



341 White Pond Drive
Akron, OH 44320

Timothy K. McHugh, Esq.
(610) 301-9072
(330) 315-9263 (Fax)

September 30, 2026

VIA ELECTRONIC FILING

Matthew Homsher, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street, 2nd Floor
Harrisburg, PA 17120

**RE: Final Annual Report to the Pennsylvania Public Utility Commission and Act 129
Statewide Evaluator; Phase IV Program year Period June 1, 2025 – May 31, 2026, for
FirstEnergy Pennsylvania Electric Company;
Docket Nos. M-2020-3020820, M-2020-3020821, M-2020-3020822, and M-2020- 3020823**

Dear Secretary Homsher:

Enclosed please find the Final Annual Report to the Pennsylvania Public Utility Commission in the above-captioned matter for FirstEnergy Pennsylvania Electric Company's rate districts, formally known as Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company.¹

Should you have any questions regarding this matter, please do not hesitate to contact me.

Very truly yours,

Timothy K. McHugh

TKM/mlr
Enclosures

cc: Certificate of Service

¹On January 1, 2024, FirstEnergy Corp.'s Pennsylvania operating companies (i.e., Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company) merged into FirstEnergy Pennsylvania Electric Company. Due to the merger transaction, the affected operating companies' tariffs were consolidated into a single tariff, with each former operating company's rates becoming its own rate district. As such, the customers of the former Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company have their own separate and distinct rate district under FirstEnergy Pennsylvania Electric Company's tariff.

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

Final Annual Report to the Pennsylvania	:	Docket No. M-2020-3020820
Public Utility Commission and Act 129	:	M-2020-3020821
Statewide Evaluator; Phase IV Program	:	M-2020-3020822
Period June 1, 2025 – May 31, 2026, for	:	M-2020-3020823
FirstEnergy Pennsylvania Electric Company	:	
	:	

CERTIFICATE OF SERVICE

I hereby certify that I have this day served a true copy of the foregoing document upon the parties via listed below by e-mail.

Office of Consumer Advocate
ra-oca@paoca.org

Joe Sherrick - Energy Conservation TUS
Pennsylvania Public Utility Commission
josherrick@pa.gov

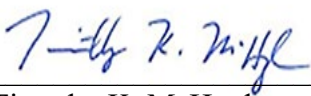
Office of Small Business Advocate
ra-sba@pa.gov

Francesco D. Capasso, Jr. - Law Bureau
Pennsylvania Public Utility Commission
fcapasso@pa.gov

Kriss Brown - Law Bureau
Pennsylvania Public Utility Commission
kribrown@pa.gov

Pennsylvania Utility Law Project
pulp@pautilitylawproject.org
Elizabeth R. Marx
emarx@pautilitylawproject.org
John Sweet
jsweet@pautilitylawproject.org
Ria Pereira
rpereira@pautilitylawproject.org

Dated: September 30, 2026



Timothy K. McHugh
FirstEnergy Service Company
341 White Pond Drive
Akron, OH 44320
(610) 301-9072
tmchugh@firstenergycorp.com

Counsel for FirstEnergy Pennsylvania
Electric Company

Final Annual Report to the Pennsylvania Public Utility Commission

Phase IV of Act 129

Program Year 17

(June 1, 2025 – May 31, 2026)

For Pennsylvania Act 129 of 2008

Energy Efficiency and Conservation Plan

Prepared by Qualus, Tetra Tech, and Ecometric Consulting

For

Metropolitan Edison Company M-2020-3020820

Pennsylvania Electric Company M-2020-3020821

Pennsylvania Power Company M-2020-3020822

West Penn Power Company M-2020-3020823

September 30, 2026

Contents

1	INTRODUCTION.....	27
2	SUMMARY OF ACHIEVEMENTS.....	28
2.1	CARRYOVER SAVINGS FROM PHASE III OF ACT 129	28
2.2	PHASE IV ENERGY EFFICIENCY ACHIEVEMENTS TO DATE	29
2.2.2	Phase IV Prescription of Low-Income Measures and Carve-Out	32
2.2.3	Phase IV Performance, Multifamily Housing.....	34
2.3	PHASE IV PERFORMANCE BY CUSTOMER SEGMENT	35
2.4	SUMMARY OF PARTICIPATION BY PROGRAM	36
2.5	SUMMARY OF IMPACT EVALUATION RESULTS	38
2.6	SUMMARY OF ENERGY IMPACTS BY PROGRAM	40
2.6.1	Incremental Annual Energy Savings by Program	40
2.6.2	Lifetime Energy Savings by Program.....	42
2.7	SUMMARY OF DEMAND IMPACTS BY PROGRAM	43
2.7.1	Peak Demand Savings Nominated to PJM Forward Capacity Market (FCM)..	45
2.8	SUMMARY OF FUEL SWITCHING IMPACTS	47
2.9	SUMMARY OF RENEWABLE ENERGY IMPACTS.....	48
2.10	SUMMARY OF COST-EFFECTIVENESS RESULTS	48
2.11	COMPARISON OF PERFORMANCE TO APPROVED EE&C PLAN	52
2.12	FINDINGS AND RECOMMENDATIONS	55
3	EVALUATION RESULTS BY PROGRAM.....	56
3.1	ENERGY EFFICIENT HOMES PROGRAM.....	57
3.1.1	Participation and Reported Savings by Customer Segment	58
3.1.2	Gross Impact Evaluation	58
3.1.3	Net Impact Evaluation	60
3.1.4	Verified Savings Estimates.....	61
3.1.5	Process Evaluation.....	61
3.1.6	Cost-Effectiveness Reporting	65
3.1.7	Status of Recommendations	68
3.2	ENERGY EFFICIENT PRODUCTS PROGRAM	69
3.2.1	Participation and Reported Savings by Customer Segment	69
3.2.2	Gross Impact Evaluation	70
3.2.3	Net Impact Evaluation	71

3.2.4	Verified Savings Estimates	72
3.2.5	Process Evaluation.....	73
3.2.6	Cost-Effectiveness Reporting	74
3.2.7	Status of Recommendations	78
3.3	LOW-INCOME ENERGY EFFICIENCY PROGRAM.....	81
3.3.1	Participation and Reported Savings by Customer Segment	82
3.3.2	Gross Impact Evaluation	82
3.3.3	Net Impact Evaluation	83
3.3.4	Verified Savings Estimates.....	84
3.3.5	Process Evaluation.....	84
3.3.6	Cost-Effectiveness Reporting	86
3.3.7	Status of Recommendations	90
3.4	C&I ENERGY SOLUTIONS FOR BUSINESS PROGRAM - SMALL.....	91
3.4.1	Participation and Reported Savings by Customer Segment	91
3.4.2	Gross Impact Evaluation	91
3.4.3	Net Impact Evaluation	93
3.4.4	Verified Savings Estimates.....	94
3.4.5	Process Evaluation.....	95
3.4.6	Cost-Effectiveness Reporting	96
3.4.7	Status of Recommendations	100
3.5	C&I ENERGY SOLUTIONS FOR BUSINESS PROGRAM - LARGE	103
3.5.1	Participation and Reported Savings by Customer Segment	103
3.5.2	Gross Impact Evaluation	103
3.5.3	Net Impact Evaluation	104
3.5.4	Verified Savings Estimates.....	105
3.5.5	Process Evaluation.....	106
3.5.6	Cost-Effectiveness Reporting	106
3.5.7	Status of Recommendations	109
4	PORTFOLIO FINANCES AND COST RECOVERY	110
4.1	PROGRAM FINANCES	110
4.2	COST RECOVERY	113
APPENDIX A	SITE INSPECTION SUMMARY	117
APPENDIX B	HER IMPACT EVALUATION DETAIL.....	118

B.1	GROSS IMPACT EVALUATION	118
B.1.1	Data Preparation and Analysis Procedure	118
B.1.2	Program Participation Levels	124
B.1.3	Results	125
APPENDIX C	PYTD AND P4TD SUMMARY BY CUSTOMER SEGMENT AND LI CARVEOUT ...	128
APPENDIX D	SUMMARY OF PROGRAM-LEVEL IMPACTS, COST-EFFECTIVENESS, AND HIM	
NTG	129	
D.1	PROGRAM AND INITIATIVE-LEVEL IMPACTS SUMMARY	129
D.2	PROGRAM-LEVEL COST-EFFECTIVENESS SUMMARY	136
D.3	HIGH-IMPACT MEASURE NET-TO-GROSS	143
D.4	PROGRAM-LEVEL COMPARISON OF PERFORMANCE TO APPROVED EE&C PLAN	143
APPENDIX E	EVALUATION DETAIL – EE KITS SUB-INITIATIVE	149
E.1	GROSS IMPACT EVALUATION	149
E.1.1	Gross Impact Evaluation Methodology	149
E.1.2	Sampling	150
E.1.3	Results for Energy	151
E.1.4	Results for Demand	152
E.2	NET IMPACT EVALUATION	153
E.2.1	Net Impact Evaluation Methodology	153
E.2.2	Sampling	153
E.2.3	Net Impact Evaluation Results	154
APPENDIX F	EVALUATION DETAIL – RESIDENTIAL DIRECT INSTALL INITIATIVE	155
F.1	GROSS IMPACT EVALUATION	155
F.1.1	Gross Impact Evaluation Methodology	155
F.1.2	Sampling	156
F.1.3	Results for Energy	157
F.1.4	Results for Demand	158
F.2	NET IMPACT EVALUATION	159
F.2.1	Net Impact Evaluation Methodology	159
F.2.2	Sampling	160
F.2.3	Net Impact Evaluation Results	160
APPENDIX G	EVALUATION DETAIL – RESIDENTIAL NEW CONSTRUCTION INITIATIVE	162
G.1	GROSS IMPACT EVALUATION	162

G.1.1	Gross Impact Evaluation Methodology	162
G.1.2	Sampling	164
G.1.3	Results for Energy	164
G.1.4	Results for Demand	165
G.2	NET IMPACT EVALUATION	166
G.2.1	Net Impact Evaluation Methodology	166
G.2.2	Net Impact Evaluation Results	167
APPENDIX H	EVALUATION DETAIL – RESIDENTIAL MULTIFAMILY DIRECT INSTALL INITIATIVE	168
H.1	GROSS IMPACT EVALUATION	168
H.1.1	Gross Impact Evaluation Methodology	168
H.1.2	Sampling	168
H.1.3	Results for Energy	169
H.1.4	Results for Demand	170
H.2	NET IMPACT EVALUATION	171
H.2.1	Net Impact Evaluation Methodology	171
H.2.2	Net Impact Evaluation Results	171
APPENDIX I	EVALUATION DETAIL – RESIDENTIAL ONLINE AUDIT INITIATIVE	172
I.1	GROSS IMPACT EVALUATION	172
I.1.2	Results for Energy and Demand	177
I.2	NET IMPACT EVALUATION	179
I.2.1	Net Impact Evaluation Methodology	179
APPENDIX J	EVALUATION DETAIL – RESIDENTIAL APPLIANCE RECYCLING SUB-INITIATIVE	180
J.1	GROSS IMPACT EVALUATION	180
J.1.1	Gross Impact Evaluation Methodology	180
J.1.2	Sampling	181
J.1.3	Results for Energy	182
J.1.4	Results for Demand	184
J.2	NET IMPACT EVALUATION	185
J.2.1	Net Impact Evaluation Methodology	185
J.2.2	Sampling	186
J.2.3	Net Impact Evaluation Results	186
APPENDIX K	EVALUATION DETAIL – RESIDENTIAL UPSTREAM ELECTRONICS INITIATIVE	188

