, ensuring that impacts reported by EDCs were in compliance with statewide standards.

The projects inspected included a variety of deemed and custom measures. The SWE identified 104 findings from the 97 site visits, which are summarized in Appendix A: Findings for Non-Residential Site Inspections. The findings have been categorized as follows:

- **Evaluation** findings are associated with ride-along visits, and may reflect site activities or evaluator savings calculations and/or reports.
- **Process** findings are associated with project applications, documents, or implementation activities.
- **TRM** findings are associated with TRM protocols or TRM stipulated values, often stemming from differences in interpreting TRM protocols. This category may also include findings that lead to recommendations for updates to existing TRM protocols.

In general, the SWE feels that site inspection activities aided in better understanding programs and establishing standard evaluation protocols among each EDC. Where issues were identified through site inspections, EDC evaluators were receptive to feedback and willing to update their evaluation procedures and findings accordingly. In most cases, realization rates were adjusted to account for SWE feedback through interactive discussions between the SWE and EDC evaluators. In turn, the SWE observed that EDC evaluators modified their evaluation processes in accordance with the SWE findings such that future realization rates would be consistent with SWE findings. SWE independent site inspections resulted in realization rates similar to reported realization rates by EDC evaluators. This correspondence leads the SWE to believe that EDCs are adequately performing verification activities for those sites where the SWE does not have the direct ability to review annual energy savings and peak demand reduction calculations.

Resolutions are listed for each of the findings in Appendix A: Findings for Non-Residential Site Inspections and usually involve actions taken by the SWE and/or evaluators to improve the accuracy of the project savings calculations. For the TRM-related findings, the resolutions involve identifying potential TRM improvements or indicating that relevant revisions were made in the 2011 or 2012 TRMs.

The most common evaluation findings included:

- Savings calculation errors or variances (11 projects)
- Insufficient measurement and verification (M&V) for industrial VFD projects (5 projects)
- Using residential TRM algorithms for commercial projects (4 projects)
- Insufficient M&V for large lighting projects (2 projects)

The process findings included:

- Not following TRM protocols (7 projects)
- Application errors (5 projects)
- Calculation errors (4 projects)

- Insufficient project documentation (3 projects)
- Inappropriate building type selected to determine lighting EFLH (2 projects)

The TRM findings included:

- TRM Table 6-6, which provides lighting operating hours for various building types, lacked suitable choices (*e.g.*, parking garages and supermarkets that are open 24/7) or the hours listed were significantly different than those established during the site visit (14 projects)
- TRM Appendix C, which includes a Table of Standard Wattages, lacked several fixture types that are commonly used (*e.g.*, fixtures with 25 watt T8 fluorescent lamps) (9 projects)
- TRM Table 6-8 does not include photocell lighting controls (2 projects)
- The protocol for small diverse lighting projects, such as those with both interior and exterior lighting, is unclear (2 projects)

### 7.3.2 Desktop Audit Summary Report

The following sections contain the SWE's desktop review of each individual EDC. Several important acronyms for this section are:

- SCI: Small Commercial and Industrial Sector
- LCI: Large Commercial and Industrial Sector
- GNP: Government, Non-Profit, and Institutional Sector

Desktop Audits consist of three tasks:

- Review of Savings Database
- Review of Project Files
- Review of Report Consistency

These three reviews mainly address reported savings figures and implementation processes to ensure that numbers reported in the quarterly and annual reports have solid bases. The review of savings database task looks at the periodic reports submitted by the EDCs and ensures that numbers in the report match with their project tracking databases. In order to complete this task, EDCs are required to submit their extracts of their database. The review of project files looks at the database files and ensures that numbers reported in the database match with the associated project files. In order to complete this task, EDCs are required to submit project files for review<sup>25</sup>. The review of report consistency looks at previous quarters and ensures that numbers are not arbitrarily changed from quarter to quarter.

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<sup>25</sup> EDCs are directed to select their projects for review. The rationale is that the EDCs will be able to select projects more efficiently and expediently, given the accelerated time frame allowed for the completion of the evaluation. The SWE believes that there is no benefit gained from the SWE selecting a sample for project file review, since EDCs have the opportunity to "clean-up" project files before sending to the SWE if desired. Based on current findings and differences between project files and the database, it is evident that EDCs did not take the opportunity to "clean-up" their files. Otherwise, the project files and the database would be identical.

### 7.3.3 Duquesne Audit Report

Duquesne listed eleven programs under the non-residential umbrella, which includes the Small Commercial and Industrial (SCI), Large Commercial and Industrial (LCI), and Government/Non-Profit (GNP) sectors. Each of these eleven programs achieved energy and demand savings during PY2. The gross reported energy savings of these programs was 103,662 MWh and the gross reported demand savings was 14.613 MW<sup>26</sup> during PY2. Table 7-18 contains the participant counts, energy impacts, demand impacts and incentive amounts reported by Duquesne in its PY2 Annual Report. The two Retail EE programs are presented together because Duquesne did not report the incentives paid to the Small and Large program separately. The SWE recommends for future submissions that Duquesne separate the small and large retail programs when reporting savings and incentive amounts.

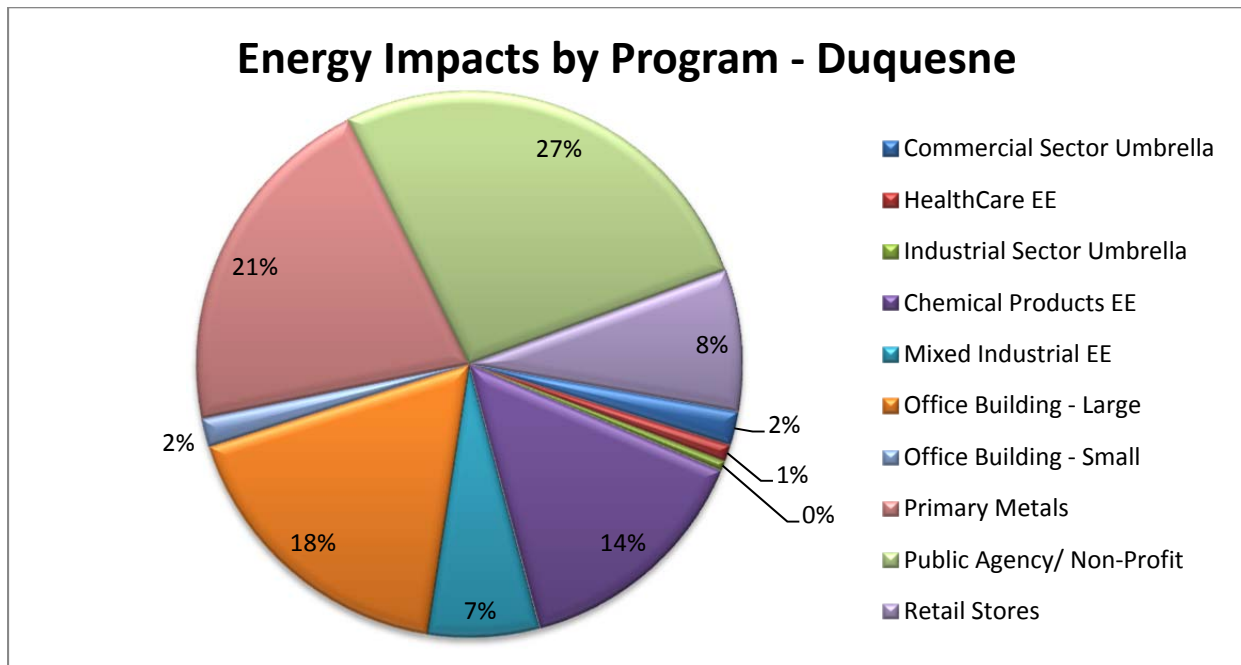
**Table 7-18: Duquesne Non-Residential Programs Annual Summary**

Program	Participants	MWh	MW	Incentives
Commercial Sector Umbrella	73	2,078	0.544	\$249,501
HealthCare EE	9	1,029	0.104	\$57,079
Industrial Sector Umbrella	4	603	0.116	\$46,084
Chemical Products EE	8	14,998	2.000	\$657,317
Mixed Industrial EE	38	6,899	0.973	\$422,352
Office Building – Large	67	18,282	3.067	\$1,068,485
Office Building – Small	68	1,754	0.389	\$159,197
Primary Metals	19	21,635	2.627	\$825,004
Public Agency/ Non-Profit	150	27,690	3.250	\$2,402,914
Retail Stores	258	8,693	1.543	\$596,598
<b>Totals</b>	<b>694</b>	<b>103,662</b>	<b>14.613</b>	<b>\$6,484,531</b>

In Duquesne’s non-residential portfolio, programs are defined by customer segment. Over a quarter of the non-residential energy savings in the Duquesne portfolio comes from the Public Agency/Non-Profit sector. Retail stores accounted for only approximately 8.0% of the Program Year 2 non-residential energy savings despite having the largest number of participants. The distribution of energy impacts across Duquesne’s non-residential portfolio is shown in Figure 7-1.

<sup>26</sup> Duquesne adjusted gross reported MW values to reflect a line loss factor of 7%.

**Figure 7-1: Distribution of Annual Gross Energy Impacts among Duquesne Non-Residential Programs**



**7.3.3.1 Review of Savings Database**

Following each quarter of PY2, Duquesne provided the SWE an extract of program activity during the period. These quarterly extracts were compiled by the SWE to create a savings database for PY2. Table 7-19 provides the participant count, energy impact, demand impact and total incentives paid by program according to these quarterly database extracts.

**Table 7-19: Duquesne Non-Residential Programs Savings Database Summary**

Program	Participants	MWh	MW	Incentives
Commercial Sector Umbrella	53	2,071	0.507	\$248,951
HealthCare EE	9	1,029	0.097	\$55,252
Industrial Sector Umbrella	3	587	0.107	\$38,084
Chemical Products EE	8	14,998	1.870	\$657,317
Mixed Industrial EE	38	6,899	0.910	\$422,352
Office Building - Large	66	16,532	2.783	\$875,985
Office Building - Small	68	1,750	0.363	\$158,234
Primary Metals	19	23,068	2.524	\$825,004
Public Agency/ Non-Profit	150	27,690	3.038	\$2,402,914
Retail Stores	254	8,623	1.424	\$590,651
<b>Totals</b>	<b>668</b>	<b>103,248</b>	<b>13.623</b>	<b>\$6,274,742</b>

In Table 7-20, the variances between the reported figures and the information contained in the database are presented. All variances are reported as:

$$\text{Reported Figure} - \text{Database Summary} = \text{Variance}$$

**Table 7-20: Duquesne Non-Residential Program Variances**

Program	Participants	MWh	MW <sup>27</sup>	Incentives
Commercial Sector Umbrella	20	7	-0.001	\$550
HealthCare EE	0	0	0.000	\$1,827
Industrial Sector Umbrella	1	16	0.001	\$8,001
Chemical Products EE	0	0	-0.010	\$0
Mixed Industrial EE	0	0	-0.005	\$0
Office Building - Large	1	1,750	0.074	\$192,500
Office Building - Small	0	4	-0.001	\$963
Primary Metals	0	-1,433	-0.087	\$0
Public Agency/ Non-Profit	0	0	-0.016	\$0
Retail Stores	4	70	0.012	\$5,947
<b>Totals</b>	<b>26</b>	<b>413</b>	<b>-0.035</b>	<b>\$209,789</b>

There are several minor variances between the savings databases and the reported annual figures, but overall the SWE found the Duquesne tracking data to be highly accurate when compared to the figures reported in Duquesne's PY2 Annual report. The SWE understands that program tracking is a continuous process and changes to impacts are sometimes necessary after a quarterly data request response has been compiled. The largest participant count variance was observed for the Commercial Sector Umbrella program due to the reclassification of 19 projects completed during Quarter 1. These 19 projects were Residential EE kits that were installed in residences served by master-meter accounts. In the Quarter 1 data request response, these projects were classified as part of the Residential EE Rebate program. Prior to compiling its annual report, Duquesne corrected the classification of these projects and has identified the projects to the SWE team.

### 7.3.3.2 Review of Project Files

Duquesne submitted project files for a sample of ten participants from its non-residential programs to the SWE Team as part of the PY2 Q4 data request response.

The SWE Team used the project files to examine each of the projects from the selected sample in detail. The purpose of this exercise was to verify that there were no variances between the gross energy and demand impact figures and incentive amounts in the Duquesne database and those listed in the project files and to identify areas where the reporting process could be improved. Out of the sample of ten

<sup>27</sup> A line loss factor of 7% was applied to the gross demand figures from Table 7-19 prior to calculating variances between the annual report and the savings database.



projects, there were five lighting, one commercial refrigeration measure, two custom, and two variable frequency drives (VFD) projects. The savings figures and incentive amounts detailed in the selected sample project files matched the database for seven of the projects. Other projects where slight variances were noted are discussed in detail below. The SWE Team found the savings calculations to be transparent and performed according to the methodology called for in the TRM for all the lighting and VFD projects. Table 7-21 contains a comparison of the values contained in these project files to the savings databases.

**Table 7-21: Duquesne Comparison of Sample File to Savings Database<sup>28</sup>**

Program	Project Files kWh	Database kWh	kWh Difference	Project Files kW	Database kW	kW Difference	Project Files Incentive	Database Incentive	Incentive Difference
Retail Stores	121,617	121,618	0	28.42	28.42	0.00	\$10,398	\$10,398	\$0
Retail Stores	NX	137,520	0	NX	19.06	0.00	NX	\$8,228	\$0
Retail Stores	18,159	18,159	0	4.71	4.71	0.00	\$1,102	\$1,102	\$0
Mixed Industrial	585,385	583,387	1,998	60.61	60.33	0.28	\$39,800	\$39,881	\$81
Mixed Industrial	194,184	193,845	339	27.53	27.47	0.06	\$9,709	\$10,000	\$291
Mixed Industrial	442,974	442,975	1	88.54	88.53	0.01	\$27,478	\$27,478	\$0
PAPP Public Agency Partnership	625,869	625,869	0	68.06	76.96	8.90	\$80,737	\$80,737	\$0
Office Buildings-Large	1,472,006	1,472,007	2	104.59	104.59	0.00	\$60,400	\$60,400	\$0
Mixed Industrial	680,407	680,407	0	48.70	48.70	0.00	\$40,000	\$40,000	\$0
Office Buildings-Large	922,352	922,352	0	64.88	64.88	0.00	\$46,650	\$46,650	\$0

Note: NX (Not Available)

The savings databases proved to be very consistent with project. The project files submitted to the SWE included savings calculation worksheets, specification sheets, installation reports and invoices. The SWE Team feels sufficient insight was provided into the savings calculations and the reported savings estimates are valid.

The SWE discovered some differences for the following projects:

Project 3000639181.23.01 received \$34,380 in rebates based on the invoice for a large lighting retrofit project. A total of 162 fixtures were described in the invoice, out of which 120 fixtures have integrated sensors. However, the customer incentive agreement (CIA) form provided by Duquesne lists a total of 202 lighting fixtures installed both in the freezer warehouse and the loading areas. The total incentive as

<sup>28</sup> Please note that variances do not necessarily indicate inadequate QA/QC, incorrect reported savings, incorrect verified savings, or incorrect incentives. For all the projects, the difference in savings and incentive amounts between Duquesne estimates and the SWE team estimates are less than 0.5%, and thus are not material. There are often valid differences between an EDC's tracking system (reported savings) and rebate forms, project files, and other supporting information. For example, all measures on a rebate form may not meet program eligibility requirements and, therefore, were not rebated nor recorded in the tracking system. In that case, there are differences between the rebate form (supporting information provided) and the recorded transaction but the reported savings are correct. Another example is some rebate forms include multiple measures that are split into multiple transactions in the tracking system. In that case, there is not a one-to-one relationship between the rebate form and a single recorded transaction. In cases where a transaction was incorrect in the tracking system, the EDC may have corrected the transaction after providing the "data snapshot" to the SWE, or the EDC's independent evaluator may have corrected the transaction via an ex-ante adjustment or an ex-post adjustment and, therefore, the adjusted reported/verified savings are correct. Therefore, the SWE agrees that Duquesne's PY2 verified savings include the proper adjustments to reflect the type of errors SWE found in their QA/QC review.

per the CIA is \$44,720 with an additional incentive of \$7,000 to be paid to the customer when the installation is completed and inspected, and copies of all invoices are provided. The savings were calculated based on the quantity listed in the invoice which the SWE thinks is valid. However, the SWE Team discovered a slight variance in the reported savings figures and incentive. The database reports savings of 583,387.26 kWh and 60.3336 kW, whereas the savings calculation worksheet reports savings of 585,384.71 kWh and 60.61 kW. This represents a 0.34% error in energy savings and 0.46% error in demand savings. Similarly, the incentive amount listed in the worksheet summary is \$39,800 whereas the database reported incentive is \$39,880.80. This does not represent a material difference in the overall program savings.

Project 6000601576.23.02 is a custom project involving the removal of air knives and replacing them with air nozzles. The largest energy savings came by removing 99% of the runtime on a 50hp blower that was feeding one 60" air knife. Project files submitted to SWE included invoices and savings calculation worksheets. The savings figures and incentive amount match with the database reported numbers, with slight variances. The database reports savings of 193,845 kWh and 27.47 kW, whereas the savings calculation worksheet reports savings of 194,184 kWh and 27.53 kW. This represents a 0.17% error in energy savings and 0.21% error in demand savings. Similarly, the incentive amount listed in the worksheet summary is \$9,709.18, whereas the database reported incentive is \$10,000. Project 9000679872.19.01 is a lighting retrofit project which received \$80,737 in incentives. The project files submitted to the SWE included a savings calculation worksheet, invoices, installation reports and specification sheets. The energy savings and incentive amount in the project files matched with the database reported numbers. The SWE Team discovered an inconsistency in the reported demand savings. The demand savings in the savings calculations worksheet were 13% lower than database reported number. However, in a document "RJR Project Notes" submitted to the SWE Team in the project files, the demand savings appeared to be same as database reported numbers. The SWE believes the demand savings of 68.06 kW based on the Appendix C calculations are valid.

Overall, the SWE found that values reported in the Duquesne databases were accurately backed up by the application and project file documents. In some cases, variances were identified, which, with further scrutiny, can be attributed to normal changes that occurred between the time that an application was first received and when the application was approved. In many cases, documentation and explanation was able to be furnished to support these changes. Evidenced by small variance numbers, the transfer of information from project files to database was largely accurate and effective.

### ***7.3.3.3 Review of Report Consistency***

The SWE compiled the reported impacts from each of Duquesne's quarterly reports from PY2 and compared the gross participant counts, energy impacts and demand impacts to the figures reported in the PY2 Annual Report. Reported demand impacts in quarterly reports do not account for line loss adjustments. Duquesne included unverified ex-post and in-progress projects in its Q1 and Q2 reported figures. These projects were removed from the sum of quarterly reports presented in Table 7-22 to avoid double-counting once the project was completed later in the year and creating a false appearance of disagreement. Project 5000006639.20.01 is a Large Office installation which was reported in Q1 as

unverified ex-post, but was not removed from the following sums of the quarterly reports as this project was not included in any of the subsequent quarterly reports and would not have been double counted.

**Table 7-22: Sum of Impacts from Duquesne Quarterly Reports**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Commercial Sector Umbrella EE	54	2,071	0.505
Healthcare EE	9	1,029	0.098
Industrial Sector Umbrella EE	3	588	0.108
Chemical Products EE	8	14,999	1.866
Mixed Industrial EE	38	6,900	0.906
Office Building - Large EE	67	18,282	2.865
Office Building - Small EE	68	1,750	0.368
Primary Metals EE	19	22,738	2.405
Public Agency/Non-Profit	150	27,691	3.045
Retail Stores	255	8,623	1.424
<b>Totals</b>	<b>671</b>	<b>104,671</b>	<b>13.590</b>

The total non-residential gross energy impact reported in the PY2 Annual Report and summarized in Table 7-18 was 103,662 MWh. As Table 7-22 shows, the sum of the gross energy impacts reported in the four quarterly reports from PY2 was 104,671 MWh. Variances between the sums of the impacts reported in quarterly reports and the impacts reported in the annual report are presented in Table 7-23. All variances are reported as:

$$\textit{Annual Report} - \textit{Sum(Quarterly Reports)} = \textit{Variance}$$

**Table 7-23: Variances between Duquesne Quarterly Reports and PY2 Report**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW<sup>29</sup></b>
Commercial Sector Umbrella EE	19	7	0.001
Healthcare EE	0	0	-0.002
Industrial Sector Umbrella EE	1	15	0.000
Chemical Products EE	0	-1	-0.006
Mixed Industrial EE	0	-1	-0.001
Office Building - Large EE	0	0	-0.014
Office Building - Small EE	0	4	-0.007
Primary Metals EE	0	-1,103	0.041
Public Agency/Non-Profit	0	-1	-0.024
Retail Stores	3	70	0.012
<b>Totals</b>	<b>23</b>	<b>-1,009</b>	<b>0.001</b>

The SWE Team understands the reporting challenge for EDCs given the limited amount of time between the end of a quarter and the deadline for the quarterly EDC report and recognizes that historical impacts sometimes need to be adjusted to ensure that the most accurate impacts are being incorporated into net-to-gross and TRC calculations.