APPENDIX L	EVALUATION DETAIL – RESIDENTIAL HVAC INITIATIVE	189
L.1	GROSS IMPACT EVALUATION	189
L.1.1	Gross Impact Evaluation Methodology	189
L.1.2	Sampling	191
L.1.3	Results for Energy	193
L.1.4	Results for Demand.....	195
L.2	NET IMPACT EVALUATION.....	198
L.2.1	Net Impact Evaluation Methodology	198
L.2.2	Sampling	198
L.2.3	Net Impact Evaluation Results.....	199
APPENDIX M	EVALUATION DETAIL – RESIDENTIAL APPLIANCES AND LI RESIDENTIAL APPLIANCES INITIATIVE	200
M.1	GROSS IMPACT EVALUATION	200
M.1.1	Gross Impact Evaluation Methodology	200
M.1.2	Sampling	202
M.1.3	Results for Energy	204
M.1.4	Results for Demand.....	206
M.2	NET IMPACT EVALUATION.....	209
M.2.1	Net Impact Evaluation Methodology	209
M.2.2	Sampling	209
M.2.3	Net Impact Evaluation Results.....	210
APPENDIX N	EVALUATION DETAIL – RESIDENTIAL MIDSTREAM APPLIANCES INITIATIVE ...	211
N.1	GROSS IMPACT EVALUATION	211
N.1.1	Gross Impact Evaluation Methodology	211
N.1.2	Sampling	212
N.1.3	Results for Energy	213
N.1.4	Results for Demand.....	214
N.2	NET IMPACT EVALUATION.....	216
N.2.1	Net Impact Evaluation Methodology	216
N.2.2	Sampling	216
N.2.3	Net Impact Evaluation Results.....	216
APPENDIX O	EVALUATION DETAIL – LOW-INCOME RESIDENTIAL APPLIANCE RECYCLING SUB-INITIATIVE	217

O.1	GROSS IMPACT EVALUATION	217
O.1.1	Gross Impact Evaluation Methodology	217
O.1.2	Sampling	218
O.1.3	Results for Energy	219
O.1.4	Results for Demand	220
O.2	NET IMPACT EVALUATION	222
O.2.1	Net Impact Evaluation Methodology	222
APPENDIX P EVALUATION DETAIL – RESIDENTIAL LOW-INCOME DIRECT INSTALL INITIATIVE		223
P.1	GROSS IMPACT EVALUATION	223
P.1.1	Gross Impact Evaluation Methodology	223
P.1.2	Sampling	224
P.1.3	Results for Energy	225
P.1.4	Results for Demand	226
P.2	NET IMPACT EVALUATION	227
P.2.1	Net Impact Evaluation Methodology	227
APPENDIX Q EVALUATION DETAIL – LI EE KITS SUB-INITIATIVE		228
Q.1	GROSS IMPACT EVALUATION	228
Q.1.1	Gross Impact Evaluation Methodology	228
Q.1.2	Sampling	228
Q.1.3	Results for Energy	229
Q.1.4	Results for Demand	230
Q.2	NET IMPACT EVALUATION	231
APPENDIX R EVALUATION DETAIL – COMMERCIAL AND INDUSTRIAL PRESCRIPTIVE INITIATIVE		232
R.1	GROSS IMPACT EVALUATION	232
R.1.1	Gross Impact Evaluation Methodology	232
R.1.2	Sampling	234
R.1.3	Results for Energy	236
R.1.4	Results for Demand	239
R.2	NET IMPACT EVALUATION	242
R.2.1	Net Impact Evaluation Methodology	242
R.2.2	Sampling	242

R.2.3	Net Impact Evaluation Results.....	243
APPENDIX S	EVALUATION DETAIL – COMMERCIAL AND INDUSTRIAL CUSTOM INITIATIVE ..	245
S.1	GROSS IMPACT EVALUATION	245
S.1.1	Gross Impact Evaluation Methodology	245
S.1.2	Sampling	247
S.1.3	Results for Energy.....	248
S.1.4	Results for Demand.....	250
S.2	NET IMPACT EVALUATION.....	252
S.2.1	Net Impact Evaluation Methodology	252
S.2.2	Sampling	252
S.2.3	Net Impact Evaluation Results.....	253
APPENDIX T	EVALUATION DETAIL – COMMERCIAL AND INDUSTRIAL ENERGY MANAGEMENT AND NEW CONSTRUCTION INITIATIVE	255
T.1	GROSS IMPACT EVALUATION	255
T.1.1	Gross Impact Evaluation Methodology	255
T.1.2	Sampling	258
T.1.3	Results for Energy.....	260
T.1.4	Results for Demand.....	263
T.2	NET IMPACT EVALUATION.....	265
T.2.1	Net Impact Evaluation Methodology	265
T.2.2	Sampling	265
T.2.3	Net Impact Evaluation Results.....	266
APPENDIX U	EVALUATION DETAIL – COMMERCIAL AND MASTER-METERED MULTIFAMILY DIRECT INSTALL INITIATIVE	268
U.1	GROSS IMPACT EVALUATION	268
U.1.2	Sampling	268
U.1.3	Results for Energy.....	269
U.1.4	Results for Demand.....	270
U.2	NET IMPACT EVALUATION.....	271
APPENDIX V	EVALUATION DETAIL – C&I APPLIANCE RECYCLING SUB-INITIATIVE.....	272
V.1	GROSS IMPACT EVALUATION	272
V.1.1	Sampling	272
V.1.2	Results for Energy.....	273

V.1.3	Results for Demand.....	273
V.2	NET IMPACT EVALUATION.....	274
V.2.1	Net Impact Evaluation Methodology	274
APPENDIX W	REPORT VALIDATION	275
W.1	LINKED IMAGES	275

FIGURE 1: CARRYOVER SAVINGS FROM PHASE III OF ACT 129	28
FIGURE 2: LOW-INCOME CARRYOVER FROM PHASE III.....	29
FIGURE 3: EE&C PLAN PERFORMANCE TOWARD PHASE IV PORTFOLIO COMPLIANCE	
TARGET (MWh)	31
FIGURE 4: EE&C PLAN PERFORMANCE TOWARD PHASE IV PORTFOLIO COMPLIANCE	
TARGET (MW)	31
FIGURE 5: EE&C PLAN PERFORMANCE TOWARD PHASE IV LOW-INCOME COMPLIANCE	
TARGET.....	34
FIGURE 6: EVALUATION ACTIVITY MATRIX	56
FIGURE 7: FRACTION OF VERIFIED ENERGY SAVINGS BY EVALUATION ACTIVITY.	234
FIGURE 8: VERIFIED VS. REPORTED ENERGY SAVINGS FOR SAMPLED PRESCRIPTIVE	
PROJECTS.	237
FIGURE 9: FRACTION OF VERIFIED ENERGY SAVINGS BY EVALUATION ACTIVITY.	247
FIGURE 10: VERIFIED VS. REPORTED ENERGY SAVINGS FOR SAMPLED CUSTOM PROJECTS.	249
FIGURE 11: FRACTION OF VERIFIED ENERGY SAVINGS BY EVALUATION ACTIVITY.	258
FIGURE 12: VERIFIED VS. REPORTED ENERGY SAVINGS FOR SAMPLED EMNC PROJECTS.	261
FIGURE 13: VERIFIED VS. REPORTED ENERGY SAVINGS FOR SAMPLED MULTIFAMILY	
PROJECTS.	269

TABLE 1: CARRYOVER SAVINGS FROM PHASE III	28
TABLE 2: GROSS REPORTED AND VERIFIED ELECTRIC AND DEMAND SAVINGS FOR PY17.....	30
TABLE 3: GROSS REPORTED AND VERIFIED ELECTRIC AND DEMAND SAVINGS SINCE THE BEGINNING OF PHASE IV OF ACT 129.....	30
TABLE 4: PHASE IV ELECTRIC SAVINGS INCLUDING PHASE III CARRYOVER.....	30
TABLE 5: PHASE IV ENERGY CARRYOVER	32
TABLE 6: PHASE IV PEAK DEMAND CARRYOVER	32
TABLE 7: PROPORTION OF MEASURES OFFERED TO LOW-INCOME CUSTOMERS	33
TABLE 8: LOW-INCOME PROGRAM ENERGY SAVINGS AND TARGETS.....	33
TABLE 9: PHASE IV LOW-INCOME ENERGY SAVINGS CARRYOVER	34
TABLE 10: ENERGY SAVINGS IN THE MULTIFAMILY SECTOR.....	35
TABLE 11: PROGRAM YEAR 17 SUMMARY STATISTICS BY CUSTOMER SEGMENT	35
TABLE 12: PHASE IV SUMMARY STATISTICS BY CUSTOMER SEGMENT	36
TABLE 13: EE&C PORTFOLIO PARTICIPATION BY PROGRAM	38
TABLE 14: IMPACT EVALUATION RESULTS SUMMARY FOR MET-Ed AND PENELEC	39
TABLE 15: IMPACT EVALUATION RESULTS SUMMARY FOR PENN POWER AND WPP	40
TABLE 16: INCREMENTAL ANNUAL ENERGY SAVINGS BY PROGRAM - MET-Ed	41
TABLE 17: INCREMENTAL ANNUAL ENERGY SAVINGS BY PROGRAM - PENELEC.....	41
TABLE 18: INCREMENTAL ANNUAL ENERGY SAVINGS BY PROGRAM – PENN POWER	41
TABLE 19: INCREMENTAL ANNUAL ENERGY SAVINGS BY PROGRAM - WPP.....	41
TABLE 20: LIFETIME ENERGY SAVINGS BY PROGRAM FOR MET-Ed.....	42
TABLE 21: LIFETIME ENERGY SAVINGS BY PROGRAM FOR PENELEC.....	43
TABLE 22: LIFETIME ENERGY SAVINGS BY PROGRAM FOR PENN POWER	43
TABLE 23: LIFETIME ENERGY SAVINGS BY PROGRAM FOR WPP	43
TABLE 24: LINE LOSS MULTIPLIERS BY RATE DISTRICT AND CUSTOMER SECTOR.....	44
TABLE 25: PEAK DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR MET-Ed	44
TABLE 26: PEAK DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR PENELEC.....	44
TABLE 27: PEAK DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR PENN POWER	44
TABLE 28: PEAK DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR WPP.....	45
TABLE 29: MET-Ed POTENTIAL FCM NOMINATIONS BY PY & PJM DELIVERY YEAR	45
TABLE 30: PENELEC POTENTIAL FCM NOMINATIONS BY PY & PJM DELIVERY YEAR	46
TABLE 31: PENN POWER POTENTIAL FCM NOMINATIONS BY PY & PJM DELIVERY YEAR.....	46
TABLE 32: WPP POTENTIAL FCM NOMINATIONS BY PY & PJM DELIVERY YEAR	46
TABLE 33: PHASE IV TO DATE FUEL SWITCHING SUMMARY.....	47
TABLE 34: RENEWABLES SUMMARY.....	48
TABLE 35: SUMMARY OF PROGRAM FINANCES – MET-Ed.....	49
TABLE 36: SUMMARY OF PROGRAM FINANCES – PENELEC.....	50
TABLE 37: SUMMARY OF PROGRAM FINANCES – PENN POWER	51
TABLE 38: SUMMARY OF PROGRAM FINANCES – WPP.....	52
TABLE 39: COMPARISON OF EXPENDITURES TO PHASE IV EE&C PLAN (\$1,000)	53
TABLE 40: COMPARISON OF ACTUAL PORTFOLIO SAVINGS TO PLAN PROJECTIONS	53
TABLE 41: COMPARISON OF ACTUAL PORTFOLIO DEMAND REDUCTIONS TO PLAN PROJECTIONS.....	53
TABLE 42: SUMMARY OF EVALUATION RECOMMENDATIONS	55

TABLE 43: EEH PROGRAM PARTICIPATION AND REPORTED IMPACTS	58
TABLE 44: EEH PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY17	59
TABLE 45: EEH PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY17	60
TABLE 46: PYTD AND P4TD SAVINGS SUMMARY	61
TABLE 47: EEH PROGRAM PROCESS EVALUATION SAMPLE DESIGN	62
TABLE 48: SUMMARY OF PROGRAM FINANCES – MET-ED.....	65
TABLE 49: SUMMARY OF PROGRAM FINANCES – PENELEC.....	66
TABLE 50: SUMMARY OF PROGRAM FINANCES – PENN POWER	67
TABLE 51: SUMMARY OF PROGRAM FINANCES – WPP.....	68
TABLE 52: EEP PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR MET-Ed	69
TABLE 53: EEP PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR PENELEC.....	70
TABLE 54: EEP PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR PENN POWER	70
TABLE 55: EEP PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR WPP	70
TABLE 56: EEP PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY17	71
TABLE 57: EEP PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY17	72
TABLE 58: PYTD AND P4TD SAVINGS SUMMARY	72
TABLE 59: EEP PROGRAM PROCESS EVALUATION SAMPLE DESIGN	73
TABLE 60: SUMMARY OF PROGRAM FINANCES – MET-ED.....	75
TABLE 61: SUMMARY OF PROGRAM FINANCES – PENELEC.....	76
TABLE 62: SUMMARY OF PROGRAM FINANCES – PENN POWER	77
TABLE 63: SUMMARY OF PROGRAM FINANCES – WPP.....	78
TABLE 64: LIEEP PARTICIPATION AND REPORTED IMPACTS.....	82
TABLE 65: LIEEP GROSS IMPACT EVALUATION SUMMARY FOR PY17	83
TABLE 66: PYTD AND P4TD SAVINGS SUMMARY	84
TABLE 67: LIEEP PROGRAM PROCESS EVALUATION SAMPLE DESIGN	85
TABLE 68: SUMMARY OF PROGRAM FINANCES – MET-ED.....	87
TABLE 69: SUMMARY OF PROGRAM FINANCES – PENELEC.....	88
TABLE 70: SUMMARY OF PROGRAM FINANCES – PENN POWER	89
TABLE 71: SUMMARY OF PROGRAM FINANCES – WPP.....	90
TABLE 72: ESB-SMALL PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR MET-Ed AND PENELEC	91
TABLE 73: ESB-SMALL PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR PENN POWER AND WPP	91
TABLE 74: ESB-SMALL PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY17	92
TABLE 75: ESB-SMALL PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY17	94
TABLE 76: PYTD AND P4TD SAVINGS SUMMARY	95
TABLE 77: COMBINED C&I PROGRAM PROCESS EVALUATION SAMPLE DESIGN.....	95
TABLE 78: SUMMARY OF PROGRAM FINANCES – MET-ED.....	97
TABLE 79: SUMMARY OF PROGRAM FINANCES – PENELEC.....	98
TABLE 80: SUMMARY OF PROGRAM FINANCES – PENN POWER	99
TABLE 81: SUMMARY OF PROGRAM FINANCES – WPP.....	100
TABLE 82: ESB-LARGE PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR MET-Ed AND PENELEC	103

TABLE 83: ESB-LARGE PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR PENN POWER AND WPP	103
TABLE 84: ESB-LARGE PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY17	104
TABLE 85: ESB-LARGE PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY17	105
TABLE 86: PYTD AND P4TD SAVINGS SUMMARY	105
TABLE 87: SUMMARY OF PROGRAM FINANCES – MET-ED.....	106
TABLE 88: SUMMARY OF PROGRAM FINANCES – PENELEC.....	107
TABLE 89: SUMMARY OF PROGRAM FINANCES – PENN POWER	108
TABLE 90: SUMMARY OF PROGRAM FINANCES – WPP.....	109
TABLE 91: MET-ED PY17 PROGRAM AND PORTFOLIO TOTAL FINANCES (\$1,000)	110
TABLE 92: PENELEC PY17 PROGRAM AND PORTFOLIO TOTAL FINANCES (\$1,000).....	111
TABLE 93: PENN POWER PY17 PROGRAM AND PORTFOLIO TOTAL FINANCES (\$1,000)	111
TABLE 94: WPP PY17 PROGRAM AND PORTFOLIO TOTAL FINANCES (\$1,000).....	111
TABLE 95: MET-ED P4TD PROGRAM AND PORTFOLIO TOTAL FINANCES (\$1,000)	112
TABLE 96: PENELEC P4TD PROGRAM AND PORTFOLIO TOTAL FINANCES (\$1,000)	112
TABLE 97: PENN POWER P4TD PROGRAM AND PORTFOLIO TOTAL FINANCES (\$1,000).....	113
TABLE 98: WPP P4TD PROGRAM AND PORTFOLIO TOTAL FINANCES (\$1,000)	113
TABLE 99: MET-ED EE&C EXPENDITURES BY COST-RECOVERY CATEGORY (\$1,000).....	114
TABLE 100: PENELEC EE&C EXPENDITURES BY COST-RECOVERY CATEGORY (\$1,000)	114
TABLE 101: PENN POWER EE&C EXPENDITURES BY COST-RECOVERY CATEGORY (\$1,000)	114
TABLE 102: WPP EE&C EXPENDITURES BY COST-RECOVERY CATEGORY (\$1,000)	115
TABLE 103: MET-ED FCM PROCEEDS FROM RECOGNIZED PDR (\$1000).....	115
TABLE 104: PENELEC FCM PROCEEDS FROM RECOGNIZED PDR (\$1000).....	115
TABLE 105: PENN POWER FCM PROCEEDS FROM RECOGNIZED PDR (\$1,000)	116
TABLE 106: WPP FCM PROCEEDS FROM RECOGNIZED PDR (\$1,000).....	116
TABLE 107: COST RECOVERY OFFSETS FROM RECOGNIZED FCM PDR.....	116
TABLE 108: PY17 SITE VISIT SUMMARY	117
TABLE 109: DEFINITION OF VARIABLES IN THE LAGGED SEASONAL REGRESSION MODEL	120
TABLE 110: ADJUSTMENT FACTORS FOR DUAL PARTICIPATION IN UPSTREAM PROGRAMS.	121
TABLE 111: DEFINITION OF VARIABLES FOR KWH SAVINGS CALCULATION	122
TABLE 112: DUAL PARTICIPATION CORRECTION RESULTS BY RATE DISTRICT AND PARTICIPATION WAVE	122
TABLE 113: DEFINITION OF VARIABLES IN THE LAGGED PEAK DEMAND REGRESSION MODEL	123
TABLE 114: PY17 PARTICIPATION BILL COUNTS BY MONTH AND COHORT	125
TABLE 115: VERIFIED ENERGY SAVINGS AND ABSOLUTE PRECISIONS BY R AND WAVE.....	126
TABLE 116: REPORTED AND VERIFIED DEMAND REDUCTIONS FOR THE HER INITIATIVE	127
TABLE 117: SUMMARY OF LOW-INCOME CARVEOUT ENERGY SAVINGS (MWH/YEAR).....	128
TABLE 118: MET-ED ANNUAL ENERGY SAVINGS BY PROGRAM & INITIATIVE (MWH/YEAR)	129
TABLE 119: PENELEC ANNUAL ENERGY SAVINGS BY PROGRAM & INITIATIVE (MWH/YEAR).....	130
TABLE 120: PENN POWER ANNUAL ENERGY SAVINGS BY PROGRAM & INITIATIVE (MWH/YEAR).....	131
TABLE 121: WPP ANNUAL ENERGY SAVINGS BY PROGRAM & INITIATIVE (MWH/YEAR).....	132
TABLE 122: MET-ED PEAK DEMAND SAVINGS BY PROGRAM & INITIATIVE (MW/YEAR)	133
TABLE 123: PENELEC PEAK DEMAND SAVINGS BY PROGRAM & INITIATIVE (MW/YEAR)	134

TABLE 124: PENN POWER PEAK DEMAND SAVINGS BY PROGRAM & INITIATIVE (MW/YEAR).....	135
TABLE 125: WPP PEAK DEMAND SAVINGS BY PROGRAM & INITIATIVE (MW/YEAR)	136
TABLE 126: PY17 GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR MET-Ed	137
TABLE 127: PY17 GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR PENELEC	137
TABLE 128: PY17 GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR PENN POWER.....	137
TABLE 129: PY17 GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR WPP	138
TABLE 130: PY17 NET TRC RATIOS BY PROGRAM (\$1,000) FOR MET-Ed	138
TABLE 131: PY17 NET TRC RATIOS BY PROGRAM (\$1,000) FOR PENELEC	138
TABLE 132: PY17 NET TRC RATIOS BY PROGRAM (\$1,000) FOR PENN POWER.....	139
TABLE 133: PY17 NET TRC RATIOS BY PROGRAM (\$1,000) FOR WPP	139
TABLE 134: P4TD GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR MET-Ed	140
TABLE 135: P4TD GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR PENELEC	140
TABLE 136: P4TD GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR PENN POWER.....	140
TABLE 137: P4TD GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR WPP	141
TABLE 138: P4TD NET TRC RATIOS BY PROGRAM (\$1,000) FOR MET-Ed.....	141
TABLE 139: P4TD NET TRC RATIOS BY PROGRAM (\$1,000) FOR PENELEC.....	142
TABLE 140: P4TD NET TRC RATIOS BY PROGRAM (\$1,000) FOR PENN POWER	142
TABLE 141: P4TD NET TRC RATIOS BY PROGRAM (\$1,000) FOR WPP.....	142
TABLE 142: HIGH-IMPACT MEASURE NET-TO-GROSS FOR MET-Ed AND PENELEC	143
TABLE 143: HIGH-IMPACT MEASURE NET-TO-GROSS FOR PENN POWER AND WPP	143
TABLE 144: COMPARISON OF PYTD EXPENDITURES TO EE&C PLAN (\$1,000) MET-Ed	144
TABLE 145: COMPARISON OF PYTD EXPENDITURES TO EE&C PLAN (\$1,000) PENELEC	144
TABLE 146: COMPARISON OF PYTD EXPENDITURES TO EE&C PLAN (\$1,000) PENN POWER	144
TABLE 147: COMPARISON OF PYTD EXPENDITURES TO EE&C PLAN (\$1,000) WPP	144
TABLE 148: COMPARISON OF P4TD EXPENDITURES TO EE&C PLAN (\$1,000) MET-Ed.....	145
TABLE 149: COMPARISON OF P4TD EXPENDITURES TO EE&C PLAN (\$1,000) PENELEC	145
TABLE 150: COMPARISON OF P4TD EXPENDITURES TO EE&C PLAN (\$1,000) PENN POWER	145
TABLE 151: COMPARISON OF P4TD EXPENDITURES TO EE&C PLAN (\$1,000) WPP	146
TABLE 152: COMPARISON OF PYTD ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR MET-Ed	146
TABLE 153: COMPARISON OF PYTD ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PENELEC	146
TABLE 154: COMPARISON OF PYTD ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PENN POWER.....	147
TABLE 155: COMPARISON OF PYTD ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR WPP	147
TABLE 156: COMPARISON OF PHASE IV ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PHASE IV FOR MET-Ed.....	147
TABLE 157: COMPARISON OF PHASE IV ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PHASE IV FOR PENELEC	148
TABLE 158: COMPARISON OF PHASE IV ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PHASE IV FOR PENN POWER	148
TABLE 159: COMPARISON OF PHASE IV ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PHASE IV FOR WPP	148

TABLE 160: EE KITS SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED.....	150
TABLE 161: EE KITS SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	151
TABLE 162: EE KITS SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	151
TABLE 163: EE KITS SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	151
TABLE 164: EE KITS SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	151
TABLE 165: EE KITS SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	151
TABLE 166: EE KITS SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	152
TABLE 167: EE KITS SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	152
TABLE 168: EE KITS SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed.....	152
TABLE 169: EE KITS SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	152
TABLE 170: EE KITS SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER.....	153
TABLE 171: EE KITS SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	153
TABLE 172: EE KITS INITIATIVE SAMPLING PRECISIONS	153
TABLE 173: EE KITS INITIATIVE NET-TO-GROSS SAMPLING.....	154
TABLE 174: EE KITS INITIATIVE NET-TO-GROSS RESULTS	154
TABLE 175: RES DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed	157
TABLE 176: RES DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	157
TABLE 177: RES DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	157
TABLE 178: RES DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	157
TABLE 179: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed.....	157
TABLE 180: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	158
TABLE 181: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER	158
TABLE 182: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	158
TABLE 183: RES DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed	158
TABLE 184: RES DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	159
TABLE 185: RES DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER.....	159
TABLE 186: RES DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	159
TABLE 187: RES DI INITIATIVE NET-TO-GROSS SAMPLING.....	160
TABLE 188: RES DI INITIATIVE NET-TO-GROSS RESULTS BY RATE DISTRICT.....	161
TABLE 189: RES NC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed.....	164
TABLE 190: RES NC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	164
TABLE 191: RES NC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	164
TABLE 192: RES NC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	164
TABLE 193: RES NC INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	165
TABLE 194: RES NC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	165
TABLE 195: RES NC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	165
TABLE 196: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	165
TABLE 197: RES NC INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed.....	166
TABLE 198: RES NC INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	166
TABLE 199: RES NC INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER	166
TABLE 200: RES NC INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	166
TABLE 201: RES NC INITIATIVE NET-TO-GROSS RESULTS BY RATE DISTRICT	167