Less than 1% variance was found between the energy and demand impacts reported in Duquesne's quarterly reports and the annual report once unverified ex-post and in-progress projects were removed from Duquesne's Q1 and Q2 reports. This minor level of variance is expected between the quarterly and annual reports as the implementation database is fluid and project quantities and impacts are subject to adjustment until the end of the year.

The participant count, energy and demand variances shown in Table 7-23 for the Commercial Sector Umbrella EE program are entirely due to the project reclassifications discussed in Section 7.3.3.1. The SWE team agrees with the reclassification of these projects due to the premise type of the participating buildings. The variance shown for the Retail Stores is due to three projects occurring in businesses which failed and necessitated that the impacts be removed from PY2 totals. Duquesne provided a detailed explanation to the SWE in each case where an adjustment was made to a project following the quarter it was originally reported and, in each case, the SWE team agrees that the proper action was taken to ensure the accuracy of the figures in the annual report.

#### 7.3.4 PECO Audit Report

PECO reported savings impacts from three non-residential programs in PY2: Smart Equipment Incentives C&I, Smart Equipment Incentives Government\Non-Profit and Smart Construction Incentives. The gross

<sup>29</sup> In the Duquesne PY2 Annual Report, demand impacts are reported after a 7% adjustment for line losses. No adjustment is made in the quarterly reports, so the demand impacts in Table 7-22 are adjusted to reflect a 7% line loss factor prior to calculating discrepancies.

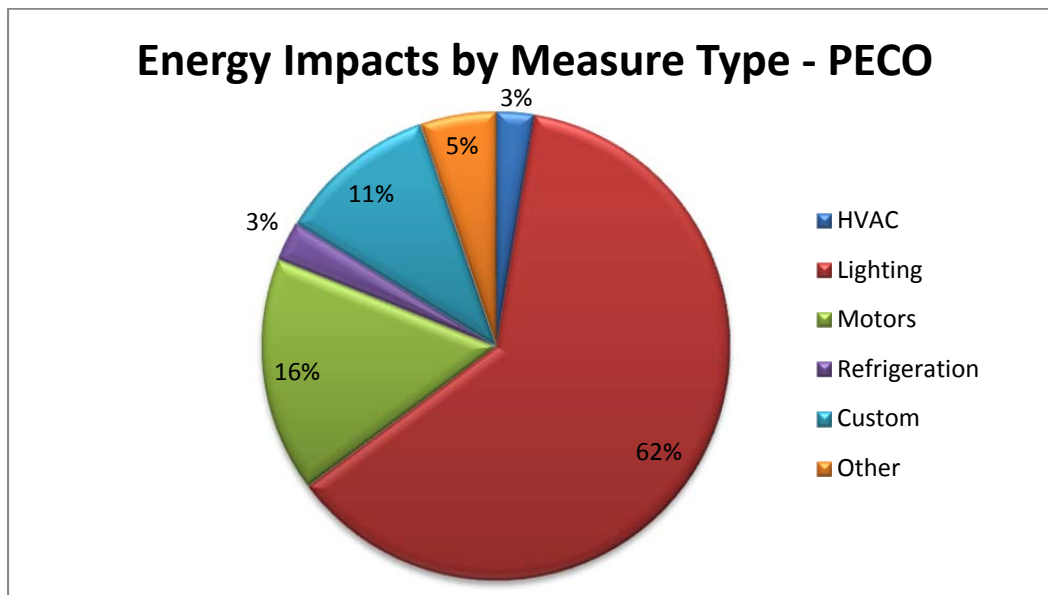
reported energy savings of these programs was 131,333 MWh and the gross reported demand savings was 20.4 MW.<sup>30</sup> Table 7-24 provides the reported number of participants, energy savings, demand savings and incentives paid from PY2.

**Table 7-24: PECO Non-Residential Programs Annual Summary**

Program	Participants	MWh	MW	Incentives
Smart Equipment Incentives -C&I	2,078	88,244	13.2	\$5,795,000
Smart Equipment Incentives -Govt/Non-Profit	402	42,058	7.1	\$4,530,000
Smart Construction	4	1,031	0.1	\$109,000
<b>Totals</b>	<b>2,484</b>	<b>131,333</b>	<b>20.4</b>	<b>\$10,434,000</b>

The majority of the PY2 energy impacts from PECO’s non-residential portfolio came from lighting measures. Motor replacement and VFD measures had the second largest energy impact at 16%. Figure 7-2 shows the relative impacts of each category of measure in the PECO non-residential portfolio.

**Figure 7-2: Distribution of Annual Gross Energy Impacts among PECO Non-Residential Measure Types**



**7.3.4.1 Review of Savings Database**

PECO provided a series of databases capturing all PY2 activity to the SWE Team for review. Table 7-25 summarizes the participant counts, energy impacts, demand impacts and total incentives paid by program according to the PECO database extract.

<sup>30</sup> PECO adjusted gross reported MW values to reflect a line loss factor of 7.1%.

**Table 7-25: PECO Non-Residential Programs Savings Database Summary**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>	<b>Incentives<sup>31</sup></b>
Smart Equipment Incentives -C&I	2,080	88,244	12.3	\$5,795,000
Smart Equipment Incentives -Govt/Non-Profit	399	42,058	6.6	\$4,529,000
Smart Construction	4	1,031	0.1	\$109,000
<b>Totals</b>	<b>2,483</b>	<b>131,333</b>	<b>19.0</b>	<b>\$10,433,000</b>

In Table 7-26, the variances between the reported figures and the information contained in the database are presented. All variances are reported as:

$$\text{Reported Figure} - \text{Database Summary} = \text{Variance}$$

**Table 7-26: PECO Non-Residential Program Variances**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW<sup>32</sup></b>	<b>Incentives</b>
Smart Equipment Incentives -C&I	-2	0	0.0	\$0
Smart Equipment Incentives -Govt/Non-Profit	3	0	0.0	\$1,000
Smart Construction	0	0	0.0	\$0
<b>Totals</b>	<b>1</b>	<b>0</b>	<b>0.0</b>	<b>\$1,000</b>

There were no variances between the gross energy figures reported in the PECO annual report and the savings database provided to the SWE for review. Once the SWE applied a 7.1% line loss adjustment to the gross demand figures in the savings database, no variances were found between the report and the savings database, relative to the demand savings. Minor variances were noted in the number of participants and the incentive amounts paid to participants.

#### **7.3.4.2 Review of Project Files**

PECO provided the SWE Team with project files for 20 individual projects completed during PY2 Q4. - Table 7-27 contains a comparison of the values contained in these project files to the savings databases PECO provided the SWE Team.

<sup>31</sup> PECO rounded reported incentives to the nearest thousand dollars. The summary of the savings database is presented in the same manner to avoid rounding errors.

<sup>32</sup> A line loss factor of 7.1% was applied to the gross demand figures from Table 7-25 prior to calculating discrepancies between the annual report and the savings database.

**Table 7-27: PECO Comparison of Project Files to Savings Database**

Customer Segment	Project Files kWh	Database kWh	kWh Difference	Project Files kW	Database kW	kW Difference	Project Files Incentive	Database Incentive	Incentive Difference
C&I Multi-Tenant	NX	94.5	-	NX	0.0225	-	\$50	\$50	\$0
C&I Multi-Tenant	NX	98	-	NX	0.059	-	\$150	\$50	\$100
C&I Multi-Tenant	NX	80	-	NX	0.0125	-	\$75	\$75	\$0
C&I Retrofit	33462.4	33462.4	0	4.5828	4.5828	0	\$1,650	\$1,650	\$0
C&I Retrofit	183998.1	183998.1	0	40.1021	40.1021	0	\$16,512.65	\$16,512.65	\$0
C&I Retrofit	324223	324223	0	97.9272	97.9272	0	\$19,600	\$19,600	\$0
C&I Retrofit	104214.5	104214.5	0	31.4766	31.4766	0	\$6,300	\$6,300	\$0
C&I Retrofit	1861.8	1861.6	0.2	0.6663	0.6663	0	\$336	\$336	\$0
C&I Retrofit	7340	7339.6	0.4	0.8378	0.8378	0	\$550	\$550	\$0
C&I Retrofit	4576	4576	0	0.618	0.618	0	\$192	\$192	\$0
GIN Multi-Tenant	NX	93.7	-	NX	0.0147	-	\$100	\$100	\$0
GIN Multi-Tenant	NX	94.5	-	NX	0.0225	-	\$25	\$50	\$25
GIN Multi-Tenant	NX	80	-	NX	0.0125	-	\$75	\$75	\$0
GIN Retrofit	98517.2	98517.2	0	30.7266	30.7266	0	\$10,657.24	\$10,657.24	\$0
GIN Retrofit	2060.4	2060.4	0	0.2814	0.2814	0	\$175	\$175	\$0
GIN Retrofit	18760.5	18760.5	0	5.5505	5.5505	0	\$1,110	\$1,110	\$0
GIN Retrofit	42140.4	42140.4	0	3.719	3.719	0	\$1,959	\$1,959	\$0
GIN Retrofit	14216.6	14216.6	0	2.3765	2.3772	0.0007	\$1,167	\$1,167	\$0
GIN Retrofit	2502900	2502900	0	1012	1012	0	\$200,000	\$200,000	\$0
GIN Retrofit	7996.7468	7996.7	0.0468	3.2511	3.2511	0	\$1,125	\$1,080	45

Note: NX (Not Available)

Of the projects reviewed, eight were lighting retrofit projects and three were HVAC retrofit projects. The SWE Team found no QC errors between the customer applications and PECO's database saving figures and incentives. The application form, invoices from the purchase of efficient equipment, TRM worksheets where savings were calculated and equipment specification sheets included in the project files supported the reported savings calculations.

Projects PECO-10-01304 and PECO-10-01370 involved both lighting and HVAC retrofits. The project files submitted to the SWE Team included billing data, invoices, application summary reports and savings calculation worksheets. The project files did not contain any equipment specification sheets. The database proved to be very consistent with the project files savings figures and incentive.

Project PECO-10-02041 was a commercial refrigeration project that included the installation of strip curtains, door gaskets and automatic door closers for walk-in coolers. The project files submitted to the SWE included an application form, invoice and application summary reports. The project files summarized the savings but did not explicitly state how the savings were achieved. It is assumed that PECO's implementation CSP uses calculations internal to the database to determine savings estimates. The SWE recommends that the implementation CSP provide savings calculation details for each project



to establish a transparent audit trail. This will also ensure that ex-ante savings are consistently calculated and that savings are not inappropriately adjusted after the reporting period. The SWE found no error pertaining to incentive amounts.

The project files submitted to the SWE Team for the multi-tenant programs for both the C&I and the Government/Non-Profit/Institutional market segments were scanned copies of customer applications along with invoices/receipts. Out of the sample of six projects, there were two dishwashers, one clothes washers, two refrigerators and one room air conditioner. The project files did not contain any savings calculation worksheets because all these are deemed measures (i.e., per unit savings values for installed measures are fixed and not based on any other independent variable). The SWE checked for consistency between the rebate applications and the submitted receipts and invoices.

Projects MT Utility ID = 1104700306 and MT Utility ID = 6195000306 were dishwasher measures. For the MT Utility ID = 6195000306 project, the rebates listed for this measure and other qualifying products were different in the application (\$25) compared to other similar multi-tenant retrofit project application forms (\$50). It is unclear whether PECO used different applications for different time periods. However, the incentive listed in the database is still the same as the rest of the applications (\$50). Only application forms and invoices were submitted; there were no specification sheets. The savings figures in the database for both these projects were not inconsistent with the TRM (energy savings of 77 kWh/unit and 137 kWh/unit depending on whether the dishwasher is in combination with a gas or electric hot water heater, respectively, and demand savings of 0.0225 kW/unit). These values were corrected through the evaluation process.

Project MT Utility ID = 8314001006 was a room air conditioner measure. The incentives written on the application did not match the final payment issued. The SWE Team confirmed that one or more appliances listed on the application were rejected and this caused the actual rebate amount to be lower than the figure listed on the application. No major systematic issues were identified.

Projects MT Utility ID = 9387802002 and MT Utility ID = 9511701606 were refrigerator measures. The SWE found that the database savings figures matched with the deemed savings presented in the TRM (80 kWh/unit and 0.0125 kW/unit). The SWE Team found no QC errors between the customer applications and PECO's database pertaining to savings figures and incentives.

Project MT Utility ID = 3270900105 was a clothes washer measure. The savings figures reported in the database were not inconsistent with the deemed savings in the TRM (energy savings of 26 kWh/unit and 258 kWh/unit depending on whether the clothes washer is in combination with a gas or electric hot water heater, respectively, and demand savings of 0.0147 kW/unit). These values were corrected through the evaluation process.

#### **7.3.4.3 Review of Report Consistency**

The SWE compiled the reported impacts from each of PECO's quarterly reports from PY2 and compared the gross participant counts, energy impacts and demand impacts to the figures reported in the PY2

Annual Report. Demand impacts in quarterly reports do not reflect line loss adjustments but demand impacts in annual reports do reflect line loss adjustments.

**Table 7-28: Sum of Impacts from PECO Quarterly Reports**

Program	Participants	MWh	MW
Smart Equipment Incentives -C&I	2,044	88,582	13.29
Smart Equipment Incentives - GNP	384	42,167	7.58
Smart Construction	4	1,031	0.10
<b>Totals</b>	<b>2,432</b>	<b>131,780</b>	<b>20.97</b>

The total non-residential gross energy impact reported in the PY2 Annual Report and summarized in Table 7-25 was 131,333 MWh. As Table 7-28 shows, the sum of the gross energy impacts reported in the four quarterly reports from PY2 was 131,780 MWh. Variances between the sums of the impacts reported in quarterly reports and the impacts reported in the annual report are presented in Table 7-29. All variances are reported as:

$$\text{Annual Report} - \text{Sum(Quarterly Reports)} = \text{Variance}$$

**Table 7-29: Variances between PECO Quarterly Reports and PY2 Report**

Program	Participants	MWh	MW <sup>33</sup>
Smart Equipment Incentives -C&I	34	-338	-1.10
Smart Equipment Incentives - GNP	18	-109	-1.10
Smart Construction	0	0	0.00
<b>Totals</b>	<b>52</b>	<b>-447</b>	<b>-2.20</b>

There are some minor variances between the figures reported in the PECO PY2 Annual Report and the sum of the impacts contained in the quarterly reports. The SWE Team understands the reporting challenge for the EDCs given the limited amount of time between the end of a quarter and the deadline for the quarterly EDC report and recognizes that historical energy and demand impacts sometimes need to be adjusted to ensure that the most accurate impacts are being incorporated into net-to-gross and TRC calculations. Guidance Memo 6 also addressed the possibility of a reporting lag for projects. The SWE believes that the type of reporting lag examined in Case 3 and Case 6 in Guidance Memo 6 are likely the source of variances shown in the participant counts column of Table 7-29.<sup>34</sup>

<sup>33</sup> A line loss factor of 7.1% was applied to the demand impacts in Table 7-28 prior to calculating discrepancies.

<sup>34</sup> Guidance memos are prepared by the SWE Team to offer guidance on a variety of evaluation issues. Copies of the Guidance Memos developed to-date can be provided upon request.

### 7.3.5 PPL Audit Report

PPL listed six programs under the non-residential umbrella, which includes the SCI, LCI, and GNP sectors. All six programs achieved significant energy and demand savings during PY2. PPL's programs are designed to be cross-cutting, allowing customers from all rate classes to participate in the programs. This section only addresses the non-residential portions of these programs. For the non-residential umbrella, the programs achieved a reported gross energy savings of 222,014 MWh and gross demand savings of 44.13 MW<sup>35</sup> during PY2. Key figures for PY2 for each program, by sector, are shown in Table 7-30. PPL reports incentives paid across these programs so Table 7-30 does not contain the reported incentives paid for the non-residential portions of those programs. The SWE recommends that incentive amounts be reported by sector level.

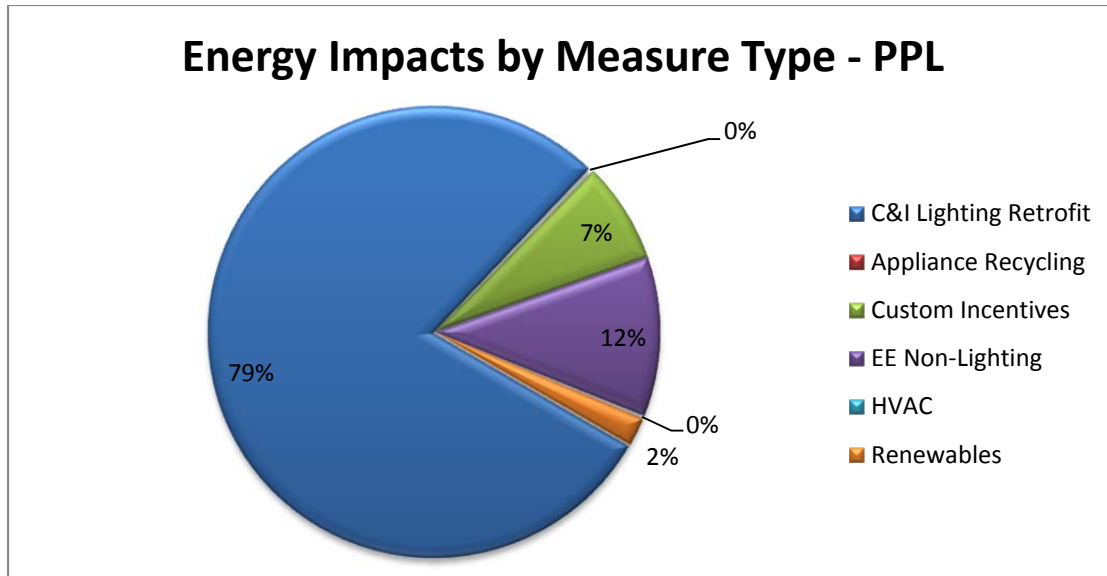
**Table 7-30: PPL Non-Residential Programs Annual Summary**

Program	Participants	MWh	MW
Small C&I Appliance Recycling	258	521	0.10
Small C&I Custom Incentive	24	1,355	1.38
Small C&I EE Non-Lighting	2,611	10,593	1.49
Small C&I Lighting	1,270	86,703	19.85
Small C&I HVAC Tune-Up	685	464	0.48
Small C&I Renewables	6	68	0.01
Large C&I Appliance Recycling	11	26	0.01
Large C&I Custom Incentive	16	11,527	1.36
Large C&I EE Non-Lighting	96	8,817	1.18
Large C&I Lighting	157	55,684	7.98
Large C&I HVAC	26	4	0.00
Large C&I Renewables	1	11	0.00
Govt/Non-Profit Appliance Recycling	1	2	0.00
Govt/Non-Profit Custom Incentive	13	3,239	0.26
Govt/Non-Profit Non-Lighting	2,253	5,962	1.22
Govt/Non-Profit Lighting	510	32,536	7.87
Govt/Non-Profit Renewables	77	4,502	0.94
<b>Totals</b>	<b>8,015</b>	<b>222,014</b>	<b>44.13</b>

Lighting measures account for less than 25% of the participation in PPL's non-residential portfolio, but account for nearly 80% of the energy impacts. The relative annual gross kWh impacts of various measures in the PPL non-residential portfolio are presented in Figure 7-3.

**Figure 7-3: Distribution of Annual Gross Energy Impacts among PPL Non-Residential Measure Types**

<sup>35</sup> The gross reported demand figures include an adjustment for transmission and distribution losses (i.e., line losses).



#### **7.3.5.1 Review of Savings Database**

PPL provided a series of databases capturing incremental measure-level activity to the SWE Team for review. Table 7-31 provides the participant count, energy savings and demand savings, by program and sector, according to the PPL database extracts. Demand impacts in the PPL database and tracking system, EEMIS, are recorded at the meter level and have not been adjusted to reflect line loss. Line loss factors were applied to the database numbers so that the reported numbers would reflect line losses. Further discussion is provided below.

**Table 7-31: PPL Non-Residential Programs Savings Database Summary**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Small C&I Appliance Recycling	258	521	0.10
Small C&I Custom Incentive	24	1,355	1.27
Small C&I EE Non-Lighting	2,611	10,593	1.38
Small C&I Lighting	1,270	86,703	18.33
Small C&I HVAC Tune-Up	685	464	0.45
Small C&I Renewables	2	8	0.00
Large C&I Appliance Recycling	11	26	0.00
Large C&I Custom Incentive	17	11,580	1.31
Large C&I EE Non-Lighting	96	8,817	1.13
Large C&I Lighting	157	55,684	7.66
Large C&I HVAC	26	4	0.00
Large C&I Renewables	0	0	0.00
Govt/Non-Profit Appliance Recycling	1	2	0.00
Govt/Non-Profit Custom Incentive	12	3,186	0.23
Govt/Non-Profit Non-Lighting	2,253	5,962	1.12
Govt/Non-Profit Lighting	510	32,536	7.27
Govt/Non-Profit Renewables	82	4,573	0.88
<b>Totals</b>	<b>8,015</b>	<b>222,012</b>	<b>41.13</b>

In Table 7-32, the variances between the reported figures and the information contained in the database are presented. Please note that variances do not necessarily indicate inadequate QA/QC, incorrect reported savings, incorrect verified savings, or incorrect incentives. There are often valid differences between an EDC's tracking system (reported savings) and rebate forms, project files, and other supporting information. For example, all measures on a rebate form may not meet program eligibility requirements and, therefore, were not rebated or recorded in the tracking system. In that case, there are differences between the rebate form (supporting information provided) and the recorded transaction but the reported savings are correct. Another example is some rebate forms include multiple measures that are split into multiple transactions in the tracking system. In that case, there is not a one-to-one relationship between the rebate form and a single recorded transaction. In cases where a transaction was incorrect in the tracking system (ex: the rebate form has 23 measures but the quantity was transposed as 32 when recorded; or the wrong customer sector was entered), the EDC may have corrected the transaction after providing the "data snapshot" to the SWE, or the EDC's independent evaluator may have corrected the transaction via an ex-ante adjustment or an ex-post adjustment and, therefore, the adjusted reported/verified savings are correct.

All variances are reported as:

$$\text{Reported Figure} - \text{Database Summary} = \text{Variance}$$

**Table 7-32: PPL Non-Residential Program Variances**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW<sup>36</sup></b>
Small C&I Appliance Recycling	0	0	0.00
Small C&I Custom Incentive	0	0	-0.01
Small C&I EE Non-Lighting	0	0	-0.01
Small C&I Lighting	0	0	-0.14
Small C&I HVAC Tune-Up	0	0	-0.01
Small C&I Renewables	4	60	0.01
Large C&I Appliance Recycling	0	0	0.00
Large C&I Custom Incentive	-1	-53	-0.01
Large C&I EE Non-Lighting	0	0	0.00
Large C&I Lighting	0	0	-0.01
Large C&I HVAC	0	0	0.00
Large C&I Renewables	1	11	0.00
Govt/Non-Profit Appliance Recycling	0	0	0.00
Govt/Non-Profit Custom Incentive	1	53	0.01
Govt/Non-Profit Non-Lighting	0	0	-0.01
Govt/Non-Profit Lighting	0	0	-0.06
Govt/Non-Profit Renewables	-5	-71	-0.02
<b>Totals</b>	<b>0</b>	<b>2</b>	<b>-0.25</b>

There was no variance in the total number of PY2 Non-Residential participants between the reported figures and the incremental database extracts. A project which was classified as Large C&I Custom Incentive in the savings database appears to have been reclassified as Government/Non-Profit Custom Incentive prior to the annual report. Reclassification of projects and adjustment of savings prior to annual reporting is expected so that the most accurate figures are used in net-to-gross and cost-effectiveness calculations. The SWE Team used the sector line loss factors specified in the PPL TRC model in an attempt to adjust the database demand impacts prior to comparing them to the figures from the PPL Annual report, which reflect transmission and distribution losses. A factor of 8.33% was used for Small C&I and GNP and a factor of 4.12% was used for Large C&I.

### **7.3.5.2 Review of Project Files**

In response to the SWE's data request, PPL requested that the SWE Team obtain the participant's data for a sample of projects for all the non-residential programs from PPL Electric's EEMIS tracking system. The SWE Team searched for each participant in the tracking system by CSP job number and program name.

<sup>36</sup> A line loss adjustment was applied to demand impacts prior to the PY2 Annual Report. This adjustment is approximated for the demand impacts in Table 7-31 prior to the calculation of the demand impact variance in Table 7-32.

PPL provided project files for a sample group of projects. In this situation, the savings recorded in the database were checked against actual project files to verify consistency in the reporting process and to identify potential opportunities for improvement. These project files included projects for Efficient Equipment Incentive Lighting, Efficient Equipment Incentive Non-Lighting and Custom Incentive Programs only. The following section examines each of these programs individually. Table 7-32 compares the contents of the savings database to the details provided in the project files for all the programs SWE reviewed.

The SWE Team reviewed project files for ten participants out of all the samples randomly selected by PPL's evaluator from its *Efficient Equipment Incentive Lighting Program*. PPL-10-01460, PPL-10-00853, PPL-10-00134, PPL-10-00344, PPL-10-00894, PPL-10-00919, PPL-10-00925, PPL-10-01032, PPL-10-01184 and PPL-10-00578 were lighting retrofit projects approved during PY2 Q4. Savings calculation sheets, customer applications, equipment specifications and invoices were provided for all these projects.

Gross energy savings, demand savings and incentive amounts matched perfectly for seven of the ten participants in the sample. The SWE Team discovered inconsistencies between the energy savings and total incentive amount for the three remaining projects.

- Variances in energy savings were observed for Project # PPL-10-01460. The database reported a savings of 5,037 kWh whereas the calculation sheets reported a savings of 5,147 kWh. This represents a 2% error in energy savings.
- Variances in the incentive were observed for Project # PPL-10-01032. The database reported an incentive of \$8,923 whereas the project files reported an incentive of \$8,023. This represents a 10% error in incentive.
- Variances in the incentive were observed for Project # PPL-10-00578. The database reported incentive is based on fixture types and quantities that are different compared to those listed in the Appendix C worksheet. The incentive amount should be based on the actual fixture types and quantities rebated.

Based on findings from the sample that Cadmus included in their EMV & QAQC samples, the SWE's findings are consistent with those identified by PPL's independent evaluator (Cadmus). Cadmus calculated the Q4 realization rates by sampling from the entire Q4 population for EMV activities (which included the projects Cadmus and SWE included in QAQC samples) so the realization rate is representative of the entire Q4 population. Cadmus made ex-ante adjustments and ex-post adjustments, as needed, to each project included in the EMV sample. The final realization rate is applied to the population. Therefore, the SWE agrees that PPL's PY2 verified savings include the proper adjustments to reflect the type of errors SWE found in their QA/QC review.

PPL provided the SWE Team with extensive project files on a sample of ten non-residential customers participating in the *Custom Incentives program* out of which the SWE reviewed two projects. For projects 1 and 11, the project files submitted to the SWE Team included savings calculation sheets, equipment specification sheets, pictures, and baseline and post-installation meter data. Verified savings were used to report database figures for both the projects. The project files provided a high level of

transparency into the verification process and there were no variances between the verified figures and the figures reported in the savings database.



**Table 7-33: PPL Commercial Database-Project Files Comparison<sup>37</sup>**

Customer Segment	Project Files kWh	Database kWh	kWh Difference	Project Files kW	Database kW	kW Difference	Project Files Incentive	Database Incentive	Incentive Difference
<b>Efficient Equipment Incentive Lighting Program</b>									
Gov't/Non-Profit	5,147	5,037	110	0.59	0.58	0.01	\$375	\$375	\$0
Small C&I	26,055	26,055	0	6.93	6.93	0.00	\$1,115	\$1,115	\$0
Gov't/Non-Profit	9,085	9,085	0	2.82	2.82	0.00	\$112	\$112	\$0
Small C&I	29,982	29,982	0	5.27	5.27	0.00	\$560	\$560	\$0
Small C&I	4,574	4,575	1	1.54	1.53	0.01	\$1,255	\$1,255	\$0
Gov't/Non-Profit	11,128	11,128	0	1.46	1.46	0.00	\$1,287	\$1,287	\$0
Gov't/Non-Profit	13,259	13,259	0	3.92	3.92	0.00	\$4,608	\$4,608	\$0
Gov't/Non-Profit	41,446	41,447	1	11.66	11.66	0.00	\$8,023	\$8,923	\$900
Gov't/Non-Profit	105,846	105,846	0	31.32	31.32	0.00	\$14,000	\$14,000	\$0
Small C&I	34,247	34,247	0	8.78	8.78	0.00	NX	\$168	\$0
<b>Custom Incentives Program</b>									
Large C&I	347,828	347,828	0	37.30	37.30	0.00	\$34,783	\$34,783	\$0
Large C&I	125,988	125,988	0	20.70	20.70	0.00	\$12,599	\$12,599	\$0
<b>Efficient Equipment Incentive Non-Lighting Program</b>									
Gov't/Non-Profit	3,990	4,530	540	0.54	0.61	0.07	\$90	\$90	\$0
Gov't/Non-Profit	156	156	0	0.02	0.02	0.00	\$6	\$6	\$0
Gov't/Non-Profit	150	1,560	1,410	0.02	0.21	0.19	\$30	\$30	\$0
Gov't/Non-Profit	1,771	1,771	0	0.24	0.24	0.00	\$21	\$21	\$0
Small C&I	361	361	0	0.02	0.05	0.03	\$3	\$3	\$0
Small C&I	NX	470	0	NX	0.06	0.00	\$100	\$100	\$0
Gov't/Non-Profit	NX	61	0	NX	0.01	0.00	\$115	\$115	\$0
Large C&I	NX	6,223,317	0	NX	851.43	0.00	\$21,210	\$21,210	\$0
Small C&I	NX	2,160	0	NX	0.27	0.00	\$360	\$360	\$0
Small C&I	NX	1,945	0	NX	0.04	0.00	\$170	\$170	\$0
Small C&I	NX	17,820	0	NX	2.43	0.00	\$1,620	\$1,620	\$0
Gov't/Non-Profit	NX	732	0	NX	0.14	0.00	\$6	\$6	\$0
Note: NX (Not Available)									

<sup>37</sup> Please see the note before Table 7-24. Discrepancies do not necessarily indicate inadequate QA/QC, incorrect reported savings, incorrect verified savings, or incorrect incentives. There are often valid differences between an EDC's tracking system (reported savings and incentives) and rebate forms, project files, and other supporting information. For example, all measures on a rebate form may not meet program eligibility requirements and, therefore, were not rebated nor recorded in the tracking system. In that case, there are differences between the rebate form (supporting information provided) and the recorded transaction but the reported savings are correct. For some measures, the PY2 savings in the tracking system is a single deemed value even though the TRM has an algorithm because there was not enough time to incorporate the algorithm into the tracking system. In those situations, PPL's independent evaluator corrects the reported savings via an ex-ante adjustment.

The SWE Team reviewed project files for twelve participants out of all the samples randomly selected by PPL's evaluator from its *Efficient Equipment Incentive Non-Lighting Program*. PPL provided scanned copies of rebate applications and invoices/receipts. The project files which the SWE Team reviewed for the Efficient Equipment Non Lighting Program mainly involved Office Equipment and Commercial Refrigeration measures.

Projects 63025601, 63177072, 63651092 and 63814125 involved purchasing of computers, printers, monitors and scanners, respectively. For all four participants, the quantities and incentives written on the application did not match the final payment issued. This variance does not necessarily indicate inadequate QA/QC, incorrect savings, or incorrect incentives. A single rebate application form for office equipment includes multiple measures that are recorded into multiple transactions in PPL's tracking system. Therefore, there is not a one-to-one relationship between the rebate form and a single recorded transaction. Also, one or more of the measures listed on the application may have been rejected and this caused the actual rebate amount to be correctly lower than the figure listed on the application. The SWE verified that the quantity and incentive listed on the first page of all these applications matched with the database reported figures. In the sample check for PY2 Q4, the SWE Team discovered inconsistencies with the database reported savings figures for projects 63025601 and 63651092 compared to the 2010 TRM. (Cadmus and PPL used the approved interim measure protocols to compute and verify savings.) No QC errors were found for projects 63177072 and 63814125 pertaining to savings figures.

Projects 62342391, 61207130, 59715740, 59613966, 62710365 and 59613969 involved installing high efficiency evaporator fans, an ice machine, a compressor VFD for a chiller, display cases, anti-sweat heater controls, and high efficiency case fans, respectively. Project 59409038 involved installing faucet aerators. The project files only contained applications and invoices and did not state how the savings were achieved. The SWE however was able to check for consistency between the rebate applications and submitted receipts and invoices and also against the entries for the rebate applications in PPL's database. It is assumed that PPL's implementation CSP uses calculations internal to the database to determine savings estimates. The SWE recommends that the implementation CSP provide savings calculation details for each project to establish a transparent audit trail. This will also ensure that *ex ante* savings are consistently calculated and that savings are not inappropriately adjusted after the reporting period.

Project 57987628 was purchase of ENERGY STAR water coolers. Because there is no TRM protocol and the assumed savings were low, PPL did not claim any savings for this measure in their annual report.

In past reviews, where the SWE Team discovered inconsistencies in gross energy and demand savings and requested for more information, PPL explained the use of the adjusted value in the following excerpt from the PY2 Annual Report.

“The energy and demand *ex ante* gross savings reported in EEMIS for the Efficient Equipment Incentive Program underwent two levels of adjustment:

1. First, EEMIS reported savings were adjusted to bring the reported *ex ante* into alignment with the TRM algorithms, correcting the deemed savings used as placeholders in EEMIS. This resulted in the TRM-adjusted *ex ante* energy and demand savings values. The *ex ante* adjustments were based on information about the systems installed through the program (configuration and geographic location). This adjustment accounts for differences between planning assumptions and installed equipment, and relies solely on information in the EEMIS tracking database.
2. Second, additional adjustments were made to the TRM-adjusted *ex ante* savings to compute the verified *ex post* savings. These adjustments reflect the results of M&V activities and account for systems information (efficiency, tonnage, and features), installation rates, and equipment qualifications collected through surveys, site visits, and records review.”

The SWE Team also reviewed the savings figures in the EEMIS tracking system and found that these numbers were the same as the reported *ex ante* savings. PPL clarified in their annual report that, for some measures, the EEMIS reported values reflect deemed savings assumptions because there was not enough time to incorporate TRM algorithms into the tracking system. In those cases, PPL’s independent evaluator corrects the reported savings via an *ex-ante* adjustment before determining *ex-post* savings. Therefore, rather than a direct correlation, there is an indirect correlation between reported and verified savings; the direct correlation is between the adjusted *ex-ante* savings and the verified savings.

PPL noted in its Annual Report that there was no additional information available besides actual participation captured in the EEMIS tracking database for measures that include commercial refrigeration, faucet aerators, motors, variable speed drives (VFDs), and large commercial HVAC. For these measures, over the course of PY2, the EM&V CSP reviewed records, conducted site visits and surveys of nonresidential customers for verification purposes and all adjustments were made to the *ex post* savings. For many of these measures, the PY2 savings in the tracking system is a single deemed value (determined by an average value derived from the TRM algorithm) even though the TRM has an algorithm, because there was not enough time to incorporate the algorithm into the tracking system. In those situations, PPL’s independent evaluator corrects the reported savings via an *ex-ante* adjustment. In some cases, such as HVAC motors and VFDs, the reported savings are calculated using TRM spreadsheets outside of the tracking system, and those results are recorded in the tracking system.

### ***7.3.5.3 Review of Report Consistency***

The SWE compiled the reported impacts from each of PPL’s quarterly reports from PY2 and compared the gross participant counts, energy impacts and demand impacts to the figures reported in the PY2 Annual Report. The demand impact figures in the PPL quarterly reports are adjusted for transmission and distribution losses.

**Table 7-34: Sum of Impacts from PPL Quarterly Reports**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Small C&I Appliance Recycling	258	522	0.10
Small C&I Custom Incentive	24	1,355	1.38
Small C&I EE Non-Lighting	2,679	22,410	3.76
Small C&I Lighting	1,202	74,886	17.59
Small C&I HVAC Tune-Up	685	464	0.48
Small C&I Renewables	2	8	0.00
Large C&I Appliance Recycling	11	27	0.00
Large C&I Custom Incentive	17	11,580	1.36
Large C&I EE Non-Lighting	105	18,624	2.45
Large C&I Lighting	148	45,877	6.69
Large C&I HVAC	26	3	0.00
Large C&I Renewables	0	0	0.00
Govt/Non-Profit Appliance Recycling	1	2	0.00
Govt/Non-Profit Custom Incentive	12	3,186	0.26
Govt/Non-Profit Non-Lighting	2,280	6,493	1.44
Govt/Non-Profit Lighting	483	32,004	7.65
Govt/Non-Profit Renewables	82	4,573	0.96
<b>Totals</b>	<b>8,015</b>	<b>22,2013</b>	<b>44.13</b>

The total non-residential gross energy impact reported in the PY2 Annual Report and summarized in Table 7-30 was 220,014 MWh. As Table 7-34 shows, the sum of the gross energy impacts reported in the four quarterly reports from PY2 was 202,013 MWh. Variances between the sums of the impacts reported in quarterly reports and the impacts reported in the annual report are presented in Table 7-35. All variances are reported as:

$$\text{Annual Report} - \text{Sum(Quarterly Reports)} = \text{Variance}$$

**Table 7-35: Variances between PPL Quarterly Reports and PY2 Report**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Small C&I Appliance Recycling	0	-1	0.00
Small C&I Custom Incentive	0	0	0.00
Small C&I EE Non-Lighting	-68	-11,817	-2.27
Small C&I Lighting	68	11,817	2.26
Small C&I HVAC Tune-Up	0	0	0.00
Small C&I Renewables	4	60	0.01
Large C&I Appliance Recycling	0	-1	0.01
Large C&I Custom Incentive	-1	-53	0.00
Large C&I EE Non-Lighting	-9	-9,807	-1.27
Large C&I Lighting	9	9,807	1.29
Large C&I HVAC	0	1	0.00
Large C&I Renewables	1	11	0.00
Govt/Non-Profit Appliance Recycling	0	0	0.00
Govt/Non-Profit Custom Incentive	1	53	0.00
Govt/Non-Profit Non-Lighting	-27	-531	-0.22
Govt/Non-Profit Lighting	27	532	0.22
Govt/Non-Profit Renewables	-5	-71	-0.02
<b>Totals</b>	<b>0</b>	<b>0</b>	<b>0.00</b>

There are some minor variances between the figures reported in the PPL annual report and the sum of the impacts contained in the quarterly reports, however these variances appear to be a result of project reclassification between the quarterly report and the annual report. The total participant count, energy impact and demand impact for the non-residential sectors show no variances.

### 7.3.6 FirstEnergy Audit Report

The three FirstEnergy EDCs, Met-Ed, Penelec and Penn Power, offer seven non-residential energy efficiency programs under Act 129. None of these EDCs reported impacts from its Demand Response programs during PY2. The following series of tables provide a summary of the reported non-residential participant counts, gross energy impacts, gross demand impacts and incentive amounts for PY2.

Table 7-36 shows that Met-Ed reported a total of 2,350 non-residential participants. The reported gross energy savings is 85,804 MWh, the reported gross demand savings is 13.13 MW and the reported incentive total is over \$10.5 million.

**Table 7-36: Met-Ed Non-Residential Programs Annual Summary**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>	<b>Incentives</b>
Energy Audit, Assessment and Equipment Rebate	435	22,161	3.95	\$2,810,678
C/I Performance Contracting/Equipment	105	36,782	4.36	\$3,308,562
Industrial Motors and VSD	6	2,368	0.14	\$90,475
Street Lighting	191	4,198	0.00	\$2,901,237
Non-Profit	27	751	0.20	\$37,187
Remaining Government /Non-Profit	1,586	19,544	4.48	\$1,426,225
<b>Totals</b>	<b>2,350</b>	<b>85,804</b>	<b>13.13</b>	<b>\$10,574,364</b>

Table 7-37 shows that Penelec reported a total of 2,496 non-residential participants. The reported gross energy savings is 97,434 MWh, the reported gross demand savings is 16.31 MW and the reported incentive total is almost \$10 million.