TABLE 202: RES MF INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed	168
TABLE 203: RES MF INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	169
TABLE 204: RES MF INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	169
TABLE 205: RES MF INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	169
TABLE 206: RES MF INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	169
TABLE 207: RES MF INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	169
TABLE 208: RES MF INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	170
TABLE 209: RES MF INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	170
TABLE 210: RES MF INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed	170
TABLE 211: RES MF INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	170
TABLE 212: RES MF INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER	170
TABLE 213: RES MF INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	171
TABLE 214: RES MF INITIATIVE NET-TO-GROSS SAMPLING	171
TABLE 215: RES MF INITIATIVE NET-TO-GROSS RESULTS BY EDC.....	171
TABLE 216: DEFINITION OF VARIABLES IN THE ONLINE AUDIT REGRESSION MODEL	175
TABLE 217: DEFINITION OF VARIABLES FOR KWH SAVINGS CALCULATION	177
TABLE 218: RES ONLINE AUDIT INITIATIVE ENERGY GROSS REALIZATION RATES.....	178
TABLE 219: RES ONLINE AUDIT INITIATIVE DEMAND GROSS REALIZATION RATES	179
TABLE 220: DATA SOURCES FOR THE ATI INITIATIVE GROSS IMPACT EVALUATION	181
TABLE 221: ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed	181
TABLE 222: ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	182
TABLE 223: ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	182
TABLE 224: ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	182
TABLE 225: ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed.....	183
TABLE 226: ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	183
TABLE 227: ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER	183
TABLE 228: ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	183
TABLE 229: ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed	184
TABLE 230: ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	184
TABLE 231: ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER.....	184
TABLE 232: ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	185
TABLE 233: ATI INITIATIVE SAMPLING PRECISIONS	185
TABLE 234: ATI INITIATIVE NET-TO-GROSS SAMPLING FOR MET-Ed.....	186
TABLE 235: ATI INITIATIVE NET-TO-GROSS SAMPLING FOR PENELEC	186
TABLE 236: ATI INITIATIVE NET-TO-GROSS SAMPLING FOR PENN POWER	186
TABLE 237: ATI INITIATIVE NET-TO-GROSS SAMPLING FOR WPP	186
TABLE 238: ATI INITIATIVE NET-TO-GROSS RESULTS FOR MET-Ed	187
TABLE 239: ATI INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC.....	187
TABLE 240: ATI INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER	187
TABLE 241: ATI INITIATIVE NET-TO-GROSS RESULTS FOR WPP.....	187
TABLE 242: DATA SOURCES FOR THE RES HVAC INITIATIVE GROSS IMPACT EVALUATION	189
TABLE 243: RES HVAC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed.....	192
TABLE 244: RES HVAC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	192
TABLE 245: RES HVAC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	193

TABLE 246: RES HVAC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	193
TABLE 247: RES HVAC INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	194
TABLE 248: RES HVAC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	194
TABLE 249: RES HVAC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	195
TABLE 250: RES HVAC INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	195
TABLE 251: RES HVAC INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed.....	196
TABLE 252: RES HVAC INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	196
TABLE 253: RES HVAC INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER	197
TABLE 254: RES HVAC INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	197
TABLE 255: RES HVAC INITIATIVE NET-TO-GROSS SAMPLING FOR MET-Ed	198
TABLE 256: RES HVAC INITIATIVE NET-TO-GROSS SAMPLING FOR PENELEC	198
TABLE 257: RES HVAC INITIATIVE NET-TO-GROSS SAMPLING FOR PENN POWER.....	198
TABLE 258: RES HVAC INITIATIVE NET-TO-GROSS SAMPLING FOR WPP	198
TABLE 259: RES HVAC INITIATIVE NET-TO-GROSS RESULTS FOR MET-Ed.....	199
TABLE 260: RES HVAC INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC	199
TABLE 261: RES HVAC INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER.....	199
TABLE 262: RES HVAC INITIATIVE NET-TO-GROSS RESULTS FOR WPP	199
TABLE 263: DATA SOURCES FOR THE RES APPLIANCES INITIATIVE GROSS IMPACT EVALUATION.....	201
TABLE 264: RES APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed.....	202
TABLE 265: RES APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	203
TABLE 266: RES APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	203
TABLE 267: RES APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	204
TABLE 268: RES APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	204
TABLE 269: RES APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	205
TABLE 270: RES APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	205
TABLE 271: RES APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	206
TABLE 272: RES APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed.....	207
TABLE 273: RES APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	207
TABLE 274: RES APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER.....	208
TABLE 275: RES APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	208
TABLE 276: RES APPLIANCES INITIATIVE NET-TO-GROSS SAMPLING FOR MET-Ed	209
TABLE 277: RES APPLIANCES INITIATIVE NET-TO-GROSS SAMPLING FOR PENELEC	209
TABLE 278: RES APPLIANCES INITIATIVE NET-TO-GROSS SAMPLING FOR PENN POWER.....	209
TABLE 279: RES APPLIANCES INITIATIVE NET-TO-GROSS SAMPLING FOR WPP	210
TABLE 280: RES APPLIANCES INITIATIVE NET-TO-GROSS RESULTS FOR MET-Ed	210
TABLE 281: RES APPLIANCES INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC	210
TABLE 282: RES APPLIANCES INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER.....	210
TABLE 283: RES APPLIANCES INITIATIVE NET-TO-GROSS RESULTS FOR WPP	210

TABLE 284: RES MIDSTREAM APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed.....	212
TABLE 285: RES MIDSTREAM APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	212
TABLE 286: RES MIDSTREAM APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	212
TABLE 287: RES MIDSTREAM APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	213
TABLE 288: RES MIDSTREAM APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed.....	213
TABLE 289: RES MIDSTREAM APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	213
TABLE 290: RES MIDSTREAM APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER	214
TABLE 291: RES MIDSTREAM APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP.....	214
TABLE 292: RES MIDSTREAM APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed.....	214
TABLE 293: RES MIDSTREAM APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	215
TABLE 294: RES MIDSTREAM APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER	215
TABLE 295: RES MIDSTREAM APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	215
TABLE 296: RES APPLIANCES INITIATIVE NET-TO-GROSS SAMPLING	216
TABLE 297: RES APPLIANCES INITIATIVE NET-TO-GROSS RESULTS.....	216
TABLE 298: DATA SOURCES FOR THE LI ATI INITIATIVE GROSS IMPACT EVALUATION	218
TABLE 299: LI ATI SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed	218
TABLE 300: LI ATI SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	219
TABLE 301: LI ATI SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	219
TABLE 302: LI ATI SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	219
TABLE 303: LI ATI SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	219
TABLE 304: LI ATI SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	220
TABLE 305: LI ATI SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	220
TABLE 306: LI ATI SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	220
TABLE 307: LI ATI SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed	221
TABLE 308: LI ATI SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	221
TABLE 309: LI ATI SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER	221
TABLE 310: LI ATI SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	221
TABLE 311: LI DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed	224
TABLE 312: LI DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	225
TABLE 313: LI DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	225
TABLE 314: LI DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	225
TABLE 315: LI DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	225

TABLE 316: LI DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	226
TABLE 317: LI DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	226
TABLE 318: LI DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	226
TABLE 319: LI DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed	226
TABLE 320: LI DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	227
TABLE 321: LI DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER	227
TABLE 322: LI DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	227
TABLE 323: LI EE KITS SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed.....	228
TABLE 324: LI EE KITS SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	229
TABLE 325: LI EE KITS SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	229
TABLE 326: LI EE KITS SUB-INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	229
TABLE 327: LI EE KITS SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	229
TABLE 328: LI EE KITS SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	229
TABLE 329: LI EE KITS SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	230
TABLE 330: LI EE KITS SUB-INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	230
TABLE 331: LI EE KITS SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed.....	230
TABLE 332: LI EE KITS SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	230
TABLE 333: LI EE KITS SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER.....	231
TABLE 334: LI EE KITS SUB-INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	231
TABLE 335: CI PRESCRIPTIVE INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed.....	235
TABLE 336: CI PRESCRIPTIVE INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	235
TABLE 337: CI PRESCRIPTIVE INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	236
TABLE 338: CI PRESCRIPTIVE INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	236
TABLE 339: CI PRESCRIPTIVE INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	238
TABLE 340: CI PRESCRIPTIVE INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	238
TABLE 341: CI PRESCRIPTIVE INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	239
TABLE 342: CI PRESCRIPTIVE INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	239
TABLE 343: CI PRESCRIPTIVE INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed	240
TABLE 344: CI PRESCRIPTIVE INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	240
TABLE 345: CI PRESCRIPTIVE INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER.....	241
TABLE 346: CI PRESCRIPTIVE INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	241
TABLE 347: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS SAMPLING FOR MET-Ed	243
TABLE 348: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS SAMPLING FOR PENELEC.....	243
TABLE 349: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS SAMPLING FOR PENN POWER	243
TABLE 350: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS SAMPLING FOR WPP	243
TABLE 351: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS RESULTS FOR MET-Ed	244
TABLE 352: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC	244
TABLE 353: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER	244

TABLE 354: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS RESULTS FOR WPP	244
TABLE 355: CI CUSTOM INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED.....	248
TABLE 356: CI CUSTOM INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	248
TABLE 357: CI CUSTOM INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	248
TABLE 358: CI CUSTOM INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	248
TABLE 359: CI CUSTOM INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED	250
TABLE 360: CI CUSTOM INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	250
TABLE 361: CI CUSTOM INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	250
TABLE 362: CI CUSTOM INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	250
TABLE 363: CI CUSTOM INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED.....	251
TABLE 364: CI CUSTOM INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	251
TABLE 365: CI CUSTOM INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER	251
TABLE 366: CI CUSTOM INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	251
TABLE 367: CI CUSTOM INITIATIVE NET-TO-GROSS SAMPLING FOR MET-ED	252
TABLE 368: CI CUSTOM INITIATIVE NET-TO-GROSS SAMPLING FOR PENELEC	253
TABLE 369: CI CUSTOM INITIATIVE NET-TO-GROSS SAMPLING FOR PENN POWER.....	253
TABLE 370: CI CUSTOM INITIATIVE NET-TO-GROSS SAMPLING FOR WPP	253
TABLE 371: CI CUSTOM INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED.....	253
TABLE 372: CI CUSTOM INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC	253
TABLE 373: CI CUSTOM INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER	254
TABLE 374: CI CUSTOM INITIATIVE NET-TO-GROSS RESULTS FOR WPP	254
TABLE 375: CI LIGHTING INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED	259
TABLE 376: CI EMNC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	259
TABLE 377: CI EMNC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	259
TABLE 378: CI EMNC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	260
TABLE 379: CI EMNC INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	261
TABLE 380: CI EMNC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	262
TABLE 381: CI EMNC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER	262
TABLE 382: CI EMNC INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	262
TABLE 383: CI EMNC INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED	263
TABLE 384: CI EMNC INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	263
TABLE 385: CI EMNC INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER.....	264
TABLE 386: CI EMNC INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	264
TABLE 387: CI EMNC INITIATIVE NET-TO-GROSS SAMPLING FOR MET-ED.....	266
TABLE 388: CI EMNC INITIATIVE NET-TO-GROSS SAMPLING FOR PENELEC.....	266
TABLE 389: CI EMNC INITIATIVE NET-TO-GROSS SAMPLING FOR PENN POWER	266
TABLE 390: CI EMNC INITIATIVE NET-TO-GROSS SAMPLING FOR WPP.....	266
TABLE 391: CI EMNC INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED	267
TABLE 392: CI EMNC INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC.....	267
TABLE 393: CI EMNC INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER	267
TABLE 394: CI EMNC INITIATIVE NET-TO-GROSS RESULTS FOR WPP.....	267
TABLE 395: CI MF INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED	268
TABLE 396: CI MF INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	268
TABLE 397: CI MF INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	269