**Table 7-37: Penelec Non-Residential Programs Annual Summary**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>	<b>Incentives</b>
<b>Small C&amp;I Audit Assessment and Equipment Rebate</b>	678	34,949	6.82	\$4,241,082
<b>C&amp;I Performance Contracting/Equipment</b>	106	31,252	4.02	\$2,706,871
<b>Industrial Motors and VSD</b>	4	3,887	0.37	\$220,338
<b>Street Lighting</b>	183	976	0.00	\$881,459
<b>Non-Profit</b>	36	463	0.11	\$43,321
<b>Remaining Government/Non-Profit</b>	1,489	25,907	4.99	\$1,795,267
<b>Totals</b>	<b>2,496</b>	<b>97,434</b>	<b>16.31</b>	<b>\$9,888,338</b>

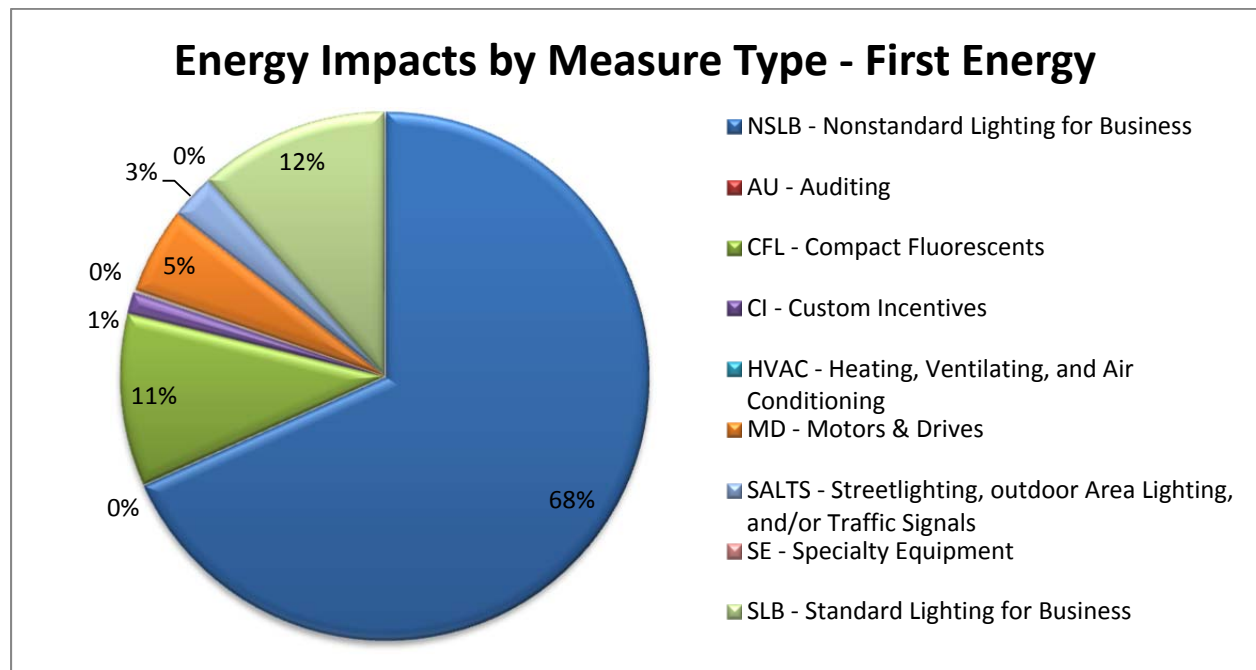
Table 7-38 shows that Penn Power reported a total of 856 non-residential participants. The reported gross energy savings is 33,355 MWh, the reported gross demand savings is 4.50 MW and the reported incentive total is over \$3 million.

**Table 7-38: Penn Power Non-Residential Programs Annual Summary**

Program	Participants	MWh	MW	Incentives
Small C&I Audit, Assessment and Equipment	146	10,156	1.63	\$1,217,472.00
C&I Performance Contracting/Equipment	33	13,538	1.30	\$1,172,905.00
Industrial Motors and VSD	3	566	0.09	\$25,619.00
Street Lighting	127	247	0.00	\$175,326.00
Non-Profit	4	90	0.02	\$9,735.00
Remaining Government/Non-Profit	543	8,758	1.46	\$461,138.00
<b>Totals</b>	<b>856</b>	<b>33,355</b>	<b>4.5</b>	<b>\$3,062,195.00</b>

Lighting measures accounted for approximately 94% of the annual energy impacts in the non-residential portfolios of the three FirstEnergy EDCs. The relative energy impact of each measure type is presented in Figure 7-4.

**Figure 7-4: Distribution of Annual Gross Energy Impacts among FirstEnergy Non-Residential Measure Types**



### 7.3.6.1 Review of Savings Database

FirstEnergy provided the SWE Team a database of project activity for each of its operating companies. The following tables contain the total participant counts, energy savings, demand savings and incentive amounts, by program, from FirstEnergy.

**Table 7-39: Met-Ed Non-Residential Programs Savings Database Summary**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>	<b>Incentives</b>
Energy Audit, Assessment and Equipment Rebate	435	22,161	3.95	\$2,730,447
C/I Performance Contracting/Equipment	105	36,782	4.36	\$3,171,310
Industrial Motors and VSD	6	2,368	0.14	\$39,250
Street Lighting	191	4,198	0.00	\$2,905,238
Non-Profit	27	751	0.20	\$146,999
Remaining Government /Non-Profit	1,586	19,544	4.48	\$1,234,659
<b>Totals</b>	<b>2,350</b>	<b>85,804</b>	<b>13.12</b>	<b>\$10,227,902</b>

**Table 7-40: Penelec Non-Residential Programs Savings Database Summary**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>	<b>Incentives</b>
Small C&I Audit Assessment and Equipment Rebate	678	34,949	6.82	\$4,333,154
C&I Performance Contracting/Equipment	106	31,252	4.02	\$2,607,071
Industrial Motors and VSD	4	3,887	0.37	\$176,188
Street Lighting	183	976	0.00	\$879,626
Non-Profit	36	463	0.11	\$43,847
Remaining Government/Non-Profit	1,489	25,907	4.99	\$1,573,951
<b>Totals</b>	<b>2,496</b>	<b>97,433</b>	<b>16.30</b>	<b>\$9,613,837</b>

**Table 7-41: Penn Power Non-Residential Programs Savings Database Summary**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>	<b>Incentives</b>
Small C&I Audit, Assessment and Equipment	147	10,156	1.63	\$1,191,179
C&I Performance Contracting/Equipment	33	13,538	1.30	\$1,116,496
Industrial Motors and VSD	3	566	0.09	\$28,304
Street Lighting	127	247	0.00	\$171,200
Non-Profit	4	90	0.02	\$13,605
Remaining Government/Non-Profit	558	8,758	1.46	\$442,598
<b>Totals</b>	<b>872</b>	<b>33,355</b>	<b>4.50</b>	<b>\$2,963,382</b>

In the following tables, the variances between the reported figures and the information contained in the database are presented for each of the FirstEnergy EDCs. All variances are reported as:

$$\text{Reported Figure} - \text{Database Summary} = \text{Variance}$$



**Table 7-42: Met-Ed Non-Residential Program Variances**

Program	Participants	MWh	MW	Incentives
Energy Audit, Assessment and Equipment Rebate	0	0	0.00	\$80,231
C/I Performance Contracting/Equipment	0	0	0.00	\$137,252
Industrial Motors and VSD	0	0	0.02	\$51,225
Street Lighting	0	0	0.00	-\$4,001
Non-Profit	0	0	0.00	-\$109,812
Remaining Government /Non-Profit	0	0	0.00	\$191,566
<b>Totals</b>	<b>0</b>	<b>0</b>	<b>0.02</b>	<b>\$346,462</b>

The reported incentive amounts in the Met-Ed PY2 Annual Report were drawn from its SAP financial tracking system which led to slight variances between the report and the database. This incentive variance is present for each of the FirstEnergy operating companies.

**Table 7-43: Penelec Non-Residential Program Variances**

Program	Participants	MWh	MW	Incentives
Small C&I Audit Assessment and Equipment Rebate	0	0	0.00	-\$92,072
C&I Performance Contracting/Equipment	0	0	0.00	\$99,800
Industrial Motors and VSD	0	0	0.00	\$44,150
Street Lighting	0	0	0.00	\$1,833
Non-Profit	0	0	0.00	-\$526
Remaining Government/Non-Profit	0	0	0.00	\$221,316
<b>Totals</b>	<b>0</b>	<b>0</b>	<b>0.00</b>	<b>\$274,501</b>

Table 7-43 shows perfect alignment between the Penelec savings database and the figures reported in the PY2 Annual Report with the exception of incentive amounts.

**Table 7-44: Penn Power Non-Residential Program Variances**

Program	Participants	MWh	MW	Incentives
Small C&I Audit, Assessment and Equipment	-1	0	0.00	\$26,292.77
C&I Performance Contracting/Equipment	0	0	0.00	\$56,408.71
Industrial Motors and VSD	0	0	0.00	-\$2,684.90
Street Lighting	0	0	0.00	\$4,126.00
Non-Profit	0	0	0.00	-\$3,870.00
Remaining Government/Non-Profit	-15	0	0.00	\$18,540.02
<b>Totals</b>	<b>-16</b>	<b>0</b>	<b>0.00</b>	<b>\$98,812.60</b>

Table 7-44 reveals no variances in energy impacts or demand impacts between the FirstEnergy savings database and the Penn Power PY2 annual report. However, there is a slight difference in the participation counts. The SWE requests clarification of the definition of a unique participation to help eliminate variances in future audits.

**7.3.6.2 Review of Project Files**

The review of project files task is intended to compare the database files with submitted project files to ensure that the transfer of information from the application files to the database is functioning correctly. Although files were not reviewed for the PY2 Q4 cycle, the SWE reviewed project files throughout the site inspection process and also during previous quarters in program year 2. Through these other tasks, the SWE determined that the evaluator’s independent reviews and QA/QC procedures were sufficient to ensure that the transfer of information occurred correctly and that any variances would be systematically captured by the impact evaluation.

**7.3.6.3 Review of Report Consistency**

The SWE compiled the reported impacts from each of the FirstEnergy EDC’s quarterly reports from PY2 and compared the gross participant counts, energy impacts and demand impacts to the figures reported in the PY2 Annual Report. The following tables present the sum of the figures reported in the four quarterly reports.

**Table 7-45: Sum of Impacts from Met-Ed Quarterly Reports**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Energy Audit, Assessment and Equipment Rebate	440	22,131	3.95
C/I Performance Contracting/Equipment	106	37,417	4.35
Industrial Motors and VSD	7	2,368	0.14
Street Lighting	191	4,191	0
Non-Profit	27	751	0.21
Remaining Government /Non-Profit	187	21,065	4.49
<b>Totals</b>	<b>958</b>	<b>87,923</b>	<b>13.14</b>

**Table 7-46: Sum of Impacts from Penelec Quarterly Reports**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Small C&I Audit Assessment and Equipment Rebate	692	35,528	6.83
C&I Performance Contracting/Equipment	107	31,286	4.03
Industrial Motors and VSD	5	3,887	0.36
Street Lighting	184	977	0
Non-Profit	36	463	0.11
Remaining Government/Non-Profit	307	28,295	4.96
<b>Totals</b>	<b>1,331</b>	<b>100,436</b>	<b>16.29</b>

**Table 7-47: Sum of Impacts from Penn Power Quarterly Reports**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Small C&I Audit, Assessment and Equipment	149	10,295	1.65
C&I Performance Contracting/Equipment	34	13,951	1.42
Industrial Motors and VSD	3	566	0.09
Street Lighting	127	247	0
Non-Profit	4	90	0.02
Remaining Government/Non-Profit	48	9,129	1.44
<b>Totals</b>	<b>365</b>	<b>34,278</b>	<b>4.62</b>

The total non-residential gross energy impact reported in the Met-Ed PY2 Annual Report and summarized in Table 7-36 was 85,804 MWh. As Table 7-45 shows, the sum of the gross energy impacts reported in the four Met-Ed quarterly reports from PY2 was 87,923 MWh. The SWE team expects to see a certain level of variance between the quarterly and annual reports as the implementation database is fluid and project quantities and impacts are subject to adjustment until the end of the year. Variances between the sums of the impacts reported in quarterly reports and the impacts reported in the annual report are presented in Table 7-48, Table 7-49 and Table 7-50. All variances are reported as:

$$\text{Annual Report} - \text{Sum(Quarterly Reports)} = \text{Variance}$$

**Table 7-48: Variances between Met-Ed Quarterly Reports and PY2 Report**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Energy Audit, Assessment and Equipment Rebate	-5	30	0
C/I Performance Contracting/Equipment	-1	-635	0.01
Industrial Motors and VSD	-1	0	0
Streetlighting	0	7	0
Non-Profit	0	0	-0.01
Remaining Government /Non-Profit	1,399	-1,521	-0.01
<b>Totals</b>	<b>1,392</b>	<b>-2,119</b>	<b>-0.01</b>

**Table 7-49: Variances between Penelec Quarterly Reports and PY2 Report**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Small C&I Audit Assessment and Equipment Rebate	-14	-579	-0.01
C&I Performance Contracting/Equipment	-1	-34	-0.01
Industrial Motors and VSD	-1	0	0.01
Street Lighting	-1	-1	0
Non-Profit	0	0	0
Remaining Government/Non-Profit	1,182	-2,388	0.03
<b>Totals</b>	<b>1,165</b>	<b>-3,002</b>	<b>0.02</b>

**Table 7-50: Variances between Penn Power Quarterly Reports and PY2 Report**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Small C&I Audit, Assessment and Equipment	-3	-139	-0.02
C&I Performance Contracting/Equipment	-1	-413	-0.12
Industrial Motors and VSD	0	0	0
Street Lighting	0	0	0
Non-Profit	0	0	0
Remaining Government/Non-Profit	495	-371	0.02
<b>Totals</b>	<b>491</b>	<b>-923</b>	<b>-0.12</b>

Aside from the minor variances which can result from project reclassification, impact adjustment or simple rounding error, the quarterly figures from FirstEnergy non-residential programs were very close to the PY2 Annual Report. The exception for each EDC is the Remaining Government/Non-Profit program. Notice that in all three tables the participants, energy impact and demand impact were greater in the PY2 Annual Report than in the sum of the quarterly reports. This is because the PY2 tracking information from the implementation contractor for the Government/Non-Profit CFL program was included in the figures shown in the annual report. The SWE recommends that implementers report program activity to FirstEnergy with enough time to be included in quarterly reports moving forward to the extent practical.

### 7.3.7 West Penn Power Audit Report

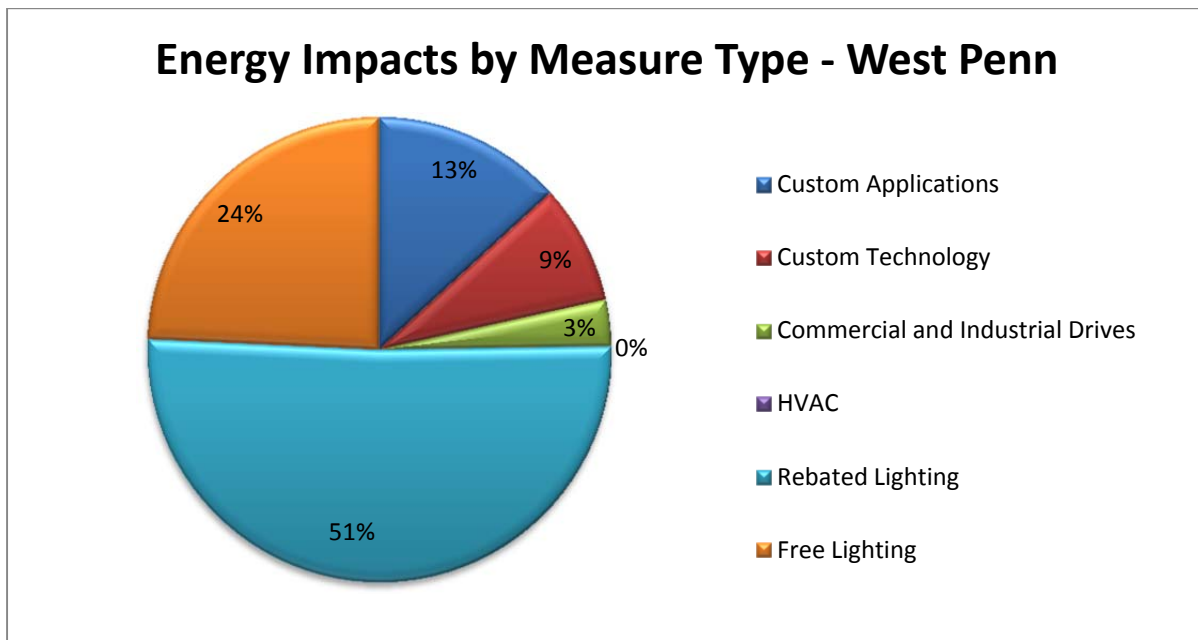
West Penn Power listed 11 programs under the non-residential umbrella, which includes the SCI, LCI, and GNP sectors. Of these eleven programs, six programs achieved energy and demand savings during PY2. The programs achieved a reported gross energy savings of 28,529 MWh and reported gross demand savings of 6.7 MW during PY2. Key figures for PY2 for each individual program are shown in Table 7-51.

**Table 7-51: West Penn Non-Residential Programs Annual Summary**

Program	Participants	MWh	MW	Incentives
Custom Applications	9	3,990	0.8	\$412,933
Custom Technology	15	2,509	0.4	\$154,010
Commercial Products Efficiency	153	10,439	2.1	\$342,933
Govt/Non-Profit Lighting Efficiency	434	10,617	3.3	\$356,223
Commercial HVAC	2	2	0.0	\$225
Commercial and Industrial Drives	6	972	0.1	\$10,350
<b>Totals</b>	<b>619</b>	<b>28,529</b>	<b>6.7</b>	<b>\$1,276,674</b>

Lighting measures account for approximately 75% of the gross annual energy impacts in West Penn’s non-residential portfolio. Figure 7-5 examines the relative impact of each category of measure in West Penn’s offerings to non-residential customers during PY2.

**Figure 7-5: Distribution of Annual Gross Energy Impacts among West Penn Non-Residential Measure Types**



**7.3.7.1 Review of Savings Database**

West Penn Power provided a series of databases to the SWE Team detailing project activity during PY2. Table 7-52 shows the participant counts, energy savings, demand savings and EDC incentives contained in each program database.

**Table 7-52: West Penn Non-Residential Programs Savings Database Summary**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>	<b>Incentives</b>
Custom Applications	9	3,990	0.8	\$376,808
Custom Technology	15	2,509	0.4	\$154,010
Commercial Products Efficiency	146	10,774	2.1	\$251,669
Govt/Non-Profit Lighting Efficiency	572	11,942	3.4	\$369,881
Commercial HVAC	2	2	0.0	\$450
Commercial and Industrial Drives	6	972	0.1	\$29,796
<b>Totals</b>	<b>750</b>	<b>30,191</b>	<b>6.9</b>	<b>\$1,182,614</b>

In Table 7-53, the variances between the reported figures and the information contained in the program databases are presented. All variances are reported as:

$$\textit{Reported Figure} - \textit{Database Summary} = \textit{Variance}$$

**Table 7-53: West Penn Non-Residential Program Variances**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>	<b>Incentives</b>
Custom Applications	0	0	0.0	\$36,125
Custom Technology	0	0	0.0	\$0
Commercial Products Efficiency	7	-335	0.0	\$91,264
Govt/Non-Profit Lighting Efficiency	-138	-1,325	-0.1	-\$13,658
Commercial HVAC	0	0	0.0	-\$225
Commercial and Industrial Drives	0	0	0.0	-\$19,446
<b>Totals</b>	<b>-131</b>	<b>-1,660</b>	<b>-0.2</b>	<b>\$94,060</b>

In Table 7-53, there are variances in participant counts, gross energy impacts and gross demand impacts for the Government/Non-Profit Lighting Efficiency and Commercial Products Efficiency program. These variances are a result of the way the West Penn tracking system is structured. If a customer participates in both the Government/Non-Profit Free Lighting and Government/Non-Profit Rebated Lighting program or the Commercial Products Efficiency Program, the energy impacts and demand impacts resulting from both programs are reported in that customer's record in each database extract. Consequently, when the SWE Team sums the impacts in the tracking database, impacts and participation for these customers the result is a perceived variance that the customers are counted once for each measure they participated in. However, West Penn provided a Reconciliation tab which addressed this issue and the SWE Team is confident that the figures in the West Penn PY2 Annual Report compensate for this issue adequately. The incentive amounts in the West Penn tracking database also differ slightly from the reported numbers. This is a function of the lag between the conclusion of a project and the payment of incentives

to that customer. Many of these issues will be resolved in PY3 as West Penn Power migrates to FirstEnergy's systems and processes.

### **7.3.7.2 Review of Project Files**

West Penn provided the SWE Team with project files for 26 individual projects completed during PY2 Q4. The SWE Team reviewed all 26 projects to check the savings recorded in the databases against actual project files to verify consistency in the reporting process and to identify potential opportunities for improvement. Table 7-54 contains a comparison of the values contained in these project files to the savings databases West Penn provided the SWE Team.

Please note that variances for the projects described below do not necessarily indicate inadequate QA/QC, incorrect reported savings, or incorrect verified savings. There are often valid differences between an EDC's tracking system (reported savings) and rebate forms, project files, and other supporting information. For example, all measures on a rebate form may not meet program eligibility requirements and, therefore, were not rebated nor recorded in the tracking system. In that case, there are differences between the rebate form (supporting information provided) and the recorded transaction but the reported savings are correct. Another example is that the savings calculations submitted by the applicant may have been corrected based on more accurate information. Another example is some rebate forms include multiple measures that are split into multiple transactions in the tracking system. In that case, there is not a one-to-one relationship between the rebate form and a single recorded transaction. In cases where a transaction was incorrect in the tracking system, the EDC may have corrected the transaction after providing the "data snapshot" to the SWE, or the EDC's independent evaluator may have corrected the transaction via an ex-ante adjustment or an ex-post adjustment and, therefore, the adjusted reported/verified savings are correct. Therefore, the SWE agrees that West Penn Power's PY2 verified savings include the proper adjustments to reflect the type of errors SWE found in their QA/QC review.

**Table 7-54: West Penn Commercial Database-Project Files Comparison**

Program Name	Project Files kWh	Database kWh	kWh Difference	Project Files kW	Database kW	kW Difference	Project Files Incentive	Database Incentive	Incentive Difference
CommCustApplic.	1,216,689	1,216,689	0	295.00	295.00	0.00	NX	\$115,000.00	\$0
CommCustApplic.	391,620	391,620	0	82.67	82.67	0.00	NX	\$19,500.00	\$0
CommCustApplic.	479,740	479,740	0	102.31	102.31	0.00	NX	\$23,500.00	\$0
CommCustApplic.	697,460	697,460	0	115.00	115.00	0.00	NX	\$90,000.00	\$0
CommCustApplic.	29,291	29,291	0	3.85	3.85	0.00	NX	\$850.00	\$0
CommIndDrv.	105,880	105,880	0	4.60	4.60	0.00	\$1,285.00	\$1,285.00	\$0
Lgt Rebated-C&I Cust	21,444	22,178	735	7.67	7.94	0.26	\$1,022.00	\$1,022.00	\$0
Lgt Rebated-C&I Cust	59,857	60,408	551	14.60	14.73	0.13	\$2,394.28	\$2,394.28	\$0
Lgt Rebated-C&I Cust	66,395	67,845	1,450	8.50	8.66	-0.16	\$2,655.82	\$2,655.82	\$0
Lgt Rebated-C&I Cust	25,474	24,564	910	7.62	7.35	0.27	\$300.00	\$300.00	\$0
Lgt Rebated-C&I Cust	28,796	23,841	4,955	4.80	4.03	0.77	\$1,151.84	\$1,151.84	\$0
Lgt Rebated-GSNP Cust	31,595	29,886	1,709	10.42	9.82	0.59	\$2,925.00	\$2,925.00	\$0
Lgt Rebated-GSNP Cust	12,866	13,359	492	6.00	6.23	0.23	\$2,025.00	\$2,025.00	\$0
Lgt Rebated-GSNP Cust	30,307	28,808	1,499	7.55	7.18	0.37	\$2,250.00	\$2,250.00	\$0
Lgt Rebated-GSNP Cust	11,707	11,099	609	4.62	4.38	0.24	\$2,425.00	\$2,425.00	\$0
Lgt Rebated-GSNP Cust	16,451	16,086	364	5.89	5.76	0.13	\$675.00	\$675.00	\$0
Lgt Rebated-GSNP Cust	9,719	9,717	2	3.45	1.11	2.35	\$981.44	\$981.44	\$0
Lgt Rebated-GSNP Cust	13,427	13,189	238	5.03	4.97	0.05	\$1,050.00	\$1,050.00	\$0
Lgt Rebated-GSNP Cust	25,877	25,262	615	5.99	5.87	0.11	\$1,494.80	\$1,494.80	\$0
Lgt Rebated-GSNP Cust	13,614	13,513	101	5.42	5.46	0.04	\$753.01	\$753.01	\$0
PA Free CFL & Exit	4,253	4,253	0	1.26	1.32	0.06	FREE	FREE	\$0
CommCustTech.	1,090,362	341,116	749,246	155.77	29.00	126.77	NX	\$8,750.00	\$0
CommCustTech.	187,008	187,008	0	68.43	68.43	0.00	NX	\$8,953.45	\$0
CommCustTech.	20,356	20,356	0	3.70	3.70	0.00	NX	\$870.00	\$0
CommCustTech.	423,037	423,037	0	51.24	51.24	0.00	\$17,037.00	\$17,037.00	\$0
CommCustTech.	12,500	17,317	4,817	2.43	3.26	0.83	NX	\$1,750.00	\$0

Note: NX (Not Available)

The SWE Team found some variances in savings figures for all 14 of the lighting retrofit projects under the “Lgt Rebated-C&I Cust” Program. The project files submitted to SWE for all these projects included application details, invoices and savings calculation worksheets. The project files did not contain any specification sheets. The SWE Team found no QC errors pertaining to the incentives between the project files and West Penn’s database.

Seven projects were lighting retrofit projects approved during PY2 Q4. The project files submitted to the SWE included application forms, specification sheets and EM&V reports containing detailed analyses pertaining to savings calculations. Verified savings were used to report database figures for all of these projects. The project files did not clearly specify the incentive amount. The project files provided a high



level of transparency into the verification process and there were no variances between the verified figures and the figures reported in the savings database.

Project PCLGT00001354 is a lighting retrofit project. The project files submitted to the SWE contained application details, receipt (manually completed) and savings calculation worksheets. The project files did not contain any specification sheets. The SWE observed that the database reported savings only for free CFL & exit sign lighting upgrades. However, the savings calculations provided by WPP contained an additional energy and demand savings of 23,939 kWh and 9.44 kW, respectively, with a rebate of \$1,915.13 for other lighting upgrades under the same project ID. The SWE team found that the savings and incentive were part of the Rebated Lighting program which was reported during PY3Q1.

Project PCTCH00000011 is a lighting retrofit project. The project files submitted to the SWE contained an application form, specification sheets and a savings calculation worksheet. The project files did not contain any invoice/receipts. The energy and demand savings calculated using Appendix C were significantly higher (kWh and kW savings by 69% and 81% respectively) than the database reported numbers. This variance is because the database reported numbers have been adjusted based on the pre- and post-EM&V analysis.

Project PCTCH00000027 is a lighting retrofit project. The project files submitted to the SWE contained an application form, specification sheets and a savings calculation worksheet. The project files did not contain any invoices/receipts. The gross energy and demand savings database reported numbers were significantly higher than numbers listed in project files. The database reported savings of 17,317 kWh and 3.26 kW, whereas the calculation sheets reported savings of 12,500 kWh and 2.43 kW. This represents a 28% error in energy savings and 25% error in demand savings. This is because after the site-inspection was conducted, the customer made appropriate corrections to the project overview and Appendix C calculations based on accurate information and resubmitted the documentation which was later captured in the West Penn Power Watt Watcher database.

Project PCCST00000020 involved a lighting retrofit and motor/VFDs installation. The project files submitted to SWE contained an application form, specification sheets (only for lighting) and an EM&V report containing a detailed analysis pertaining to savings calculations. The project files did not specify the incentive amount. The SWE Team found no QC errors between the customer applications and West Penn's database pertaining to savings figures. The SWE Team believes sufficient insight was provided into the savings calculation and the reported savings estimates are valid.

Project PCDRV00000013 is a VFD installation project. The project files submitted to the SWE contained an application form, specification sheets, Appendix D and EM&V report containing a detailed analysis pertaining to the savings calculations. The SWE Team found no QC errors between the customer application and West Penn's database pertaining to the saving figures.

**7.3.7.3 Review of Report Consistency**

The SWE compiled the reported impacts from each of the West Penn’s quarterly reports from PY2 and compared the gross participant counts, energy impacts and demand impacts to the figures reported in the PY2 Annual Report. The following tables present the sum of the figures reported in the four quarterly reports.

**Table 7-55: Sum of Impacts from West Penn Quarterly Reports**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Custom Applications	9	3,990	0.8
Custom Technology	15	2,509	0.4
Commercial Products Efficiency	153	10,439	2.1
Govt/Non-Profit Lighting Efficiency	434	10,619	3.3
Commercial HVAC	2	2	0.0
Commercial and Industrial Drives	6	972	0.1
<b>Totals</b>	<b>619</b>	<b>28,531</b>	<b>6.7</b>

The total non-residential gross energy impact reported in the PY2 Annual Report and summarized in Table 7-51 was 28,529 MWh. As Table 7-55 shows, the sum of the gross energy impacts reported in the four quarterly reports from PY2 was 28,531 MWh. Variances between the sums of the impacts reported in quarterly reports and the impacts reported in the annual report are presented in Table 7-56. All variances are reported as:

$$\text{Annual Report} - \text{Sum(Quarterly Reports)} = \text{Variance}$$

**Table 7-56: Variances between West Penn Quarterly Reports and PY2 Report**

<b>Program</b>	<b>Participants</b>	<b>MWh</b>	<b>MW</b>
Custom Applications	0	0	0
Custom Technology	0	0	0
Commercial Products Efficiency	0	0	0
Govt/Non-Profit Lighting Efficiency	0	-2	0
Commercial HVAC	0	0	0
Commercial and Industrial Drives	0	0	0
<b>Totals</b>	<b>0</b>	<b>-2</b>	<b>0</b>

As Table 7-56 shows, figures reported in the West Penn PY2 Annual report were almost identical to the sums of the figures contained in the four quarterly reports. The difference in the energy impact of the Government/Non-Profit Lighting Efficiency program is most likely the result of rounding error.

#### **7.4 Demand Response Audit Activities**

No demand response programs were audited in PY2 as any demand response programs implemented were either run as tests of pilots for a full implementation in the Summer of 2012.

#### **7.5 Total Resource Cost Test Audit by EDC**

For each EDC, the SWE Team examined the TRC calculations for residential programs and found that these TRC ratios were calculated correctly. While calculations are being performed correctly by each EDC, the TRC test depends on a number of assumptions and these assumptions are being dealt with differently by each EDC. The SWE Team recommends that the PUC explore standardizing discount rates, line loss factors, and avoided costs of energy and capacity across all EDCs in an effort to create a uniform cost-effectiveness metric. For each residential program, the SWE Team verified the following components of TRC calculations:

- Use of the correct avoided costs from 2009 approved EE&C plans
- Use of the correct kWh and kW savings for each program
- Use of the correct deemed kWh and kW savings values from the 2010 TRM
- Use of the correct measure lives for measures included in each program
- Use of the correct line loss factors for each EDC's 2009 approved EE&C plan
- Use of the correct TRC costs for each program

The following table summarizes the SWE Team audit findings for residential sector TRC calculations.

**Table 7-57: Summary of Residential TRC Audit Findings.**

	<b>Avoided Costs</b>	<b>Measure Savings</b>	<b>Measure Costs</b>	<b>Measure Life</b>	<b>Benefit/ cost ratio</b>	<b>Net-Gross ratio = 1</b>
<b>PECO</b>	Correct	Correct	Correct	Correct	Correct	Correct
<b>PPL</b>	Correct	correct	Correct	Correct	Correct	Correct
<b>Duquesne</b>	Correct	correct	Correct	Correct	Correct	Correct
<b>Penelec</b>	Correct	correct	Correct	Correct	Correct	Correct
<b>Met Ed</b>	Correct	correct	Correct	Correct	Correct	Correct
<b>Penn Power</b>	Correct	correct	Correct	Correct	Correct	Correct
<b>West Penn Power</b>	Correct	correct	Correct	Correct	Correct	Correct

The following sections provide greater detail on the audit findings for the review of TRC inputs and assumptions; additionally, the sections contain findings from the SWE Team audit of commercial and industrial sector TRC calculations.

**7.5.1 Duquesne**

A summary of the TRC benefit-cost ratios for the portfolio and individual program are presented in the following table.

**Table 7-58: TRC Benefit-Cost Ratios – Duquesne**

<b>Program</b>	<b>TRC Benefit-Cost Ratio</b>
<b>TOTAL PORTFOLIO</b>	3.7
<b>Residential: EE Rebate</b>	4.7
<b>Residential: School Energy Pledge</b>	1.0
<b>Residential: Appliance Recycling</b>	3.9
<b>Residential: Low Income EE</b>	6.9
<b>Commercial Sector Umbrella EE</b>	2.6
<b>Healthcare EE</b>	1.3
<b>Industrial Sector Umbrella EE</b>	3.2
<b>Chemical Products EE</b>	2.8
<b>Mixed Industrial EE</b>	4.1
<b>Office Buildings – Large – EE</b>	3.6
<b>Office Buildings – Small – EE</b>	2.0
<b>Primary Metals EE</b>	3.2
<b>Government &amp; Non-Profit EE</b>	2.6
<b>Retail Stores EE</b>	2.6

**7.5.1.1 Assumptions and Inputs**

The Duquesne TRC model is the most granular of the non-residential TRC models reviewed by the SWE Team for PY2. Costs and benefits are calculated for each record in the PMRS database, Duquesne’s data tracking and reporting system. Administrative costs are allocated to each measure and costs and benefits are then aggregated prior to calculation of the TRC ratio. Duquesne uses a weighted average cost of capital, or discount rate, of 6.90% to discount program benefits and costs. This rate is used to compare the Net Present Value of program benefits which will occur later in a measure’s lifetime, to the upfront costs of installation and implementation. Discount rates vary between the EDCs because each company used what was filed in their original EE&C plan. Duquesne uses the lowest discount rate used by any of the EDCs in PY2 TRC calculations and this plays some role in the high portfolio TRC ratio shown in Table 7-58. A line loss factor of 7.0% is used for all programs per EDC EE&C filings.

An effective useful life (EUL) was assigned to each measure in the Duquesne TRC model. Measures such as commercial lighting retrofit, which were included in Appendix A of the TRM, were assigned a EUL consistent with the TRM specified value. A reference source was provided for measure lives not specified in the TRM. DEER 2008 was a frequently used source for EUL assignment. Other measures simply referred to an “accepted Duquesne value.” The SWE Team examined several of these values and found them to be reasonable, but requests that Duquesne provide some insight into how these values were determined.

Incremental costs were also applied at the measure level in the Duquesne TRC model. The Duquesne TRC model contained several tabs which detailed the calculation using DEER cost references as inputs. The measure unit cost of the base case is subtracted from the measure unit cost of the efficient case to return an incremental cost per unit of the measure.

The energy and demand impacts used in the TRC analysis were drawn from the PMRS tracking database which used TRM specified values and equations to assign ex-ante annual savings values to completed measures. The TRC analysis is based on ex-post verified savings so program impacts are adjusted by an applicable realization rate. Separate realization rates were applied to energy and demand impacts. The Industrial realization rates were applied to the ISUP Industrial Umbrella, Mixed Industrial, Primary Metals and Chemical Products programs and the Commercial realization rates were applied to each of the other non-residential programs in Duquesne's portfolio.

#### ***7.5.1.2 Avoided Costs of Energy***

The Duquesne TRC model assigns a value (\$/kWh) to the avoided cost of energy for each year from 2010 through 2029 under four different load conditions: summer on-peak, summer off-peak, winter on-peak and winter off-peak. Each measure in Duquesne's portfolio is assigned to an end-use load shape most correlated with the affected equipment. The energy impacts of a given measure are divided across the four load conditions based on the associated load profile. The impacts under a given load condition are multiplied by the avoided cost of energy for that condition and summed across the effective lifetime of the measure to calculate the avoided energy benefits produced by the measures. The use of specific end-use load shapes makes the TRC findings more realistic because measures which yield energy savings during periods with high energy costs are more cost-effective per kWh saved than measures which produce savings during off-peak periods.

#### ***7.5.1.3 Avoided Cost of Capacity***

The Duquesne TRC model does not assign a separate value (\$/kW) to the cost of adding generation capacity. Avoided costs of capacity are included in the avoided energy costs, and are based on PJM RPM Auction prices. This is converted to cost per unit of energy saved based on Duquesne's system load factor. Consequently, the demand savings attributed to a measure are not used in the cost-effectiveness calculations.

#### ***7.5.1.4 Conclusions and Recommendations***

The Duquesne TRC model was very transparent and all inputs were well documented and consistent with other documentation provided to the SWE for review. The use of end-use load shapes to determine peak and off-peak energy use by season associates larger avoided cost benefits to measures which reduce consumption during periods of high system load.

**7.5.2 PECO**

A summary of the TRC benefit-cost ratios for the portfolio and individual program are presented in the following table.

**Table 7-59: TRC Benefit-Cost Ratios – PECO**

<b>Program</b>	<b>TRC Benefit-Cost Ratio</b>
<b>TOTAL PORTFOLIO</b>	4.98
<b>Low-Income Energy Efficiency Program</b>	3.31
<b>Smart Lighting Discount Program</b>	12.01
<b>Smart Appliance Recycling Program</b>	7.93
<b>Smart Home Rebates Program</b>	0.89
<b>Smart Equipment Incentives – C&amp;I</b>	1.79
<b>Smart Equipment Incentives – Government/Non-Profit</b>	2.08
<b>Conservation Voltage Reduction</b>	262 <sup>38</sup>

**7.5.2.1 Assumptions and Inputs**

The PECO TRC model uses a weighted average cost of capital, or discount rate, of 7.45% to discount program benefits and costs. This rate is used to compare the Net Present Value of program benefits which will occur later in a measure’s lifetime to the upfront costs of installation and implementation. A general annual escalation rate of 3.0% is also applied to participant equipment savings for certain measures. Participant equipment savings are produced by measures such as CFL conversion, where the efficient technology has a longer effective life than the incumbent technology. In the case of CFLs, the participant will have to replace bulbs less frequently over the effective life of the measure and incur an equipment savings in addition to energy savings. A line loss factor of 7.1% is used for all programs.

A single TRC workbook was submitted to the SWE for review which contained all data inputs, assumptions and calculations. Two tabs were devoted to each program in the PECO portfolio. The first tab consisted of measure level inputs such as the number of participants, the effective measure life, the sum of the energy and demand impacts and realization rates. The second tab for each program compiled the data inputs contained in the first tab, determined the associated financial benefits and calculated the TRC ratio.

The gross annual energy and demand savings reported for each measure were allocated each year until the end of its effective lifetime. The effective measure lives used in the PECO TRC model were consistent with Appendix A of the TRM. Several measures, such as air-cooled chillers and ground-source heat

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<sup>38</sup> PECO’s CVR program generates a great deal of electricity savings with very minimal costs. The TRC ratio reported in this PY2 report includes only those costs incurred in PY2. In the TRC were recalculated in a cumulative manner including both PY1 and PY2 costs, the TRC would drop to approximately 150, which is still extremely beneficial. PECO will have additional costs for the CVR program in PY3 and PY4 and PECO will continue to update the TRC for the CVR program in subsequent filed reports.

pumps, were assigned measure lives greater than 15 years in the PECO TRC model, but no energy or demand savings were associated with the measure after 15 years as directed by the TRC order.

Incremental costs were not applied at the measure level in the PECO TRC model. Instead, the incremental costs, or costs incurred by the participant, were introduced into the PECO TRC model at the program level. The model lists a Navigant team member or PECO program manager as the source of the participant cost data. It is difficult to review the incremental cost assumptions when the figure is aggregated at a high level and no supporting documentation is provided.

The energy and demand impacts used in the PECO TRC analysis were drawn from the tracking database which used TRM specified values and equations to assign ex-ante annual savings values to completed measures. The SWE Team compared the ex-ante impacts used in the TRC model with the PECO PY2 measure-level database extract for several measures and found perfect agreement between the participation counts, energy impacts and demand impacts. The TRC analysis is based on ex-post verified savings so program impacts are adjusted by an applicable realization rate. Realization rates were determined at the program level and separate realization rates were applied to energy and demand impacts. The ex-post verified savings are extended over the effective measure life and summed, by year, for each program.

#### ***7.5.2.2 Avoided Costs of Energy***

PECO's TRC model uses the values (\$/kWh) filed in its EE&C plan for the avoided costs of energy for each year from 2010 through 2023 for each sector; Residential, Small Commercial and Large Commercial. Avoided energy costs are highest for the Residential sector and lowest for the Large C&I sector. The PECO TRC model uses the average of the Small and Large C&I avoided energy costs to quantify benefits to both the Smart Equipment Incentives – C&I and the Smart Equipment Incentives – GNP programs. The avoided cost forecast in the PECO EE&C Plan ended in 2023 so avoided energy costs for 2024 were calculated by applying a 3% inflation rate to the 2023 values. The program-level ex-post savings impacts for each year are adjusted for line loss and then multiplied by the appropriate avoided energy cost stream to calculate avoided energy benefits.

#### ***7.5.2.3 Avoided Cost of Capacity***

The PECO TRC model assigns a flat annual figure (\$/kW) to the cost of adding generation capacity. A single value is used for the avoided cost of capacity for all programs and sectors. The PECO forecasted avoided costs of capacity figures increase steadily over the next 15 years and are the highest of any EDC for 2022, 2023 and 2024. Ex-post demand savings are adjusted for line loss and multiplied by the avoided capacity estimate to determine the financial benefit of demand impacts.

#### ***7.5.2.4 Conclusions and Recommendations***

The SWE Team feels that the PECO TRC model provided adequate detail regarding the determination of financial benefits from energy and demand impacts. Measure life assumptions were consistent with Appendix A of the TRM and gross energy and demand impacts were consistent with reported figures and database extracts provided to the SWE for review. The SWE Team requests that PECO make the incremental program costs more transparent in future iterations of the TRC model. This could be



accomplished by adding a tab to the TRC workbook which lists measures, the average extra expense incurred by the customer to install the efficient technology rather than the incumbent technology and the source of this cost information.