TABLE 398: CI MF INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	269
TABLE 399: CI MF INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed	270
TABLE 400: CI MF INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	270
TABLE 401: CI MF INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	270
TABLE 402: CI MF INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	270
TABLE 403: CI MF INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed	270
TABLE 404: CI MF INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	271
TABLE 405: CI MF INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER	271
TABLE 406: CI MF INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	271
TABLE 407: C&I ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed	272
TABLE 408: C&I ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	272
TABLE 409: C&I ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	272
TABLE 410: C&I ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	273
TABLE 411: C&I ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed.....	273
TABLE 412: C&I ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	273
TABLE 413: C&I ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER	273
TABLE 414: C&I ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	273
TABLE 415: C&I ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed	274
TABLE 416: C&I ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	274
TABLE 417: C&I ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENN POWER.....	274
TABLE 418: C&I ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	274
TABLE 419: REPORT UPDATE TIMESTAMP.....	275

Acronyms-

ATI	Appliance Turn-In or Appliance Recycling
BOC	Building Operator Certification
C&I	Commercial and Industrial
CFL	Compact Fluorescent Lamp
CSP	Conservation Service Provider or Curtailment Service Provider
CV	Coefficient of Variation
DLC	Direct Load Control
DDR	Dispatchable Demand Response
EAP	Energy Association of Pennsylvania
EDC	Electric Distribution Company
EDT	Eastern Daylight Time
EE&C	Energy Efficiency and Conservation
EM&V	Evaluation, Measurement, and Verification
EMNC	Energy Management and New Construction
ER	Early Replacement
EUL	Effective Useful Life
FCM	Forward Capacity Market
GNI	Government, Non-Profit, Institutional
HER	Home Energy Report
HERS	Home Energy Rating System
HIM	High-Impact Measure
HPWP	Heat Pump Water Heater
HVAC	Heating, Ventilating, and Air Conditioning
ICSP	Implementation Conservation Service Provider
IDI	In-Depth Interview
IMP	Interim Measure Protocol
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light-Emitting Diode
LI	Low-Income
LIURP	Low-Income Usage Reduction Program
LLF	Line Loss Factor
M&V	Measurement and Verification
MW	Megawatt
MWh	Megawatt-hour
NPV	Net Present Value
NTG	Net-to-Gross
O&M	Operation and Maintenance
P4TD	Phase IV to Date
PA PUC	Pennsylvania Public Utility Commission
PDR	Peak Demand Reductions
PSA	Phase IV to Date Preliminary Savings Achieved; equal to VTD + PYRTD
PSA+CO	PSA savings plus Carryover from Phase III
PY	Program Year: e.g., PY17, from June 1, 2025, to May 31, 2026
PYRTD	Program Year Reported to Date

PYVTD	Program Year Verified to Date
RCT	Randomized Control Trial
ROB	Replace on Burnout
RTD	Phase IV to Date Reported Gross Savings
RTO	Regional Transmission Organization
SO	Spillover
SWE	Statewide Evaluator
TRC	Total Resource Cost
TRM	Technical Reference Manual
VTD	Phase IV to Date Verified Gross Savings
WACC	Weighted Average Cost of Capital

Types of Savings

Gross Savings: The change in energy consumption and/or peak demand that results directly from program-related actions taken by participants in an EE&C program, regardless of why they participated.

Net Savings: The total change in energy consumption and/or peak demand that is attributable to an EE&C program. Depending on the program delivery model and evaluation methodology, the net savings estimates may differ from the gross savings estimate due to adjustments for the effects of free riders, changes in codes and standards, market effects, participant and nonparticipant spillover, and other causes of changes in energy consumption or demand not directly attributable to the EE&C program.

Reported Gross: Also referred to as *ex ante* (Latin for “beforehand”) savings. The energy and peak demand savings values calculated by the EDC or its program Implementation Conservation Service Providers (ICSP) and stored in the program tracking system.

Unverified Reported Gross: The Phase IV Evaluation Framework allows EDCs and the evaluation contractors the flexibility to not evaluate each program every year. If an EE&C program is being evaluated over a multi-year cycle, the reported savings for a program year where evaluated results are not available are characterized as unverified reported gross until the impact evaluation is completed and verified savings can be calculated and reported.

Verified Gross: Also referred to as *ex post* (Latin for “from something done afterward”) gross savings. The energy and peak demand savings estimates reported by the independent evaluation contractor after the gross impact evaluation and associated M&V efforts have been completed.

Verified Net: Also referred to as *ex post* net savings. The energy and peak demand savings estimates reported by the independent evaluation contractor after application of the results of the net impact evaluation. Typically calculated by multiplying the verified gross savings by a net-to-gross (NTG) ratio.

Annual Savings: Energy and demand savings expressed on an annual basis, or the amount of energy and/or peak demand an EE&C measure or program can be expected to save over the course of a typical year. Annualized savings are noted as MWh/year or MW/year. The Pennsylvania TRM provides algorithms and assumptions to calculate annual savings, and Act 129 compliance targets for consumption reduction are based on the sum of the annual savings estimates of installed measures or behavior change.

Lifetime Savings: Energy and demand savings expressed in terms of the total expected savings over the useful life of the measure. Typically calculated by multiplying the annual savings of a measure by its effective useful life. The TRC Test uses savings from the full lifetime of a measure to calculate the cost-effectiveness of EE&C programs.

Program Year Reported to Date (PYRTD): The reported gross energy and peak demand savings achieved by an EE&C program or portfolio within the current program year. PYTD values for energy efficiency will always be reported gross savings in a semi-annual or preliminary annual report.

Program Year Verified to Date (PYVTD): The verified gross energy and peak demand savings achieved by an EE&C program or portfolio within the current program year as determined by the impact evaluation findings of the independent evaluation contractor.

Phase IV to Date (P4TD): The energy and peak demand savings achieved by an EE&C program or portfolio within Phase IV of Act 129. Reported in several permutations described below.

Phase IV to Date Reported (RTD): The sum of the reported gross savings recorded to date in Phase IV of Act 129 for an EE&C program or portfolio.

Phase IV to Date Verified (VTD): The sum of the verified gross savings recorded to date in Phase IV of Act 129 for an EE&C program or portfolio, as determined by the impact evaluation finding of the independent evaluation contractor.

Phase IV to Date Preliminary Savings Achieved (PSA): The sum of the verified gross savings (VTD) from previous program years in Phase IV where the impact evaluation is complete plus the reported gross savings from the current program year.

Phase IV to Date Preliminary Savings Achieved + Carryover (PSA+CO): The sum of the verified gross savings from previous program years in Phase IV plus the reported gross savings from the current program year plus any verified gross carryover savings from Phase III of Act 129. This is the best estimate of an EDC's progress toward the Phase IV compliance targets.

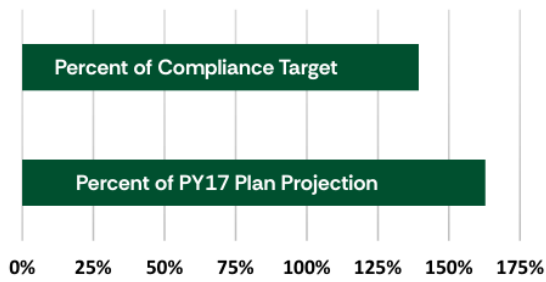
Phase IV to Date Verified + Carryover (VTD + CO): The sum of the verified gross savings recorded to date in Phase IV plus any verified gross carryover savings from Phase III of Act 129.



Met-Ed • Penelec • Penn Power • West Penn Power

Phase IV Portfolio Results

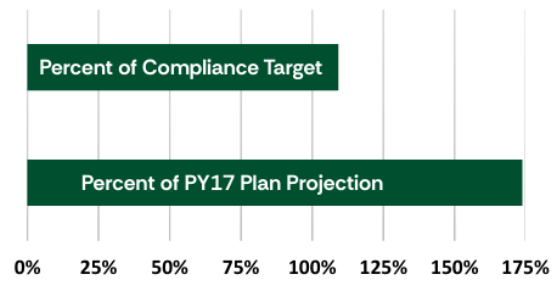
Reported Energy Savings



Phase IV Energy Savings: 2,137,937 MWh (VTD + CO)

PY17 Energy Savings: 495,401 MWh (VTD + CO)

Reported Demand Reductions



Phase IV Energy Savings: 2,137,937 MWh (VTD + CO)

PY17 Energy Savings: 495,401 MWh (VTD + CO)

Phase IV Participation



297,924 Low Income

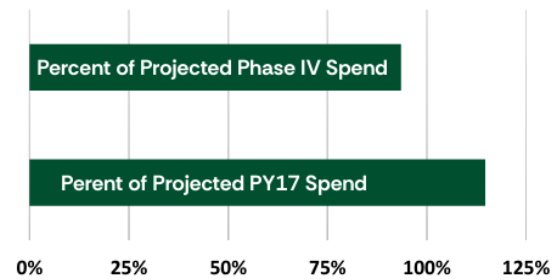


2,174,208 Residential



19,533 Nonresidential

Actual Expenditures (\$1,000)



Phase IV Expenditures \$364,424

PY17 Expenditures \$90,185

FE PA's Phase IV energy saving are equivalent to the annual electricity usage of 159,000 homes



1 Introduction

Pennsylvania Act 129 of 2008, signed on October 15, 2008, mandated energy savings and demand reduction goals for the largest electric distribution companies (EDCs) in Pennsylvania for Phases I (2008 through 2013), II (2013 through 2016) and III (2016 through 2021). In late 2020, each EDC filed a new energy efficiency and conservation (EE&C) plan with the PA PUC detailing the proposed design of its portfolio for Phase IV. These plans were updated based on stakeholder input and subsequently approved by the PUC in 2021.

Implementation of Phase IV of the Act 129 programs began on June 1, 2021. This report documents the progress and effectiveness of the Phase IV EE&C accomplishments in Program Year 17 (PY17) for Metropolitan Edison (Met-Ed), Pennsylvania Electric Company (Penelec), Pennsylvania Power Company (Penn Power), and West Penn Power Company (WPP), collectively referred to herein as FirstEnergy Pennsylvania Electric Company (“FE PA”) (Company) or the four PA Rate Districts¹, as well as the cumulative accomplishments of the Phase IV programs since inception. This report additionally documents the energy savings carried over from Phase III. The Phase III carryover savings count towards Rate District savings compliance targets for Phase IV.

This report details the participation, spending, reported gross, verified gross, and verified net impacts of the energy efficiency programs in PY17. Compliance with Act 129 savings goals is ultimately based on verified gross savings. This report also includes estimates of cost-effectiveness according to the Pennsylvania Total Resource Cost test (TRC).² The Companies have retained Qualus (formerly ADM), Tetra Tech, and Ecometric Consulting (the Qualus team, or Qualus) as an independent evaluation contractor for Phase IV of Act 129. The Qualus team is responsible for the measurement, verification, and calculation of gross verified and net verified savings.

The Qualus team also performed process evaluations to examine the design, administration, implementation, and market response to the EE&C program. This report presents the key findings and recommendations identified by the process evaluation and documents any changes to EE&C program delivery considered based on the recommendations.

¹ In Docket Nos. A-2023-3038771, et. al., The Commission approved FirstEnergy Corp.'s Pennsylvania distribution operating companies' (i.e., Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, and West Penn Power Company) request to merge into FirstEnergy Pennsylvania Electric Company, and be known as “Rate Districts”. For purposes of this report and continuance of Act 129 Phase IV reporting norms, EDC may be used in this report to distinguish compliance targets.

² The Pennsylvania TRC Test for Phase I was adopted by PUC Order at Docket No. M-2009-2108601 on June 23, 2009 (2009 PA TRC Test Order). The TRC Test Order for Phase I later was refined in the same docket on August 2, 2011 (2011 PA TRC Test Order). The 2013 TRC Order for Phase II of Act 129 was issued on August 30, 2012. The 2016 TRC Test Order for Phase III of Act 129 was adopted by PUC Order at Docket No. M-2015-2468992 on June 11, 2015. The 2021 TRC Test Order for Phase IV of Act 129 was adopted by PUC Order at Docket No. M-2019-3006868 on December 19, 2019.