### 7.5.3 PPL

A summary of the TRC benefit-cost ratios for the portfolio and individual program are presented in the following table.

Four of PPL’s programs did not pass the cost-effectiveness test. The HVAC Tune-Up program showed a low TRC ratio for PY2 because of significant start-up costs and limited savings during the year.<sup>39</sup> The costs of Renewable Energy program were higher than expected and the NTG ratio was low (38%) due to high free-ridership. Consequently, PPL has limited the offerings in its Renewable Energy to institutional Ground Source Heat Pumps. The Low-Income WRAP Program had a TRC ratio of 0.81, which was close to the estimated TRC value approved in the original EE&C Plan.<sup>40</sup>

**Table 7-60: TRC Benefit-Cost Ratios – PPL**

<b>Program</b>	<b>TRC Benefit-Cost Ratio</b>
<b>TOTAL PORTFOLIO</b>	1.73
<b>Appliance Recycling Program</b>	11.73
<b>Compact Fluorescent Lighting Campaign</b>	6.97
<b>Custom Incentive Program</b>	1.80
<b>Energy Efficiency Behavior &amp; Education Program</b>	1.51
<b>Efficient Equipment Incentive Program</b>	2.45
<b>Efficiency Equipment Incentive Program (C&amp;I Lighting)</b>	1.87
<b>E-Power Wise</b>	3.59
<b>Low-Income WRAP</b>	0.80
<b>Renewable Energy Program</b>	0.29
<b>HVAC Tune-Up Program</b>	0.28
<b>Home Assessment &amp; Weatherization Program</b>	0.61

#### 7.5.3.1 Assumptions and Inputs

PPL uses a TRC discount rate of 8.0% to discount program benefits and costs. This rate is used to compare the Net Present Value of program benefits which will occur later in measure’s lifetime to the

<sup>39</sup> As PPL explained in a Petition submitted February 2, 2011, the HVAC Tune-Up Program has not performed well and the program is not expected to achieve material savings. PPL has stopped payments to the program CSP but continues to allow HVAC contractors to provide measures to customers and to receive rebates.

<sup>40</sup> PPL is experiencing a lower low-income TRC value than the other EDCs in part because PPL has the highest average cost per WRAP project. Additionally, other EDCs have incorporated costs and savings of low-income participations in non low-income programs into low-income TRC values (e.g., low-income participants in CFL lighting programs). The SWE Team will investigate these differences going forward and work to standardize the way low-income TRC values are computed.

upfront costs of installation and implementation. A line loss factor of 8.33% is used for residential and commercial projects. A line loss factor of 4.12% is applied for to industrial projects. Energy is lost as steadily as it is carried along transmission and distribution lines as well as when voltage is stepped down so line loss is a function of both line length and the voltage at which a customer is supplied power. Industrial customers are supplied at a higher voltage than commercial and residential customers, so there is less line loss.

An effective life was associated with each measure in PPL’s portfolio in order to determine the number of years of savings to attribute to that measure. The SWE Team checked the measure lives in the PPL TRC model against the measure lives called for in Appendix A of the TRM and found no variances. The measure lives applied to custom measures not explicitly stated in the TRM were found to be reasonable.

Several different methods were used to assign incremental costs to measures in the PPL TRC model. For Efficient Equipment programs, incremental costs were based on a mixture of engineering calculations and weather adjusted figures from the Database for Energy Efficient Resources (DEER) or ENERGY STAR. The scope of the measures in the C&I Lighting program were larger than estimated in the PPL EE&C plan so incremental costs were determined through an analysis of the project files and tracking data. Appendix M of the PPL PY2 Annual Report provides a complete table detailing incremental costs by measure and the data source used to determine the incremental cost.

The PPL TRC analysis is based on ex-post verified savings so measure impacts are adjusted by an applicable realization rate. Realization rates were calculated by program, sector and stratum. Table 7-61 demonstrates a sample calculation for two measures in the Efficient Equipment program. The energy impact realization rate for Government/Non-Profit Traffic Signals is 78.8%.

**Table 7-61: Application of Realization Rate in PPL TRC Model**

Measure	TRM Impact (Annual kWh)	Realization Rate	TRC Value (Annual kWh)	Average Number of Units per Participant	Impact per Participant in PPL TRC Model
Government Non-Profit Red 8" LED Traffic Signal	299	78.8%	235.6	6.7576	1592.2
Government Non-Profit Red 12" LED Traffic Signal	694	78.8%	546.9	12.9412	7077.2

Realization rates for demand impacts are calculated separately and are used to adjust the reported demand impacts prior to entering the TRC calculation in the same manner shown above. The demand impacts used in the TRC calculations for the two measures shown above matched the TRM-specified values following the application of a 145.95% realization rate.

The SWE Team reviewed the participant counts and found the energy impacts and demand impacts used in the PPL model to be consistent with the contents of the measure level database extracts provided to the SWE for review once the realization rates were applied. Energy and demand impacts in the PPL database were calculated at the meter level and a line loss factor was applied prior to the calculation of avoided cost benefits.

Due to the number and variety of measures in the C&I Lighting program, cost-effectiveness was modeled at the program level. Participation was determined by the number of distinct combinations of participant and measure. The ex-post savings value for each sector was divided by this participation figure to produce a per-unit figure for the TRC model. As specified in the TRM, a measure life of 15 years is used for the C&I Lighting program.

#### ***7.5.3.2 Avoided Costs of Energy***

The PPL TRC model assigns a value (\$/MWh) to the avoided cost of energy for each hour of each year from 2010 through 2027 for each sector; residential, small commercial and large commercial. These hourly avoided energy costs are used in combination with a library of 8,760 load shapes to determine the annual avoided cost for each combination of end-use and sector. Each measure in PPL's portfolio is assigned to the end-use load shape most correlated with the affected equipment and the associated avoided cost value. The SWE Team feels that this is an excellent way to determine the actual avoided cost of energy for each measure because it quantifies the value of when a measure saves energy. Measures which yield energy savings during periods with high energy costs are more cost-effective per kWh saved than measures which produce savings during off peak periods.

#### ***7.5.3.3 Avoided Cost of Capacity***

The PPL model assigns a flat annual cost (\$/kW) to the cost of generation capacity for each year from 2010 to 2019. These values are multiplied by the gross demand savings of each measure to estimate the avoided cost of capacity. For 2020 and beyond, the avoided cost of energy in the PPL TRC model are based upon the EIA Annual Energy Outlook forecast and are assumed to include capacity costs. Consequently, measures with lives beyond 2019 do not include a separate estimated avoided cost of capacity for those years.

#### ***7.5.3.4 Conclusions and Recommendations***

PPL's programs are designed to produce impacts across sectors. However, avoided cost estimates, load profiles and line loss factors vary significantly between the residential, commercial and industrial sectors. This variation was handled expertly in the TRC calculation workbooks and TRC costs and benefits were calculated for each sector and for each program (across multiple sectors). The PUC's Annual Report currently requires TRC results at the program, not the sector level. The SWE will consult with the PUC to determine if the PUC's annual report template should be modified to show TRC results per program and per sector for Phase 2 of Act 129 (post-2013).

#### **7.5.4 FirstEnergy**

A summary of the TRC benefit-cost ratios for the portfolio and individual program are presented in the following table. These figures reflect the TRC benefit-cost ratios the EDCs reported in their PY2 Annual

reports. A calculation issue was discovered that would reduce the TRC ratio of several programs by approximately 4%. The low TRC Ratio of the Government/Non-Profit Program is a result of the high incremental costs of the program and the low energy and capacity benefits. The low New Construction TRC values are a result of low participation in the current program year.

**Table 7-62: TRC Benefit-Cost Ratios – Met-Ed**

<b>Program</b>	<b>TRC Benefit-Cost Ratio</b>
<b>TOTAL PORTFOLIO</b>	3.5
<b>Residential Home Energy Audit Program</b>	5.7
<b>Residential Appliance Turn-In Program</b>	7.8
<b>Residential Energy Efficiency HVAC Program</b>	2.0
<b>Residential Energy Efficient Products Program</b>	4.9
<b>Residential New Construction</b>	0.81
<b>Residential Whole Building Comprehensive</b>	0.04
<b>Residential Multi-Family Program</b>	5.9
<b>Residential Low-Income Programs</b>	2.7
<b>C/I Small Sector Energy Audit &amp; Technical Assessment Program</b>	2.7
<b>C/I Small Sector Equipment Program</b>	
<b>C/I Large Sector Performance Contracting/Equipment Program</b>	3.2
<b>C/I Large Sector Industrial Motors and Variable Speed Drives Program</b>	4.1
<b>Government/Non-Profit Street Lighting Program</b>	7.2
<b>Government/Non-Profit Program</b>	1.7
<b>Remaining Government/Non-Profit Programs</b>	4.1

**Table 7-63: TRC Benefit-Cost Ratios – Penelec**

<b>Program</b>	<b>TRC Benefit-Cost Ratio</b>
<b>TOTAL PORTFOLIO</b>	2.99
<b>Residential Home Energy Audit Program</b>	6.62
<b>Residential Appliance Turn-In Program</b>	8.2
<b>Residential Energy Efficiency HVAC Program</b>	1.3
<b>Residential Energy Efficient Products Program</b>	5.2
<b>Residential New Construction</b>	0.5
<b>Residential Whole Building Comprehensive</b>	0.04
<b>Residential Multi-Family Program</b>	6.8
<b>Residential Low-Income Programs</b>	2.2
<b>C/I Small Sector Energy Audit &amp; Technical Assessment Program</b>	2.5
<b>C/I Small Sector Equipment Program</b>	2.5
<b>C/I Large Sector Performance Contracting/Equipment Program</b>	4.5
<b>C/I Large Sector Industrial Motors and Variable Speed Drives Program</b>	2.5
<b>Government/Non-Profit Street Lighting Program</b>	0.3
<b>Government/Non-Profit Program</b>	2.0
<b>Remaining Government/Non-Profit Programs</b>	2.0

**Table 7-64: TRC Benefit-Cost Ratios – Penn Power**

<b>Program</b>	<b>TRC Benefit-Cost Ratio</b>
<b>TOTAL PORTFOLIO</b>	3.65
<b>Residential Home Energy Audit Program</b>	8.4
<b>Residential Appliance Turn-In Program</b>	8.2
<b>Residential Energy Efficiency HVAC Program</b>	1.8
<b>Residential Energy Efficient Products Program</b>	7.0
<b>Residential New Construction</b>	0.97
<b>Residential Whole Building Comprehensive</b>	0.09
<b>Residential Multi-Family Program</b>	6.3
<b>Residential Low-Income Programs</b>	2.9
<b>C/I Small Sector Energy Audit &amp; Technical Assessment Program</b>	3.6
<b>C/I Small Sector Equipment Program</b>	
<b>C/I Large Sector Performance Contracting/Equipment Program</b>	2.7
<b>C/I Large Sector Industrial Motors and Variable Speed Drives Program</b>	4.6
<b>Government/Non-Profit Street Lighting Program</b>	4.8
<b>Government/Non-Profit Program</b>	0.77
<b>Remaining Government/Non-Profit Programs</b>	3.1

**7.5.4.1 Assumptions and Inputs**

TRC calculations are handled independently for Met-Ed, Penelec and Penn Power, but each EDC uses the same FirstEnergy TRC model. FirstEnergy uses a TRC discount rate of 7.92% to discount program benefits and costs. This rate is used to compare the Net Present Value of program benefits which will occur later in a measure’s lifetime to the upfront costs of installation and implementation. Discount rates vary between the EDCs because each company used what was filed in their original EE&C plans. A line loss factor of 11.0% is used for all programs.

Effective measure life was applied to the FirstEnergy TRC calculation at the program level rather than at the measure level. In order to determine the measure life for a program, a weighted average of the effective lives of the program measures was calculated and rounded to the nearest year. For example, in the Non-Standard Lighting for Business program, each measure had an effective life of 15 years except for CFL retrofit, which has a measure life of 6.4 years. However the weighted average measure life of the Non-Standard Lighting for Business program rounds to 15 years so this is the figure used in the avoided supply and avoided capacity benefits calculations.

Incremental costs were also assigned at the program level in the FirstEnergy TRC model. The original EE&C plans and DEER were the sources of incremental costs for individual measures. These incremental measure costs were multiplied by the weight of that measure in the program. Measure weighting within a program was a function of the quantity of that measure within a given rebate type.

The energy and demand impacts used in the FirstEnergy TRC analysis were drawn from the tracking database which used TRM specified values and equations to assign ex-ante annual savings values to completed measures. The TRC analysis is based on ex-post verified savings so program impacts are adjusted by an applicable realization rate. Separate realization rates were applied to energy and demand impacts. The ex-post verified savings rates for a given EDC, sector and program are divided by the number of participants in the program to return average annual savings figures (kWh/unit and kW/unit).

#### ***7.5.4.2 Avoided Costs of Energy***

The FirstEnergy TRC model assigns a value (\$/kWh) to the avoided cost of energy for each year from 2010 through 2028 for each sector; residential, small commercial and large commercial as well as each sector in specific seasons. The unit impacts are multiplied by the most appropriate avoided cost stream to determine the per-unit avoided energy costs for that program. The SWE Team noticed an issue with the way measure life was incorporated into the avoided energy cost calculation for several Met-Ed non-residential programs. Avoided energy costs were actually attributed to the program for one year longer than the measure life. This artificially inflates the TRC benefits and increases the TRC ratio, especially for programs with short measure lives. TRCs for those programs are approximately 4% lower at the program level. At the portfolio level, the variance is less than 2%.

#### ***7.5.4.3 Avoided Cost of Capacity***

The FirstEnergy model assigns a flat annual figure (\$/kW) to the cost of adding generation capacity. A single value is used for the avoided cost of capacity for all programs and sectors. The forecasted avoided cost of capacity figures are the same for Met-Ed and Penelec. The figures used for Penn Power are slightly higher than those used for Met-Ed and Penelec. This value is multiplied by the ex-post demand savings for each combination of program and sector to determine the benefits incurred by the EDC from not having to expand capacity. The SWE Team discovered the same issue with the application of measure lives for the demand impacts of several non-residential Met-Ed programs. This caused programs with a measure life of 15 years to receive avoided capacity cost benefits for 16 years.

#### ***7.5.4.4 Conclusions and Recommendations***

The SWE recommends that FirstEnergy explore the feasibility of performing avoided cost calculations at the measure level so a measure-specific effective life can be imposed. This would also allow the measure-specific incremental costs to be used and would provide insight into the relative performance of measures within a program. The TRC workbooks should also be reviewed to ensure that the measure life is being applied properly in the avoided cost of energy and the avoided cost of capacity calculations. The inadvertent incorporation of the additional year in TRC calculations resulted in a 4.16% overestimation of TRC for the Small Commercial Equipment program, a 4.17% overestimation in the TRC for the Large Commercial Equipment /Performance Contracting program, a 3.94% overestimation of TRC for the "Remaining" Government Programs, a 4.15% overestimation of the TRC for the Public Service program and a 4.16% overestimation of the TRC for the Motors and Drives program, well within the uncertainty for a mid-program cycle TRC calculation.

**7.5.5 West Penn Power**

A summary of the TRC benefit-cost ratios for the portfolio and individual program are presented in the following table. Two of West Penn Power’s non-residential program offerings returned a TRC Benefit-Cost Ratio of less than 1.0; the Commercial HVAC Efficiency Program and the Commercial and Industrial Drives Program. The Commercial HVAC Efficiency Program was not launched until the end of PY2 and only had two participants before the end of the program year. Consequently, TRC calculations included considerable start-up and administrative costs for PY2, but very few benefits from energy savings. As the program matures, the TRC ratio is expected to increase. West Penn Power removed the Commercial and Industrial Drives Program from its EE&C Plan on September 10, 2010. Currently the plan offers incentives for installing efficient drives under the Custom Technology and Custom Applications Programs. The TRC Ratio shown in Table 7-65 is based on six projects which were approved prior to the decommissioning of the program. The low TRC value for the JUUMP program was due in part to low participation rates, minimal savings per projects, and high administrative costs

**Table 7-65: TRC Benefit-Cost Ratios – West Penn Power**

<b>Program</b>	<b>TRC Benefit-Cost Ratio</b>
<b>TOTAL PORTFOLIO</b>	1.9
<b>Compact Fluorescent Lighting (CFL) Rewards Program</b>	7.6
<b>Residential Energy Star and High Efficiency Appliance Program</b>	1.2
<b>Residential Home Performance Program</b>	2.5
<b>Residential Whole Home Appliance Efficiency Program</b>	1.1
<b>Low Income Home Performance Check-Up Audit &amp; Appliance Replacement</b>	0.8
<b>Residential Low Income Joint Utility Usage Management Program (JUUMP)</b>	0.1
<b>Government/Non-Profit Lighting Efficiency Program</b>	3.2
<b>Commercial HVAC Efficiency Program</b>	0.0
<b>Commercial Product Efficiency Program</b>	4.8
<b>Custom Technology Applications Program</b>	2.0
<b>Custom Applications Program</b>	1.8
<b>Commercial and Industrial Drives Program</b>	0.5

**7.5.5.1 Assumptions and Inputs**

The look and functionality of the West Penn Power TRC model is similar to the FirstEnergy model that was used to calculate cost-effectiveness for Penn Power, Penelec and Met-Ed with several notable differences. West Penn Power uses a weighted average cost of capital, or discount rate, of 9.034% to discount program benefits and costs. This rate is used to compare the Net Present Value of program benefits which will occur later in a measure’s lifetime to the upfront costs of installation and implementation. This is the largest discount rate used by any of the EDCs in PY2 TRC calculations. A line loss factor of 11.0% is used for all programs.



A separate TRC workbook was submitted to the SWE for each of West Penn Power's non-residential programs. The residential TRC workbooks were not provided in time for the SWE Team audit findings to be included in this report. Each non-residential workbook laid out the key inputs used in the TRC calculation in a transparent fashion. These inputs included the number of units installed, the average energy and demand impacts, realization rate, incremental cost and effective lifetime for each measure in that program. Measure costs and benefits were calculated at a measure level and then aggregated along with program administrative costs to return the TRC ratio for the program.

The effective measure lives used in the West Penn Power TRC model were consistent with Appendix A of the TRM with the exception of CFL replacement. CFL measures in the C&I Custom Technologies, C&I Custom Applications and Government Lighting programs were assigned an effective measure life of 3 years in the West Penn Power TRC model. The SWE feels that the underlying assumption is that CFL bulbs in these sectors will see more annual hours of use than in the residential sector and this will shorten the effective measure life.

Incremental costs were also applied at the measure level in the West Penn Power TRC model. The West Penn Power EE&C plans and DEER were the sources of incremental costs for traditional measures such as lighting retrofit. For measures such as C&I Drives, no incremental measure cost was determined in the EE&C plans so the average incentive was used as a proxy.

The energy and demand impacts used in the West Penn Power TRC analysis were drawn from the tracking database which used TRM specified values and equations to assign ex-ante annual savings values to completed measures. The TRC analysis is based on ex-post verified savings so program impacts are adjusted by an applicable realization rate. Separate realization rates were applied to energy and demand impacts. In the Government Lighting program, larger realization rates were applied to PY2 measures than were used for PY1 measures. The measure ex-post verified savings rates are divided by the number of participants in the program to return average annual savings figures (kWh/unit and kW/unit).

#### ***7.5.5.2 Avoided Costs of Energy***

The West Penn Power TRC model assigns a value (\$/kWh) to the avoided cost of energy for each year from 2010 through 2027 for each sector; residential, small commercial and large commercial as well as each sector in specific seasons. The unit impacts are multiplied by the most appropriate avoided cost stream to determine the per-unit avoided energy costs for that program. Avoided energy costs are highest for residential programs and lowest for Large C&I programs. Measures in the Government and Non-Profit sector use the same avoided energy costs as Small C&I measures, which are slightly higher than the estimates for Large C&I.

#### ***7.5.5.3 Avoided Cost of Capacity***

The West Penn Power TRC model assigns a flat annual figure (\$/kW) to the cost of adding generation capacity. A single value is used for the avoided cost of capacity for all programs and sectors. The forecasted avoided costs of capacity figures are very low for the 2012 and 2013. In 2012, the value used is \$6.01 per kW and in 2013 the value used is \$10.12 per kW. This is approximately \$70 lower than the

values used in the FirstEnergy model in 2012 and almost \$90 lower than the FirstEnergy values for 2013. These low values reduce the financial benefits attributed to demand savings in the West Penn TRC model.

***7.5.5.4 Conclusions and Recommendations***

The SWE recommends that West Penn Power investigate the avoided cost of capacity calculation and inputs for 2012 and 2013 to ensure that the proper financial benefits are being attributed to the peak demand savings produced by measures in its non-residential portfolio.

## **8 Summary and Recommendations**

The Statewide Evaluation (SWE) Team, the Pennsylvania Public Utility Commission Technical Utility Services (PA PUC TUS Staff), the electric distribution companies (EDCs) and the EDC evaluation contractors have worked hard to develop a solid foundation for the evaluation, measurement and verification (EM&V) of the Act 129 energy efficiency and demand response programs. The SWE Team notes that improvements continue to be made to the SWE audit processes and appreciates the support and responsiveness of the Pennsylvania Energy Association, the EDCs and their evaluation contractors.

Based on the findings from the SWE audit activities conducted in PY2, the SWE Team makes the following recommendations to the PA PUC relating to the Act 129 energy efficiency and demand response programs:

- The SWE recommends that the verified savings reported by the EDCs in their respective PY2 Annual Reports remain as filed.
- The Program Year 2 (PY2) kWh and kW savings numbers provided in the EDC PY2 annual reports should be accepted by the Commission.
- The SWE recommends that, going forward, line loss factors taken from more recently filed reports be used to reflect the most accurate representation of benefits and cost when calculating the Total Resource Cost (TRC) cost-effectiveness ratios.
- The SWE Team, the PUC's TUS staff and the EDCs should continue to work together during PY3 to develop the incremental cost database for all energy efficiency measures included in the Act 129 energy efficiency programs.
- The SWE Team, the PUC's TUS staff and the EDCs should continue to develop Guidance Memos to address detailed technical issues that arise in PY3 relating to the development and reporting of kWh and kW savings and Total Resource Cost (TRC) test calculations.
- The SWE Team, the PUC's TUS staff and the EDCs should review the findings from EDC process and impact evaluations at the next SWE program evaluation workshop to continue the process of reviewing and modifying Act 129 programs to ensure that they are as effective as possible.

## Appendix A: Findings for Non-Residential Site Inspections

The following table presents all findings and resolutions from non-residential site inspections conducted during PY2. Columns headers are defined as:

- **SWE ID:** The SWE assigned each project that received a site inspection a unique identifier.
- **Measures:** Measures that were reviewed as part of the site inspection.
- **Insp. Type:** Either Ride-Along (RA) or Independent (IND). See Section 7.3.1 for more details.
- **Finding:** Issues discovered through site inspections and review of evaluator reports (for RA only).
- **Finding Type:** Categorized into Evaluation (Eval), Process (Pro) or TRM (TRM) findings.
- **Resolution:** Actions taken to resolve the issues due to findings.

**Table A-1: Non-Residential Site Inspection Findings**

SWE ID	Measures	Insp. Type	Finding	Finding Type	Resolution
DLC-001	Occupancy sensors	RA	Minor differences noted in initial calculations.	Eval	Evaluator accepted SWE results/findings 10/27/11.
DLC-002	Motors, VFDs	RA	Minor differences noted in initial calculations.	Eval	Evaluator accepted SWE results/findings 10/27/11.
DLC-003	Lighting	RA	Installation incomplete during initial inspection.	Pro	Evaluator re-inspected site following project completion and issued revised report.
	Lighting	RA	TRM Table 6-6 does not include apartment buildings.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
DLC-004	Refrigeration	RA	Differences in initial calculations.	Eval	Evaluator accepted SWE results/findings 10/27/11.
	Refrigeration	RA	IMPs not submitted for refrigeration measures.	Pro	IMPs posted on SharePoint 9/16/11.
DLC-005	LED lighting	RA	TRM Table 6-6 does not include lighting measures in 24/7 supermarkets.	Pro	Addressed in 2012 TRM (more flexibility added to determine hours of use).
	LED lighting	RA	Insufficient documentation for light fixtures in initial report.	Eval	Documentation provided.
DLC-006	VFD compressor	RA	Insufficient M&V for custom project.	Eval	Evaluator accepted SWE results/findings 10/27/11.
	VFD compressor	RA	Flawed calculations.	Eval	Evaluator accepted SWE results/findings 10/27/11.
DLC-007	Lighting	IND	Warehouse with 33% fewer annual hours than in TRM Table 6-6.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
	Lighting	IND	Six lamp, instant start, high output ballasts not listed in TRM.	TRM	Specification sheet used to determine fixture wattage; possible TRM addition.
DLC-008	Refrigeration equipment	IND	Business closed, all rebated equipment removed.	Pro	Not applicable.
DLC-009	Lighting	IND	Building type not listed in TRM Table 6-6 (24/7 parking garage).	TRM	Parking Garage added to 2011 TRM Table 3-5, but not 24/7. 24/7 Facilities added to 2012 TRM Table 3-4.
	Lighting	IND	Baseline fixture type incorrectly listed in application.	Pro	Baseline fixture type resolved through interview/inspection.
DLC-010	VFD	IND	New VFD replaced failed VFD.	Pro	Baseline assumed to be constant speed system.

SWE ID	Measures	Insp. Type	Finding	Finding Type	Resolution
DLC-010	VFD	IND	TRM Appendix D not calculating savings per TRM algorithm.	TRM	Calculate savings using TRM algorithm; check Appendix D.
DLC-011	Lighting	IND	500 watt induction fixtures not listed in TRM.	TRM	Interviews/application used to determine wattage; possible TRM addition.
	Lighting	IND	TRM does not address 24/7 manufacturing facilities.	TRM	24/7 Facilities added to 2012 TRM Table 3-4.
DLC-017	VFDs, space heating	IND	Motor baseline operating hours incorrect (preliminary).	Pro	None yet; SWE will issue site inspection report.
DLC-019	Custom, C&I, other	IND	SWE noted variances in savings calculations (preliminary).	Pro	None yet; SWE will issue site inspection report.
FE-001	Lighting occupancy sensors	RA	None		Not applicable.
FE-002	Lighting, lighting controls	RA	Savings validation difficult without detailed inventory.	Pro	None yet; possible TRM modification for small projects.
FE-003	Lighting	RA	None		Not applicable.
FE-004	Lighting	RA	Manufacturing facility with 19% fewer annual hours than in TRM Table 6-6.	TRM	Partly addressed in 2011 TRM Table 3-5; also in 2012 TRM (more flexibility added to determine hours of use).
FE-005	Lighting	RA	Auto body shop with 30% fewer annual hours than in TRM Table 6-6 for Manufacturing - Light Industrial.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
FE-006	Lighting	RA	2009 TRM Table 12 calculations use incorrect baseline fixture quantity.	TRM	SWE recalculated 2009 TRM savings using correct fixture quantity (FE later clarified that the verified savings were based on the 2010 TRM)
FE-007	Lighting	IND	None		Not applicable.
FE-008	lighting occupancy sensors	IND	Minor calculation error related to fixture type.	Pro	Not applicable.
FE-009	Lighting	IND	2009 TRM does not accurately account for pre-installation fixture type.	TRM	Use 2010 TRM to calculate savings.
FE-010	Lighting	IND	Fixtures added due to insufficient light levels.	Pro	SWE recalculated savings using revised fixture quantity.
FE-011	Lighting	IND	24/7 manufacturing facility not listed in TRM Table 6-6.	TRM	SWE used interval meter data to indirectly verify hours; addressed in 2012 TRM Table 3-4.
FE-012	Lighting	IND	TRM Table 6-6 does not include lighting measures in 24/7 supermarkets.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
	Lighting	IND	TRM does not address non-standard lighting control method.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
FE-013	Lighting, new construction	IND	TRM not followed to determine baseline for new construction project.	Pro	SWE recalculated savings using TRM Table 6-2.
FE-014	Lighting	IND	None.		Not applicable.
FE-015	HVAC	IND	Inadequate documentation of baseline unit efficiency.	Pro	Evaluator accepted SWE results/findings 9/28/11.
FE-016	Lighting	IND	Lighting operating hours not determined in accordance with TRM.	Pro	Not applicable.
	Lighting	IND	Evaluator measured hours, calculated savings, and issued report for lighting project (kW savings > 50 kW).		Not applicable.
FE-017	Lighting	IND	Minor differences noted with application.	Pro	Not applicable.

SWE ID	Measures	Insp. Type	Finding	Finding Type	Resolution
FE-018	Lighting	IND	Lighting inventory form provided with application did not use whole building hours (< 50 kW).	Pro	Addressed in 2012 TRM (more flexibility added to determine hours of use).
FE-019	Lighting	IND	Storage facility with 175% greater annual hours than in TRM Table 6-6.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
FE-020	Lighting	IND	Suitable T8 fixture codes not found in TRM.	TRM	Possible TRM addition.
PECO-001	Chillers, motors, VFDs	RA	Evaluator analysis of custom chiller/VFD project contained several errors.	Eval	Evaluator to review SWE comments and revise report.
	Chillers, motors, VFDs	RA	Custom project originally evaluated as TRM project.	Pro	Evaluator prepared SSMVP following discussions with SWE.
	Chillers, motors, VFDs	RA	SWE not informed of second site visit.	Pro	Evaluator plans new site visit notification system.
PECO-002	Lighting	RA	Evaluator's analysis contained some quantity/type/EFLH errors.	Eval	Evaluator accepted SWE results/findings.
PECO-003	Lighting	RA	Lighting inventory form not revised for post-installation conditions or separated by area.	Pro	Improve documentation QA/QC.
	Lighting	RA	Insufficient number of lighting loggers deployed.	Eval	Evaluator to increase logger deployment.
	Lighting	RA	TRM does not contain 49 watt T5 lamps.	TRM	Possible TRM addition.
PECO-004	Lighting	RA	Applicant's lighting form contained several inaccuracies.	Pro	Improve documentation QA/QC and/or simplified Appendix C form.
	Lighting	RA	Insufficient M&V for lighting project with savings > 50 kW.	Eval	Addressed in 2012 TRM (more flexibility added to determine hours of use).
PECO-005	Lighting	RA	Evaluator's initial analysis included savings for lighting controls (not incented).	Eval	Evaluator revised savings calculations.
	Lighting	RA	EFLH used in evaluator's initial analysis not in accordance with site interview.	Eval	Evaluator revised savings calculations.
PECO-006	Lighting	RA	Evaluator did not assess operating hours in various areas, but the initial analysis included a breakdown (savings < 50 kW).	Eval	Evaluator revised savings calculations.
	Lighting	RA	Evaluator incorrectly recorded lighting fixture type.	Eval	Evaluator revised savings calculations.
PECO-007	Lighting	RA	Lighting project with < 50 kW savings included diverse building types.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
	Lighting	RA	Evaluator's initial analysis omitted some fixtures and contained a type/wattage error.	Eval	Evaluator revised savings calculations.
PECO-008	EMS, VFDs	RA	Evaluator selected unnecessarily distant weather station for bin analysis.	Eval	Not applicable.
PECO-009	EMS, VFDs, lighting	RA	Project documentation was contradictory and lacked detail.	Pro	Improve documentation QA/QC.
	EMS, VFDs, lighting	RA	Pre-installation inspection not performed for large custom project.	Pro	None yet; possibly reevaluate inspection criteria.
	EMS, VFDs, lighting	RA	Lighting operating hours appear significantly greater than indicated.	Eval	Evaluator to review SWE report and revise lighting savings, if necessary.
PECO-010	Lighting	RA	Minor variance in fixture quantity and space type.	Eval	Not applicable.
PECO-011	Lighting	RA	Evaluator used multiple EFLH for project with savings < 50 kW.	Eval	None yet; evaluator to review SWE report.

SWE ID	Measures	Insp. Type	Finding	Finding Type	Resolution
PECO-012	VFDs	IND	Custom M&V required for small VFD project.	Pro	None yet; evaluator to review SWE report.
PECO-013	Lighting	IND	Parking garage where most lighting operates 24/7.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
PECO-014	Lighting	IND	TRM does not contain 80 and 300 watt QL induction lamps.	TRM	Possible TRM addition.
	Lighting	IND	Lighting inventory form provided with application did not use whole building hours (< 50 kW).	Pro	Addressed in 2012 TRM (more flexibility added to determine hours of use).
PECO-015	VFDs	IND	None		Not applicable.
PECO-016	Lighting	IND	TRM does not contain photocell lighting controls.	TRM	Possible TRM addition.
PECO-017	Lighting	IND	Inappropriate building type selected to determine EFLH.	Pro	Addressed in 2012 TRM (more flexibility added to determine hours of use).
PECO-018	VFDs	IND	M&V difficult for custom VFD project.	Pro	None yet; evaluator to review SWE report.
PECO-019	Lighting	IND	Detailed lighting inventory separated by area not provided for project with savings > 20 kW.	Pro	None yet; evaluator to review SWE report.
PECO-020	Lighting	IND	SWE used multiple EFLH values for project with savings < 50 kW (project had interior and exterior lighting).	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
PECO-021	Lighting	IND	Detailed lighting inventory separated by area not provided for project with savings > 20 kW.	Pro	None yet; evaluator to review SWE report.
PECO-022	ASHCs, LEDs, occupancy sensors	IND	Incorrect deemed values used in reported savings calculations.	Pro	SWE recalculated savings using IMP/2011 TRM.
PECO-023	Lighting	IND	Manufacturing facility with 36% fewer annual hours than in TRM Table 6-6.	TRM	Addressed in 2011 TRM (industrial manufacturing - 1 shift added).
	Lighting	IND	Spillover noted (lighting occupancy controls).	Pro	Not required.
PECO-024	HVAC	IND	Inappropriate space type selected to determine EFLH.	Pro	SWE recommended confirming space type with applicants.
	HVAC	IND	Reported savings not based on AHRI certificate data.	Pro	SWE recommended using AHRI certificate data.
PECO-025	Lighting, VFDs	IND	SWE used multiple EFLH values for project with savings < 50 kW (project had interior and exterior lighting).	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
PECO-026	Lighting	IND	Incorrect coincidence factor used to calculate reported savings.	Pro	SWE recalculated savings using CF=0.
PECO-027	Lighting	IND	Parking garage where most lighting operates 24/7.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
	Lighting	IND	TRM does not contain photocell lighting controls.	TRM	Possible TRM addition.
PECO-028	Chillers	RA	Evaluator's calculations do not consider possible post-installation IGW use (preliminary).	Eval	None yet; SWE will issue site inspection report.
PPL-001	Lighting	RA	None		Not applicable.

SWE ID	Measures	Insp. Type	Finding	Finding Type	Resolution
PPL-003	T12 Retrofit, Occupancy Sensors	RA	EDC evaluator accurately adjusted lighting inventory following pre-installation visit. Light loggers were installed for project with savings > 50 kW.		Not applicable.
PPL-006	Lighting	RA	EDC evaluator accurately adjusted lighting inventory following pre-installation visit. Light loggers were installed for project with savings > 50 kW.		Not applicable.
	Lighting	RA	Pre-installation lighting ballast types not accurately assessed by lighting contractor.	Pro	SWE recommended checking ballast types during pre-installation visits.
PPL-007	VFDs	RA	Incorrect motor efficiency used.	Eval	Evaluator revised savings calculations.
	VFDs	RA	Some indications of custom VFD application.	Eval	Custom M&V or possible TRM revision.
PPL-008	AC	RA	Customer records insufficient to verify installation and operation of all units.	Pro	Possible TRM and/or program procedure modification.
PPL-009	AC	RA	Evaluator's initial calculations used residential algorithm and incorrect capacity.	Eval	Evaluator revised savings calculations.
PPL-010	ASHP	RA	Evaluator's initial calculations used residential algorithm. AHRI certificates not provided.	Eval	Evaluator revised savings calculations.
PPL-011	Motors, VFDs	RA	Evaluator's initial calculations did not account for all VFDs installed.	Eval	Evaluator revised savings calculations.
	Motors, VFDs	RA	Indication of custom VFD application due to building type.	Eval	Custom M&V or possible TRM revision.
PPL-014	ASHPs	RA	Evaluator's initial calculations used residential algorithm.	Eval	Evaluator revised savings calculations.
PPL-017	GSHP	RA	Evaluator did not inspect all units on site. Documentation did not indicate various unit sizes.	Eval	SWE recommended conducting census for similar projects.
PPL-018	ES appliances	RA	Evaluator's initial calculations used incorrect water heater type and deemed savings values.	Eval	Evaluator revised savings calculations.
PPL-019	Air compressor with VFD	RA	Trend data was collected for one week periods (pre and post-installation).	Eval	SWE recommended longer measurement periods.
PPL-021	GSHP	RA	Evaluator's calculations used residential algorithm with commercial EFLH values. AHRI certificates were not provided.	Eval	None yet; evaluator to review SWE report.
PPL-022	VFDs	RA	Evaluator used TRM algorithm for industrial VFD project.	Eval	None yet; evaluator to review SWE report.
PPL-023	Motors, VFDs	RA	Evaluator used TRM algorithm for industrial VFD project.	Eval	None yet; evaluator to review SWE report.
PPL-024	VFDs	RA	Evaluator selected inappropriate building type to determine operating hours, ESF, and DSF.	Eval	None yet; evaluator to review SWE report.
WPP-001	Lighting, lighting controls	RA	Small retail store with 48% fewer annual hours than in TRM Table 6-6.	TRM	Addressed in 2012 TRM (more flexibility added to determine hours of use).
WPP-002	Lighting controls	RA	None		Not applicable.
WPP-003	Lighting controls	RA	TRM does not contain 25 watt T8 lamps.	TRM	Possible TRM addition.
WPP-004	Lighting, lighting controls	RA	None		Not applicable.



SWE ID	Measures	Insp. Type	Finding	Finding Type	Resolution
WPP-005	Lighting, lighting controls	RA	TRM does not contain 25 watt T8 lamps.	TRM	Possible TRM addition.
WPP-006	Lighting	IND	TRM does not contain 19 or 5 watt CFLs.	TRM	Possible TRM addition.
	Lighting	IND	Spillover noted (additional CFLs).	Pro	Not required.
WPP-007	Lighting	IND	Inappropriate building type selected to determine operating hours.	Pro	SWE recommends confirming space type with applicants.
	Lighting	IND	TRM does not contain 19 or 5 watt CFLs.	TRM	Possible TRM addition.
WPP-008	Lighting	IND	Incorrect fixture codes used by applicant.	Pro	Improve documentation QA/QC and/or simplified Appendix C form.
WPP-009	Lighting	IND	Minor fixture quantity and type variances.	Pro	Not required.
WPP-010	Lighting	IND	SWE noted operating hour variance (preliminary).		None yet; SWE will issue site inspection report.

## Appendix B: Glossary of Terms

**ACCURACY:** An indication of how close a value is to the true value of the quantity in question. The term could also be used in reference to a model or a set of measured data, or to describe a measuring instrument's capability.

**ACHIEVABLE POTENTIAL:** The amount of energy use that efficiency can realistically be expected to displace assuming the most aggressive program scenario possible (e.g., providing end-users with payments for the entire incremental cost of more efficiency equipment). This is often referred to as maximum achievable potential. Achievable potential takes into account real-world barriers to convincing end-users to adopt efficiency measures, the non-measure costs of delivering programs (for administration, marketing, tracking systems, monitoring and evaluation, etc.), and the capability of programs and administrators to ramp up program activity over time.

**ADJUSTMENTS:** For M&V analyses, factors that modify baseline energy or demand values to account for independent variable values (conditions) in the reporting period.

**ADMINISTRATOR:** A person, company, partnership, corporation, association or other entity selected by the EDC and any subcontractor that is retained by an aforesaid entity to contract for and administer energy efficiency programs under Act 129.

**BASELINE DATA:** The measurements and facts describing facility operations and design during the baseline period. This will include energy use or demand and parameters of facility operation that govern energy use or demand.

**BASELINE FORECAST:** A prediction of future energy needs that does not take into account the likely effects of new efficiency programs that have not yet been started.

**BASELINE MODEL:** The set of arithmetic factors, equations or data used to describe the relationship between energy use or demand and other baseline data. A model may also be a simulation process involving a specified simulation engine and set of input data.

**BASELINE PERIOD:** The period of time selected as representative of facility operations before retrofit.

**BIAS:** The extent to which a measurement or a sampling or analytic method systematically underestimates or overestimates a value.

**BILLING DATA:** Has multiple meanings. Metered data obtained from the electric or gas meter used to bill the customer for energy used in a particular billing period. Meters used for this purpose typically conform to regulatory standards established for each customer class. Also used to describe the data representing the bills customers receive from the energy provider and also used to describe the

customer billing and payment streams associated with customer accounts. This term is used to describe both consumption and demand, and account billing and payment information.

**BILLING DEMAND:** The demand used to calculate the demand charge cost. This is very often the monthly peak demand of the customer, but it may have a floor of some percentage of the highest monthly peak of the previous several months (a demand “ratchet”). May have other meanings associated with customer account billing practices.

**BUILDING ENERGY SIMULATION MODEL:** Computer models based on physical engineering principals and/or standards used to estimate energy usage and/or savings. These models do not make use of billing or metered data, but usually incorporate site-specific data on customers and physical systems. Building Simulation Models usually require such site-specific data as square footage, weather, surface orientations, elevations, space volumes, construction materials, equipment use, lighting and building occupancy. Building simulation models can usually account for interactive effects between end-uses (e.g., lighting and HVAC), part-load efficiencies and changes in external and internal heat gains/losses. Examples of building simulation models include ADM2, BLAST and DOE-2.