2 Summary of Achievements

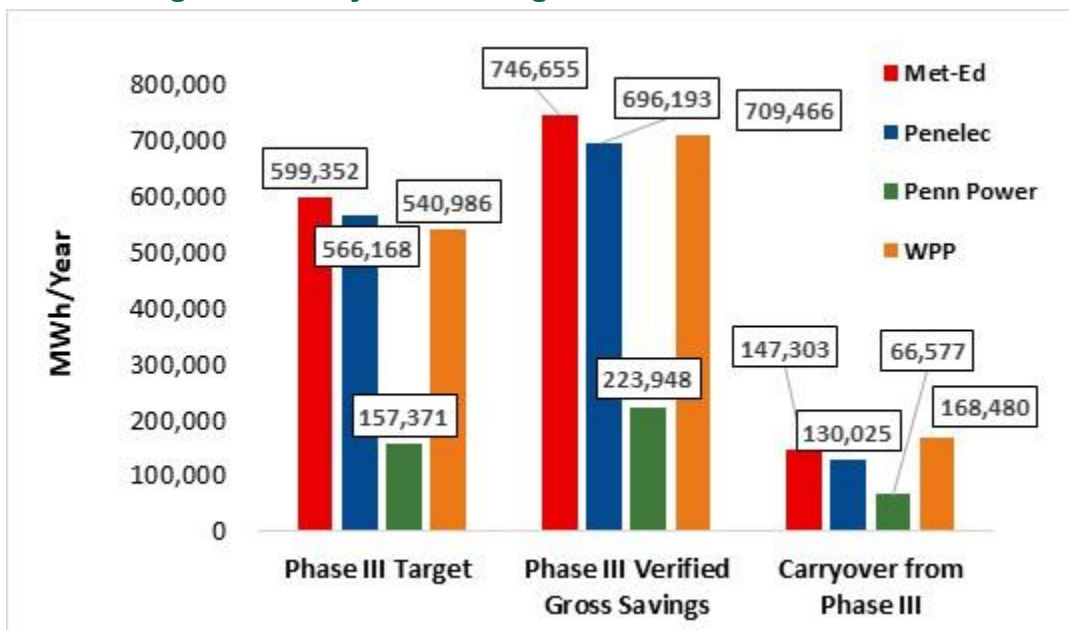
2.1 CARRYOVER SAVINGS FROM PHASE III OF ACT 129

Table 1 shows total MWh/year carryover savings from Phase III for each of the FirstEnergy Rate Districts. Figure 1 compares Phase III verified gross savings total to the Phase III compliance target to illustrate the carryover calculation.

Table 1: Carryover Savings from Phase III

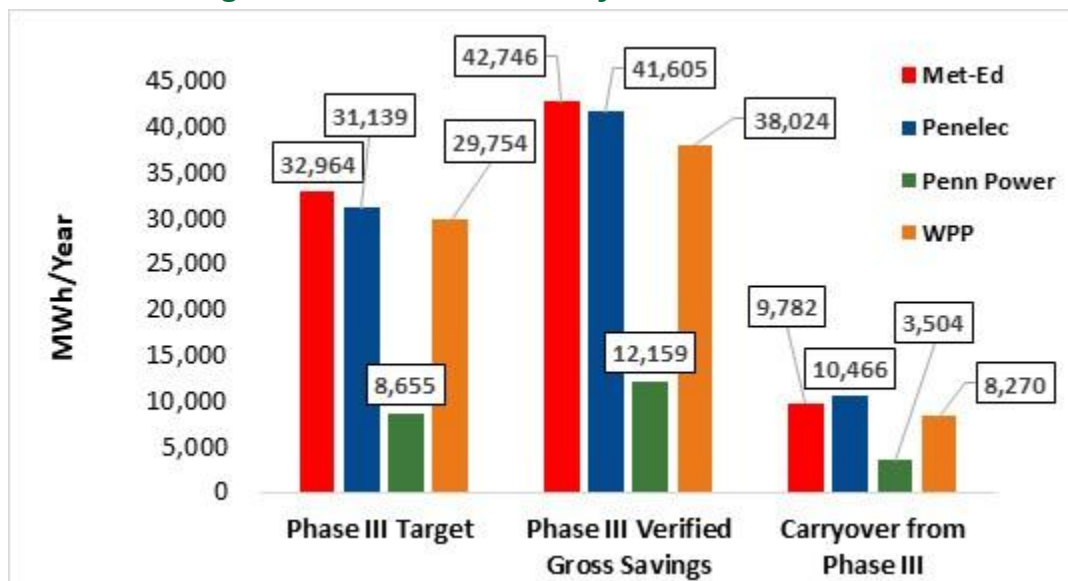
Rate District	Phase IV Carryover Savings (MWh/Year)	Phase IV Low-Income Carryover Savings (MWh/Year)
Met-Ed	147,303	9,782
Penelec	130,025	10,466
Penn Power	66,577	3,504
West Penn Power	168,480	8,270

Figure 1: Carryover Savings from Phase III of Act 129



The Commission's Phase IV Implementation Order³ also allowed for carry over savings in excess of the Phase III Low-Income (LI) savings goal.⁴ Figure 2 shows the calculation of carryover savings for the low-income customer segment.

Figure 2: Low-Income Carryover from Phase III



2.2 PHASE IV ENERGY EFFICIENCY ACHIEVEMENTS TO DATE

Phase IV energy savings targets (MWh) were established at the meter level and peak demand reduction targets (MW) were set at the system level. Accordingly, the MWh totals in this report are presented at the meter level, while peak demand savings are adjusted for transmission and distribution losses to reflect system-level savings. Since the beginning of Program Year 17 on June 1, 2025, the four FirstEnergy PA Rate Districts reported and verified gross electric energy savings and gross peak demand savings are shown in Table 2 below.

³ Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program Implementation Order*, at Docket No. M-2020-3015228, (*Phase IV Implementation Order*), entered June 18, 2020.

⁴ Proportionate to those savings achieved by dedicated low-income programs in Phase III.

Table 2: Gross Reported and Verified Electric and Demand Savings for PY17

Rate District	PYRTD MWh	PYRTD MW	PYVTD MWh	PYVTD MW
Met-Ed	115,249	23.9	115,496	23.4
Penelec	204,209	39.3	168,479	33.2
Penn Power	46,990	10.3	48,891	9.9
West Penn Power	177,762	33.5	162,535	32.1

Since the beginning of Phase IV of Act 129 on June 1, 2021, the four FirstEnergy PA Rate Districts reported and verified gross electric energy savings and gross peak demand savings are shown in Table 3 below.

Table 3: Gross Reported and Verified Electric and Demand Savings since the beginning of Phase IV of Act 129

Rate District	RTD MWh	RTD MW	VTD MWh	VTD MW
Met-Ed	500,016	91.3	495,408	83.8
Penelec	511,079	98.8	458,690	85.6
Penn Power	144,051	28.8	140,913	25.5
West Penn Power	561,393	104.1	530,541	91.4

Achievements toward Phase IV Energy Savings and Demand Reduction compliance, including carryover savings from Phase III, are shown in Table 4 for the four PA Rate Districts⁵.

Table 4: Phase IV Electric Savings including Phase III Carryover

Rate District	VTD +CO MWh	MWh Compliance Target	Percent of Energy Target to Date	VTD MW	MW Compliance Target	Percent of Demand Target to Date
Met-Ed	642,711	463,215	139%	83.8	76	110%
Penelec	588,715	437,676	135%	85.6	80	107%
Penn Power	207,490	128,909	161%	25.5	20	127%
West Penn Power	699,021	504,951	138%	91.4	86	106%

Figure 3 and Figure 4 summarize progress towards the Phase IV MWh and MW portfolio compliance targets, respectively, for each of the four Rate Districts.

⁵ Phase IV electric and demand savings for each rate district include projects as of 8/30/26. There may be negligible outstanding electric and demand savings not accounted for in this report, that bear no impact on the achievement of compliance targets.

Figure 3: EE&C Plan Performance toward Phase IV Portfolio Compliance Target (MWh)

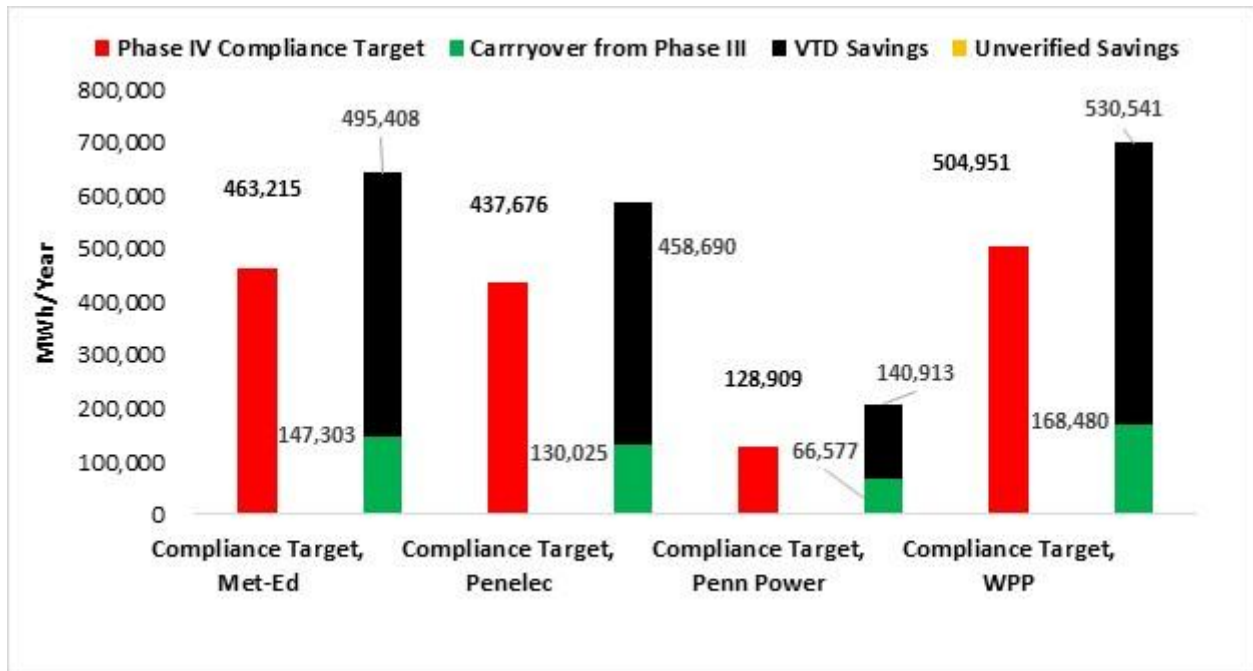
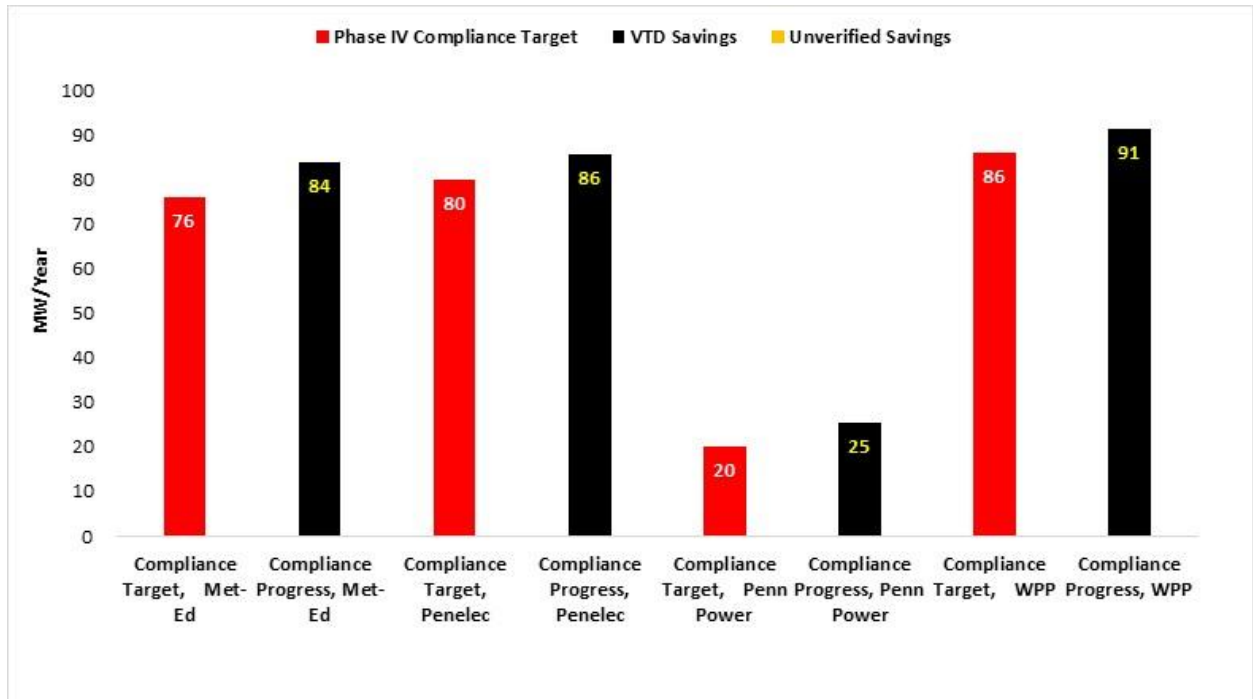


Figure 4: EE&C Plan Performance toward Phase IV Portfolio Compliance Target (MW)



2.2.1.1 Phase IV Carryover

In Phase V, the four Rate Districts, Met-Ed, Penelec, Penn Power, and West Penn Power have merged into the FE PA. Carryover for FE PA into Phase V is the sum of the carryovers for the four Rate Districts.

Table 5 below shows the amount of energy savings carryover, in units of MWh/yr from Phase IV to Phase V. The last row shows combined results for FE PA, and the last column shows the carryover as a percent of the Phase V energy savings target.

Table 5: Phase IV Energy Carryover

EDC/Rate District	VTD MWh	MWh Compliance Target	Phase IV Carryover	% of Phase V Target
Met-Ed	495,408	463,215	32,193	na
Penelec	458,690	437,676	21,014	na
Penn Power	140,913	128,909	12,004	na
West Penn Power	530,541	504,951	25,590	na
FE PA	1,625,552	1,534,751	90,801	8.3%

Table 6 below shows the amount of demand reduction carryover, in units of MW/yr from Phase IV to Phase V. The last row shows combined results for FE PA, and the last column shows the carryover as a percent of the Phase V demand reduction target.

Table 6: Phase IV Peak Demand Carryover

EDC/Rate District	VTD MW	MW Compliance Target	Phase IV Carryover	% of Phase V Target
Met-Ed	84	76	3.9	na
Penelec	86	80	2.8	na
Penn Power	25	20	2.7	na
West Penn Power	91	86	2.7	na
FE PA	286	262	12.1	6.3%

2.2.2 Phase IV Prescription of Low-Income Measures and Carve-Out

The Phase IV Implementation Order directed EDCs to offer conservation measures to the low-income customer segment based on the proportion of electric sales attributable to low-income households. The proportionate number of measures targets for the Rate Districts are listed in the second column of Table 7. The total number of EE&C measures offered by each Rate District to its residential and non-residential customer classes are shown in the third column. The fourth column shows the number of measures available to the low-income customer segment at no cost to the customer. The last column shows the percentages of total measures

offered in the EE&C plan. These percentages exceed the proportionate number of measures targets for each Rate District.

Table 7: Proportion of Measures Offered to Low-Income Customers

Rate District	% Proportionate Number of Measures Target	Total Measures Offered	Number of Measures Available at No Cost	% Measures Offered
Met-Ed	9%	136	29	21%
Penelec	10%	136	29	21%
Penn Power	11%	136	29	21%
West Penn Power	9%	136	29	21%

The PA PUC also established a low-income energy savings target of 5.8% of the portfolio savings goal. The second column of Table 8 shows the low-income savings targets, based on verified gross savings, for each Rate District. The third column of the table shows the verified low-income impacts, inclusive of Phase III carryover. The percentages of the Phase IV low-income energy savings targets achieved to date are shown in the last column of the table.

Table 8: Low-Income Program Energy Savings and Targets⁶

Rate District	Compliance Target	LI VTD +CO MWh	Percent of Target to Date
Met-Ed	26,866	37,475	139%
Penelec	25,385	38,848	153%
Penn Power	7,477	9,340	125%
West Penn Power	29,287	39,096	133%

Looking ahead to Phase V, with the VTD low-income energy savings achieved during Phase IV, FE PA has achieved an estimated low-income carryover energy savings from Phase IV to Phase V as shown in Table 9 below.⁷ This first column represents the Phase IV VTD energy savings in units of MWh/yr. The second column shows the compliance target, and the third column represents the carryover which, as shown in the last column, is 4.3% of the Phase IV low-income carveout savings target.

⁶ The sum of the LI VTD + CO in this table may differ by ± 1 MWh from the sum of the VTD and CO reported in Figure 2 due to rounding. The values in Table 8 result from adding unrounded elements, and then rounding to the nearest MWh.

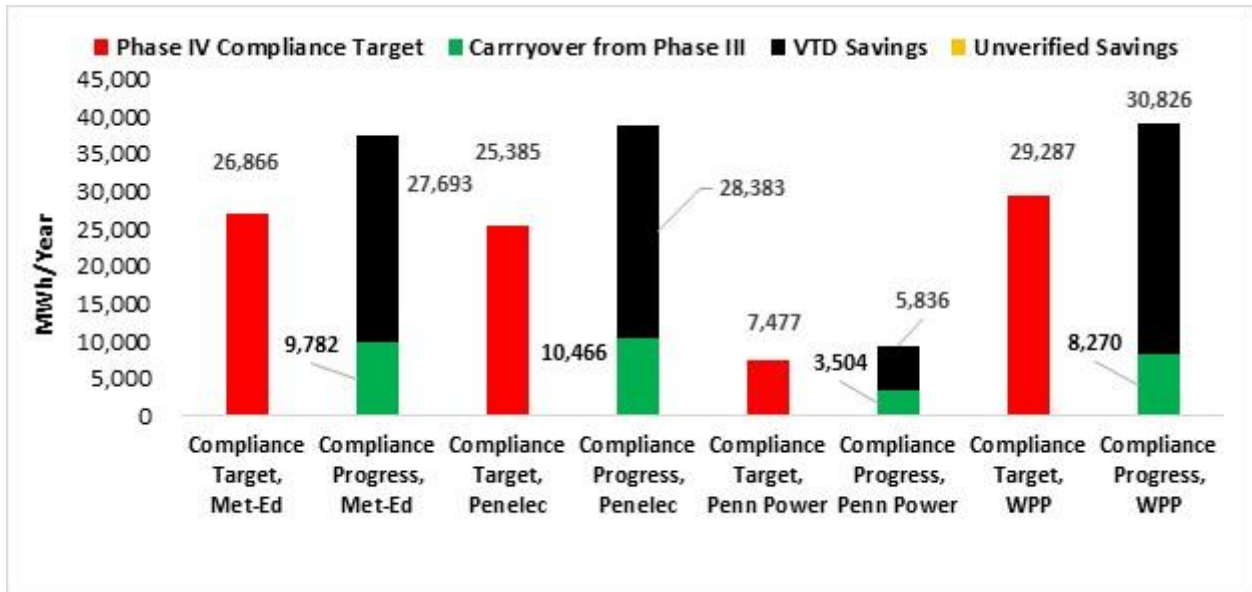
⁷ Carryover of Phase IV MWh is capped at a maximum of 20% of the respective portfolio and low-income consumption reduction targets. See Pennsylvania Public Utility Commission, Energy Efficiency and Conservation Program Implementation Order, at Docket No. M-2025-3052826, (Phase V Implementation Order), entered June 18, 2025. <https://www.puc.pa.gov/pdocs/1883669.pdf>

Table 9: Phase IV Low-Income Energy Savings Carryover

EDC/Rate District	VTD MWh	Compliance Target	Phase IV Carryover	% of Phase V Target
Met-Ed	27,693	26,866	827	na
Penelec	28,383	25,385	2,998	na
Penn Power	5,836	7,477	na	na
West Penn Power	30,826	29,287	1,540	na
FE PA	92,738	89,015	5,364	6.2%

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

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



2.2.3 Phase IV Performance, Multifamily Housing

The first and second column of Table 10 respectively show verified gross electric energy savings (PYVTD) in the multifamily sector and for low-income customers within that sector. based on verified gross savings, for each EDC. The third and fourth columns of the table show Phase IV verified gross electric energy savings (VTD) in the multifamily sector and for low-income customers within that sector.

Table 10: Energy Savings in the Multifamily Sector

Rate District	PYVTD MF MWh	PYVTD MF LI MWh	VTD MF MWh	VTD MF LI MWh
Met-Ed	684	611	3,501	2,831
Penelec	874	621	4,397	3,732
Penn Power	82	75	405	385
West Penn Power	1,362	686	5,821	4,346

2.3 PHASE IV PERFORMANCE BY CUSTOMER SEGMENT

Table 11 presents the participation⁸, savings, and spending by customer sector for PY17. The residential, small C&I, and large C&I sectors are defined by EDC tariff and the residential low-income and governmental/educational/non-profit sector were defined by statute (66 Pa. C.S. § 2806.1). The residential low-income segment is a subset of the residential customer class and the GNI segment will include customers who are part of the Small C&I or Large C&I rate classes. The savings, spending, and participation values for the LI and GNI segments have been removed from the parent sectors in Table 11.

Table 11: Program Year 17 Summary Statistics by Customer Segment

Rate District	Parameter	Residential (Non-LI)	Low Income	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI	Total
Met-Ed	# participants	211,094	22,823	583	270	23	234,793
	PYVTD MWh/yr	51,053	4,866	20,137	37,566	1,874	115,496
	PYVTD MW/yr	11.60	0.58	4.41	6.38	0.45	23.43
	Incentives (\$1000)	\$3,142	\$2,095	\$1,992	\$3,363	\$265	\$10,857
Penelec	# participants	223,388	24,455	1,840	608	83	250,374
	PYVTD MWh/yr	40,352	3,655	40,700	78,538	5,233	168,479
	PYVTD MW/yr	9.92	0.20	9.93	12.35	0.83	33.23
	Incentives (\$1000)	\$3,421	\$1,950	\$3,800	\$6,169	\$935	\$16,276
Penn Power	# participants	82,407	2,880	359	65	9	85,720
	PYVTD MWh/yr	16,201	146	8,163	23,546	836	48,891
	PYVTD MW/yr	3.58	0.03	2.19	3.89	0.18	9.88
	Incentives (\$1000)	\$1,054	\$27	\$736	\$1,699	\$182	\$3,698
West Penn Power	# participants	282,135	37,086	867	282	37	320,407
	PYVTD MWh/yr	52,431	3,761	32,480	73,321	543	162,535
	PYVTD MW/yr	13.61	0.81	7.93	9.64	0.13	32.12
	Incentives (\$1000)	\$4,922	\$1,489	\$2,537	\$5,029	\$86	\$14,063

Table 12 summarizes plan performance by sector since the beginning of Phase IV.

⁸ The definition of participant is discussed in Section 2.4 below.

Table 12: Phase IV Summary Statistics by Customer Segment

Rate District	Parameter	Residential (Non-LI)	Low Income	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI	Total
Met-Ed	# participants	533,291	93,528	2,997	987	120	630,923
	VTD MWh/yr	160,071	25,322	105,956	198,884	5,175	495,408
	VTD MW	28.7	3.4	21	30	1	83.8
	Incentives (\$1000)	\$18,685	\$8,782	\$18,357	\$11,388	\$1,048	\$58,260
Penelec	# participants	657,073	83,188	6,054	1,549	217	748,081
	VTD MWh/yr	120,962	25,820	151,865	151,239	8,804	458,690
	VTD MW	23.0	2.5	33	25	1	85.2
	Incentives (\$1000)	\$14,405	\$11,160	\$23,872	\$12,117	\$1,832	\$63,386
Penn Power	# participants	200,961	17,789	1,245	259	61	220,315
	VTD MWh/yr	49,883	5,563	32,007	50,756	2,703	140,913
	VTD MW	8.9	0.8	7	8	0	25.5
	Incentives (\$1000)	\$6,040	\$2,528	\$5,469	\$4,050	\$572	\$18,658
West Penn Power	# participants	782,883	103,419	4,919	975	150	892,346
	VTD MWh/yr	146,633	28,646	138,940	169,181	47,141	530,541
	VTD MW	29.9	3.9	27	25	6	91.4
	Incentives (\$1000)	\$19,257	\$10,921	\$21,936	\$13,267	\$1,789	\$67,171

2.4 SUMMARY OF PARTICIPATION BY PROGRAM

Participation is defined differently for certain programs depending on the program delivery channel and data tracking practices. The nuances of the participant definition vary by program and are summarized by program in the bullets below. Table 13 provides the current participation totals for PY17 and Phase IV.