**CAPACITY:** The amount of electric power for which a generating unit, generating station or other electrical apparatus is rated either by the user or manufacturer. The term is also used for the total volume of natural gas that can flow through a pipeline over a given amount of time, considering such factors as compression and pipeline size.

**COEFFICIENT OF VARIATION:** The sample standard deviation divided by the sample mean ( $Cv = sd/y$ ).

**COINCIDENT DEMAND:** The metered demand of a device, circuit or building that occurs at the same time as the peak demand of the building or facility or at the same time as some other peak of interest, such as a utility’s system load during the average 100 peak summer hours. This should properly be expressed so as to indicate the peak of interest, e.g., “demand coincident with the building peak.”

**CONFIDENCE:** An indication of how close a value is to the true value of the quantity in question. Confidence is the likelihood that the evaluation has captured the true impacts of the program within a certain range of values (i.e., precision).

**CONSERVATION:** Steps taken to cause less energy to be used than would otherwise be the case. These steps may involve, for example, improved efficiency, avoidance of waste, and reduced consumption. Related activities include, for example, installing equipment (such as a computer to ensure efficient energy use), modifying equipment (such as making a boiler more efficient), adding insulation, and changing behavior patterns.

**CONSTRUCT VALIDITY:** The extent to which an operating variable/instrument accurately taps an underlying concept/hypothesis, properly measuring an abstract quality or idea.

**CONTENT VALIDITY:** The extent to which an operating measure taps all the separate sub-concepts of a complicated concept.

**CONVERGENT VALIDITY:** When two instruments/questions/measurement methods obtain similar results when measuring the same underlying construct with varying questions/approaches.

**CORRELATION COEFFICIENT:** A measure of the linear association between two variables, calculated as the square root of the  $R_2$  obtained by regressing one variable on the other and signed to indicate whether the relationship is positive or negative.

**CORRELATION TABLE (CORRELATION MATRIX):** A table or matrix giving the correlation between all pairs of data sets. Row headings are the scores on one variable and column headings are the scores on the second variables and a cell shows how many times the score on that row was associated with the score in that column

**COST-EFFECTIVENESS:** An indicator of the relative performance or economic attractiveness of any energy efficiency investment or practice when compared to the costs of energy produced and delivered in the absence of such an investment. In the energy efficiency field, the present value of the estimated benefits produced by an energy efficiency program as compared to the estimated total program's costs, from the perspective of either society as a whole or of individual customers, to determine if the proposed investment or measure is desirable from a variety of perspectives, e.g., whether the estimated benefits exceed the estimated costs. See also TOTAL RESOURCE COST TEST.

**CUMULATIVE PROGRAM INCEPTION TO DATE:** Defined as the period since date of program implementation through the current reporting period (i.e., reporting period of this report).

**CUSTOMER:** Any person or entity responsible for payment of an electric and/or gas bill to and with an active meter serviced by a utility company.

**CUSTOMER INFORMATION:** Non-public information and data specific to a utility customer that the utility acquired or developed in the course of its provision of utility services.

**CV:** See COEFFICIENT OF VARIATION.

**DEEMED SAVINGS:** An estimate of the reported energy savings or energy-demand savings outcome for a single unit of an installed energy efficiency measure that (a) has been developed from data sources and analytical methods that are widely considered acceptable for the measure and purpose and (b) is applicable to the situation being evaluated.

**DEMAND:** The time rate of energy flow. Demand usually refers to electric power and is measured in kW (equals kWh/h) but can also refer to natural gas, usually as Btu/hr, kBtu/hr, therms/day or ccf/day.

**DEMAND (Utility):** The rate or level at which electricity or natural gas is delivered to users at a given point in time. Electric demand is expressed in kilowatts (kW). Demand should not be confused with load, which is the amount of power delivered or required at any specified point or points on a system.

**DEMAND BILLING:** The electric capacity requirement for which a large user pays. It may be based on the customer's peak demand during the contract year, on a previous maximum or on an agreed minimum. Demand billing is measured in kilowatts.

**DEMAND CHARGE:** The sum to be paid by a large electricity consumer for its peak usage level.

**DEMAND RESPONSIVENESS:** Also sometimes referred to as load shifting. Activities or equipment that induce consumers to use energy at different (lower cost) times of day or to interrupt energy use for certain equipment temporarily, usually in direct response to a price signal. Examples include interruptible rates, doing laundry after 7 p.m., and air conditioner recycling programs.

**DEMAND SAVINGS:** The reduction in the demand from the pre-retrofit baseline to the post-retrofit demand, once independent variables (such as weather or occupancy) have been adjusted for. This term is usually applied to billing demand, to calculate cost savings or to peak demand, for equipment sizing purposes.

**DEMAND SIDE MANAGEMENT (DSM):** The methods used to manage energy demand including energy efficiency, load management, fuel substitution and load building. See LOAD MANAGEMENT.

**DIRECT ENERGY SAVINGS (DIRECT PROGRAM ENERGY SAVINGS):** The use of the words "direct savings" or "direct program savings" refers to the savings from programs that are responsible for the achievement of specific energy efficiency goals. Typically these are thought of as resource acquisition programs or programs that install or expedite the installation of energy-efficient equipment and which directly cause or help to cause energy efficiency to be achieved. Rebate, incentive or direct install programs provide direct energy savings.

**DIRECT INSTALL or DIRECT INSTALLATION PROGRAMS:** These types of programs provide free energy efficiency measures and their installation for qualified customers. Typical measures distributed by these programs include low flow showerheads and compact fluorescent bulbs.

**DISTRIBUTED GENERATION:** A distributed generation system involves small amounts of generation located on a utility's distribution system for the purpose of meeting local (substation level) peak loads and/or displacing the need to build additional (or upgrade) local distribution lines.

**EFFECTIVE USEFUL LIFE:** The assumed life expectancy, in years, of an energy efficiency measure.

**EFFICIENCY:** The ratio of the useful energy delivered by a dynamic system (such as a machine, engine or motor) to the energy supplied to it over the same period or cycle of operation. The ratio is usually determined under specific test conditions.

**EM&V:** Evaluation, Measurement, Monitoring and Verification.

**END-USE (MEASURES/GROUPS):** Refers to a broad or sometimes narrower category that the program is concentrating efforts upon. Examples of end-uses include refrigeration, food service, HVAC, appliances, envelope and lighting.

**ENERGY CONSUMPTION:** The amount of energy consumed in the form in which it is acquired by the user. The term excludes electrical generation and distribution losses.

**ENERGY COST:** The total cost for energy, including such charges as base charges, demand charges, customer charges, power factor charges and miscellaneous charges.

**ENERGY EFFICIENCY:** Using less energy to perform the same function. Programs designed to use energy more efficiently - doing the same with less. For the purpose of this paper, energy efficiency programs are distinguished from DSM programs in that the latter are utility-sponsored and financed, while the former is a broader term not limited to any particular sponsor or funding source. "Energy conservation" is a term that has also been used but it has the connotation of doing without in order to save energy rather than using less energy to perform the same function and so is not used as much today. Many people use these terms interchangeably.

**ENERGY EFFICIENCY IMPROVEMENT:** Reduced energy use for a comparable level of service, resulting from the installation of an energy efficiency measure or the adoption of an energy efficiency practice. Level of service may be expressed in such ways as the volume of a refrigerator, temperature levels, and production output of a manufacturing facility or lighting level/square foot.

**ENERGY EFFICIENCY MEASURE:** Installation of equipment, subsystems or systems, or modification of equipment, subsystems, systems or operations on the customer side of the meter, for the purpose of reducing energy and/or demand (and, hence, energy and/or demand costs) at a comparable level of service.

**ENERGY EFFICIENCY OF A MEASURE:** A measure of the energy used to provide a specific service or to accomplish a specific amount of work (e.g., kWh/cubic foot of a refrigerator, therms/gallon of hot water).

**ENERGY EFFICIENCY OF EQUIPMENT:** The percentage of gross energy input that is realized as useful energy output of a piece of equipment.

**ENERGY EFFICIENCY PRACTICE:** The use of high-efficiency products, services and practices or an energy using appliance or piece of equipment, to reduce energy usage while maintaining a comparable level of service when installed or applied on the customer side of the meter. Energy efficiency activities typically require permanent replacement of energy-using equipment with more efficient models. Examples: refrigerator replacement, light fixture replacement, cooling equipment upgrades.

**ENERGY EFFICIENCY RATIO (EER):** The ratio of output cooling in BTU per hour to input electrical power in watts at a given operating point. EER is generally calculated using a 95 degree Fahrenheit outside temperature and an inside temperature of 80 degrees at 50% relative humidity. The higher the unit's EER rating the, the more energy efficiency it is.

**ENERGY MANAGEMENT SYSTEM:** A control system (often computerized) designed to regulate the energy consumption of a building by controlling the operation of energy consuming systems, such as the heating, ventilation and air conditioning (HVAC), lighting and water heating systems.

**ENERGY SAVINGS:** The reduction in use of energy from the pre-retrofit baseline to the post-retrofit energy use, once independent variables (such as weather or occupancy) have been adjusted for.

**ENGINEERING APPROACHES:** Methods using engineering algorithms or models to estimate energy and/or demand use.

**ENGINEERING MODEL:** Engineering equations used to calculate energy usage and savings. These models are usually based on a quantitative description of physical processes that transform delivered energy into useful work such as heat, lighting, or motor drive. In practice, these models may be reduced to simple equations in spreadsheets that calculate energy usage or savings as a function of measurable attributes of customers, facilities, or equipment (e.g., lighting use = watts × hours of use).

**EVALUATION:** The performance of studies and activities aimed at determining the effects of a program; any of a wide range of assessment activities associated with understanding or documenting program performance or potential performance, assessing program or program related markets and market operations; any of a wide range of evaluative efforts including assessing program-induced changes in energy efficiency markets, levels of demand or energy savings and program cost-effectiveness.

**EX-ANTE SAVINGS ESTIMATE:** Administrator-forecasted savings used for program and portfolio planning purposes as filed with the PA PUC, from the Latin for “beforehand.”

**EX-POST EVALUATION ESTIMATED SAVINGS:** Savings estimates reported by the independent evaluator after the energy impact evaluation and the associated M&V efforts have been completed. If only the term “ex-post savings” is used, it will be assumed that it is referring to the ex-post evaluation estimate, the most common usage, from the Latin for “from something done afterward.”

**EX-POST (PROGRAM) ADMINISTRATOR-ESTIMATED SAVINGS:** Savings estimates reported by the Administrator after program implementation has begun (Administrator-reported ex post), from the Latin for “from something done afterward.”

**EX-POST (PROGRAM) ADMINISTRATOR-FORECASTED SAVINGS:** Savings estimates forecasted by the Administrator during the program and portfolio planning process, from the Latin for “from something done afterward.”

**EXTERNAL VALIDITY:** The extent to which the association between an independent variable and a dependent variable that is demonstrated within a research setting also holds true in the general environment.

**FREE-DRIVER:** A non-participant who adopted a particular efficiency measure or practice as a result of a utility program. See SPILLOVER EFFECTS for aggregate impacts.

**FREE-RIDER:** A program participant who would have implemented the program measure or practice in the absence of the program.

**GROSS SAVINGS:** The change in energy consumption and/or demand that results directly from program related actions taken by participants in an efficiency program, regardless of why they participated.

**HEATING SEASONAL PERFORMANCE FACTOR:** Used to describe the heating efficiency of heat pumps. It is a measure of the estimated seasonal heating output in BTUs divided by the amount of energy that it consumes in watt-hours.

**HETEROSCEDASTICITY:** Unequal error variance. In statistics, a sequence or a vector of random variables is heteroscedastic if the random variables in the sequence or vector may have different variances. This violates the regression assumption of constant variance (the variance of the errors is constant across observations or homoscedastic). Typically, residuals are plotted to assess this assumption. Standard estimation methods are inefficient when the errors are heteroscedastic. A common example is when variance is expected to be greater on a variable measurement for larger firms than for smaller firms.

**HOMOSCEDASTIC (HOMOSCEDASTICITY):** Constant error variance, an assumption of classical regression analysis. See also HETEROSCEDASTICITY.

**IMPACT EVALUATION:** Used to measure the program-specific induced changes in energy and/or demand usage (such kWh, kW and therms) and/or behavior attributed to energy efficiency and demand response programs.

**IMPACT YEAR:** Depending on the context, impact year means either (a) the twelve months subsequent to program participation used to represent program costs or load impacts occurring in that year, or (b) any calendar year after the program year in which impacts may occur.

**INCENTIVES:** Financial support (e.g., rebates, low-interest loans) to install energy efficiency measures. The incentives are solicited by the customer and based on the customer's billing history and/or customer-specific information.

**INDEPENDENT VARIABLES:** The factors that affect the energy and demand used in a building but cannot be controlled (e.g., weather or occupancy).

**INDIRECT ENERGY SAVINGS (INDIRECT PROGRAM ENERGY SAVINGS):** The use of the words "indirect savings" or "indirect program savings" refers to programs that are typically information, education, marketing or outreach programs in which the program's actions are expected to result in energy savings achieved through the actions of the customers exposed to the program's efforts, without direct enrollment in a program that has energy savings goals.

**LINE LOSS FACTOR:** Factor used to describe the energy lost due to heating of conductors caused by electrical resistance along the transmission and distribution lines of the electric grid.



**LOAD SHAPES:** Representations such as graphs, tables, and databases that describe energy consumption rates as a function of another variable such as time or outdoor air temperature.

**INTERNAL VALIDITY:** The validity of (causal) inferences in scientific studies, usually based on experiments as experimental validity. Inferences are said to possess internal validity if a causal relation between two variables is properly demonstrated.

**MARKET EFFECT EVALUATION:** The evaluation of the change in the structure/functioning of a market or the behavior of participants in a market that results from one or more program efforts. Typically the resultant market or behavior change leads to an increase in the adoption of energy-efficient products, services, or practices.

**MARKET TRANSFORMATION:** A reduction in market barriers resulting from a market intervention, as evidenced by a set of market effects, that lasts after the intervention has been withdrawn, reduced, or changed.

**MEASUREMENT:** A procedure for assigning a number to an observed object or event.

**MEASUREMENT AND VERIFICATION (M&V):** Data collection, monitoring, and analysis associated with the calculation of gross energy and demand savings from individual sites or projects. M&V can be a subset of program impact evaluation.

**MEASUREMENT BOUNDARY:** The boundary of the analysis for determining direct energy and/or demand savings.

**METERING:** Metering is the collection of energy consumption data, over time, through the use of meters. These meters may collect information with respect to an end-use, a circuit, a piece of equipment, or a whole building (or facility). Short-term metering generally refers to data collection for no more than a few weeks. End-use metering refers specifically to separate data collection for one or more end-uses in a facility, such as lighting, air conditioning or refrigeration. Spot metering is an instantaneous measurement (rather than over time) to determine an energy consumption rate.

**MONITORING:** Gathering of relevant measurement data, including but not limited to, energy consumption data over time to evaluate equipment or system performance, e.g., chiller electric demand, inlet evaporator temperature and flow, outlet evaporator temperature, condenser inlet temperature, and ambient dry-bulb temperature and relative humidity or wet-bulb temperature, for use in developing a chiller performance map (e.g., kW/ton vs. cooling load and vs. condenser inlet temperature).

**MULTI-COLINEARITY:** A statistical phenomenon in which two or more predictor variables in a multiple regression model are highly correlated. In this situation the coefficient estimates may change erratically in response to small changes in the model or the data. Multi-Collinearity does not reduce the predictive power or reliability of the model as a whole, at least within the sample data themselves; it only affects calculations regarding individual predictors.

**NET SAVINGS:** The total change in load that is attributable to an energy efficiency program. This change in load may include, implicitly or explicitly, the effects of free drivers, free riders, energy efficiency standards, changes in the level of energy service, participant and non-participant spillover and other causes of changes in energy consumption or demand.

**NET-TO-GROSS RATIO (NTGR):** A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts.

**NON-PARTICIPANT:** Any consumer who was eligible, but did not participate in the subject efficiency program in a given program year. Each evaluation plan should provide a definition of a non-participant as it applies to a specific evaluation.

**NON-RESPONSE BIAS:** The effect of a set of respondents refusing or choosing not to participate in research; typically larger for self-administered or mail-out surveys.

**NORMALIZED ANNUAL CONSUMPTION (NAC) ANALYSIS:** A regression-based method that analyzes monthly energy consumption data.

**PARTIAL FREE-RIDER:** A program participant who would have implemented, to some degree, the program measure or practice in the absence of the program (i.e., a participant may have purchased an ENERGY STAR appliance in the absence of the program, but because of the program the participant purchases an appliance that is higher in efficiency).

**PARTICIPANT:** A consumer that received a service offered through the subject efficiency program, in a given program year. The term “service” is used in this definition to suggest that the service can be a wide variety of services, including financial rebates, technical assistance, product installations, training, energy efficiency information or other services, items, or conditions. Each evaluation plan should define “participant” as it applies to the specific evaluation.

**PEAK DEMAND:** The maximum level of metered demand during a specified period, such as a billing month or a peak demand period.

**PERSISTENCE STUDY:** A study to assess changes in program impacts over time (including retention and degradation).

**PORTFOLIO:** Either (a) a collection of similar programs addressing the same market (e.g., a portfolio of residential programs), technology (e.g., motor efficiency programs), or mechanisms (e.g., loan programs) or (b) the set of all programs conducted by one organization, such as a utility (and which could include programs that cover multiple markets, technologies, etc.).

**PRECISION:** The indication of the closeness of agreement among repeated measurements of the same physical quantity.

**PROCESS EVALUATION:** A systematic assessment of an energy efficiency program for the purposes of documenting program operations at the time of the examination, and identifying and recommending improvements to increase the program's efficiency or effectiveness for acquiring energy resources while maintaining high levels of participant satisfaction.

**PROGRAM:** A group of projects, with similar characteristics and installed in similar applications. Examples could include a utility program to install energy-efficient lighting in commercial buildings, a developer's program to build a subdivision of homes that have photovoltaic systems, or a state residential energy efficiency code program.

**PROGRAM YEAR TO DATE:** Defined as the period between June 1<sup>st</sup> and May 31<sup>st</sup> of the current reporting period

**PROGRAM YEAR TWO (PY2):** Defined as the period between June 1, 2010 to May 31, 2011.

**PROJECT:** An activity or course of action involving one or multiple energy efficiency measures, at a single facility or site.

**REALIZATION RATE:** A factor representing ex-post savings divided by ex-ante savings that is applied to gross savings to determine verified savings.

**REGRESSION ANALYSIS:** Analysis of the relationship between a dependent variable (response variable) to specified independent variables (explanatory variables). The mathematical model of their relationship is the regression equation.

**RELIABILITY:** Refers to the likelihood that the observations can be replicated.

**REPORTING PERIOD:** The time following implementation of an energy efficiency activity during which savings are to be determined.

**RETROFIT ISOLATION:** The savings measurement approach defined in IPMVP Options A and B, and ASHRAE Guideline 14, that determines energy or demand savings through the use of meters to isolate the energy flows for the system(s) under consideration.

**RIGOR:** The level of expected confidence and precision. The higher the level of rigor, the more confident one is that the results of the evaluation are both accurate and precise.

**SEASONAL ENERGY EFFICIENCY RATIO:** Rating of a unit is the cooling output in BTUs during a typical cooling-season divided by the total electric energy input in watt-hours during the same period. The higher the unit's SEER rating, the more energy efficiency it is.

**SPILLOVER:** Reductions in energy consumption and/or demand caused by the presence of the energy efficiency program, beyond the program-related gross savings of the participants. There can be participant and/or nonparticipant spillover.

**STATISTICALLY ADJUSTED ENGINEERING (SAE) MODELS:** A category of statistical analysis models that incorporate the engineering estimate of savings as a dependent variable.

**STIPULATED VALUES:** See “deemed savings.”

**TECHNICAL RESOURCE MANUAL:** Standards for measuring and verifying applicable DSM/EE measures used by EDCs to meet the Act 129 consumption and peak demand reduction targets.

**TOTAL RESOURCE COST TEST:** The TRC test analyzes the costs and benefits of the energy efficiency and conservation plans.

**UNCERTAINTY:** The range or interval of doubt surrounding a measured or calculated value within which the true value is expected to fall within some degree of confidence.

**VALUE OF INFORMATION:** A balance between the level of detail (rigor) and the level of effort required (cost) in an impact evaluation.

**VARIABLE FREQUENCY DRIVE:** System for controlling the rotational speed of an alternating current electric motor by controlling the frequency of the electrical power supplied to the motor.

**VERIFIED SAVINGS:** Savings that have undergone rigorous evaluation, measurement, and verification to ensure their accuracy within a prescribed level of confidence and precision.