- For the Appliance Recycling components of the Energy Efficient Products, Low-Income Energy Efficiency Program, and Energy Solutions for Business – Small Program, participation is the count of rebate applications, which corresponds to appliance pick-up events. If a homeowner recycles two refrigerators on one occasion, that counts as one participant.
- For the Home Energy Reports and Online Audit components of the Energy Efficient Homes and Low-Income Energy Efficiency Programs, the number of participants is taken as the maximum number of participants in the treatment group during the year. This definition of participant is selected because it aligns with the gross impact evaluation protocol for Home Energy Reports.
- For the Conservation Kits components of the Energy Efficient Homes Program and Low-Income Energy Efficiency Programs, the participant counts are equal to the overall count of kits distributed by each program. In nearly all cases, one kit is sent to a household.
- For the Residential New Construction components of the Energy Efficient Homes Program and Low-Income Energy Efficiency Programs, the participant count is equal to the number of houses (or in the case of multifamily housing, the number of dwelling units).

- For the Direct Install component of the Energy Efficient Homes Program, the participant count is equal to the number of rebate homes treated in the program.
- For Midstream Appliances component of the Energy Efficient Products Program, the participant count is equal to the number of appliances sold.
- For the HVAC component of the Energy Efficient Products Program, the participant count is equal to the sum of HVAC units and HVAC tune-ups rebated by the program. If a customer purchases multiple HVAC units or tune-ups, then the customer counts as two participants. Most rebate applications, however, are for a single HVAC system or service.
- For the Appliances components of the Energy Efficient Products Program and the Low-Income Energy Efficiency Program, the participant count is equal to the sum of rebate applications. If a customer purchases multiple appliances and submits one application for them all, then the customer counts as one participant. If a customer submits multiple rebate applications, then they count as multiple participants.
- For the Direct Install component of the Low-Income Energy Efficiency Program, the participant count is equal to the number of homes treated in the program.
- For the downstream and midstream rebates in all nonresidential energy efficiency programs, the participant count is equal to the number of unique account numbers associated with rebate applications for the program year.

Table 13: EE&C Portfolio Participation by Program

Rate District	Program	PY17 Participation	P4TD Participation
Met-Ed	Energy Efficient Homes	199,742	434,937
	Energy Efficient Products	11,352	98,354
	Low Income Energy Efficiency	22,823	93,528
	C&I Energy Solutions for Business - Small	601	3,084
	C&I Energy Solutions for Business - Large	275	1,020
	Portfolio Total	234,793	630,923
Penelec	Energy Efficient Homes	188,072	522,880
	Energy Efficient Products	35,316	134,193
	Low Income Energy Efficiency	24,455	83,188
	C&I Energy Solutions for Business - Small	1,900	6,221
	C&I Energy Solutions for Business - Large	631	1,599
	Portfolio Total	250,374	748,081
Penn Power	Energy Efficient Homes	79,885	170,659
	Energy Efficient Products	2,522	30,302
	Low Income Energy Efficiency	2,880	17,789
	C&I Energy Solutions for Business - Small	366	1,294
	C&I Energy Solutions for Business - Large	67	271
	Portfolio Total	85,720	220,315
West Penn Power	Energy Efficient Homes	240,231	630,512
	Energy Efficient Products	41,904	152,371
	Low Income Energy Efficiency	37,086	103,419
	C&I Energy Solutions for Business - Small	903	5,056
	C&I Energy Solutions for Business - Large	283	988
	Portfolio Total	320,407	892,346

2.5 SUMMARY OF IMPACT EVALUATION RESULTS

During PY17 the Qualus team completed gross impact evaluations for all the energy efficiency programs in the portfolio, and all program components except for Appliance Recycling, Residential and Commercial New Construction and Multifamily, Residential Direct Install (both Low-Income and non-Low-Income), and Nonresidential Prescriptive Downstream Appliances. The Qualus team completed net impact evaluation for the Residential and Commercial Multifamily, School Education and Energy Efficiency Kits (both low-income and non-low-income), Residential Comprehensive Audits, and Residential HVAC initiatives. Table 14 and Table 15 summarize the realization rates and net-to-gross ratios by program. Initiative-level evaluation detail is available in the Appendices to this report.

Table 14: Impact Evaluation Results Summary for Met-Ed and Penelec

Program Component	Program	Met-Ed			Penelec		
		Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio
EE Kits	Energy Efficient Homes	87.7%	88.0%	83.1%	97.6%	96.2%	106.7%
Home Energy Reports	Energy Efficient Homes	165.6%	510.5%	100.0%	52.1%	727.8%	100.0%
Direct Install	Energy Efficient Homes	81.5%	80.1%	41.3%	91.0%	97.6%	41.3%
New Homes	Energy Efficient Homes	101.3%	108.8%	72.0%	100.7%	90.8%	72.0%
Multifamily	Energy Efficient Homes	100.1%	76.7%	99.5%	98.3%	82.3%	99.5%
Online Audits	Energy Efficient Homes	158.8%	258.8%	100.0%	159.1%	231.6%	100.0%
Appliance Recycling	Energy Efficient Products	106.8%	108.0%	62.0%	97.9%	112.2%	60.0%
HVAC	Energy Efficient Products	118.0%	129.1%	50.6%	103.8%	108.3%	69.7%
Appliances	Energy Efficient Products	103.7%	106.4%	67.9%	64.5%	58.7%	49.4%
Midstream Appliances	Energy Efficient Products	100.0%	98.0%	57.6%	100.7%	97.0%	47.8%
Appliances	Low Income Program	103.7%	106.4%	100.0%	64.5%	58.7%	100.0%
Appliance Turn-In	Low Income Program	101.1%	123.0%	100.0%	103.4%	117.2%	100.0%
Direct Install	Low Income Program	97.7%	99.8%	100.0%	104.2%	104.9%	100.0%
Home Energy Reports	Low Income Program	-2866.4%	499.5%	100.0%	-815.1%	-450.2%	100.0%
Kits	Low Income Program	97.2%	101.2%	100.0%	108.7%	114.4%	100.0%
New Homes	Low Income Program	101.3%	108.8%	100.0%	100.7%	90.8%	100.0%
Online Audits	Low Income Program	189.2%	277.0%	100.0%	225.5%	306.4%	100.0%
CI Prescriptive	C&I Solutions for Business Programs - Small and Large	95.4%	84.7%	70.8%	70.2%	73.6%	65.9%
CI Custom	C&I Solutions for Business Programs - Small and Large	101.4%	101.2%	47.6%	93.0%	97.0%	49.9%
CI EMNC	C&I Solutions for Business Programs - Small and Large	97.6%	100.7%	76.2%	96.7%	79.4%	78.5%
CI Multifamily	C&I Solutions for Business Program - Small	100.9%	91.1%	99.5%	0.0%	0.0%	0.0%
Appliance Recycling	C&I Solutions for Business Program - Small	106.8%	108.0%	62.0%	97.9%	112.2%	60.0%

Table 15: Impact Evaluation Results Summary for Penn Power and WPP

Program Component	Program	Penn Power			West Penn Power		
		Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio
EE Kits	Energy Efficient Homes	87.3%	87.5%	86.4%	89.3%	89.3%	96.6%
Home Energy Reports	Energy Efficient Homes	464.5%	185.7%	100.0%	45.7%	253.2%	100.0%
Direct Install	Energy Efficient Homes	93.2%	101.3%	41.3%	105.5%	105.7%	41.3%
New Homes	Energy Efficient Homes	103.6%	96.3%	72.0%	100.9%	111.6%	72.0%
Multifamily	Energy Efficient Homes	106.2%	78.3%	99.5%	98.3%	78.4%	99.5%
Online Audits	Energy Efficient Homes	167.9%	278.4%	100.0%	158.1%	252.7%	100.0%
Appliance Recycling	Energy Efficient Products	na*	na	na*	95.4%	111.3%	66.0%
HVAC	Energy Efficient Products	130.8%	139.8%	54.7%	104.3%	105.3%	54.8%
Appliances	Energy Efficient Products	95.8%	91.3%	52.3%	51.7%	51.9%	52.2%
Midstream Appliances	Energy Efficient Products	97.8%	96.5%	50.2%	100.6%	96.9%	50.0%
Appliances	Low Income Program	na*	na	na*	51.7%	51.9%	100.0%
Appliance Turn-In	Low Income Program	na*	na	na*	112.9%	129.6%	100.0%
Direct Install	Low Income Program	na*	na	na*	103.8%	105.4%	100.0%
Home Energy Reports	Low Income Program	56.9%	135.2%	100.0%	13.6%	585.1%	100.0%
Kits	Low Income Program	87.3%	87.5%	86.4%	89.3%	89.3%	100.0%
New Homes	Low Income Program	103.6%	96.3%	72.0%	100.9%	111.6%	100.0%
Online Audits	Low Income Program	201.0%	301.9%	100.0%	197.5%	290.5%	100.0%
CI Prescriptive	C&I Solutions for Business Programs - Small and Large	94.0%	87.3%	80.1%	91.4%	73.7%	67.4%
CI Custom	C&I Solutions for Business Programs - Small and Large	103.9%	104.0%	55.7%	100.9%	101.5%	55.7%
CI EMNC	C&I Solutions for Business Programs - Small and Large	80.8%	64.7%	77.3%	90.3%	99.8%	78.1%
CI Multifamily	C&I Solutions for Business Program - Small	102.9%	102.9%	99.5%	96.9%	96.8%	99.5%
Appliance Recycling	C&I Solutions for Business Program - Small	na*	na	na*	95.4%	111.3%	66.0%

* fields denoted by “na” correspond to programs that had no participation in PY17

2.6 SUMMARY OF ENERGY IMPACTS BY PROGRAM

Act 129 compliance targets are based on annualized savings estimates (MWh/year). Each program year, the annual savings achieved by EE&C program activity are recorded as incremental annual, or “first-year”, savings and added to an EDC’s progress toward compliance. Incremental annual savings estimates are presented in Section 2.6.1. Lifetime energy savings incorporate the Effective Useful Life (EUL) of installed measures and estimate the total energy savings associated with EE&C program activity. Lifetime savings are used in the TRC test, by program participants when assessing the economics of upgrades, and by the SWE when calculating the emissions benefits of Act 129 programs. Section 2.6.2 presents the lifetime energy savings by program.

2.6.1 Incremental Annual Energy Savings by Program

Table 16, Table 17, Table 18, and Table 19 present a summary of the Program Year 17 and Phase IV to date incremental annual energy savings by program for Met-Ed, Penelec, Penn Power, and WPP respectively. As discussed earlier, the energy impacts in this report are

presented at the meter level and do not reflect adjustments for transmission and distribution losses, while the demand impacts do reflect those losses. The verified gross savings are the reported gross savings adjusted by the energy realization rate and the verified net savings are the reported gross savings adjusted by both the realization rate and the net-to-gross ratio.

Table 16: Incremental Annual Energy Savings by Program - Met-Ed

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	46,208	45,716	31,971	128,334	116,586	93,349
Energy Efficient Products	4,928	5,337	3,155	39,072	43,491	21,722
Low Income Program	3,039	4,866	4,866	22,460	25,315	25,315
C&I Solutions for Business Program - Small	21,862	21,415	14,770	109,963	109,398	77,368
C&I Solutions for Business Program - Large	39,212	38,162	27,069	200,187	200,617	124,129
Portfolio Total	115,249	115,496	81,831	500,016	495,408	341,884

Table 17: Incremental Annual Energy Savings by Program - Penelec

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	37,933	32,973	24,701	106,113	89,389	78,703
Energy Efficient Products	8,369	7,379	4,047	31,488	31,480	17,893
Low Income Program	2,579	3,655	3,655	23,113	25,913	25,913
C&I Solutions for Business Program - Small	55,513	42,589	28,475	174,417	155,964	109,758
C&I Solutions for Business Program - Large	99,815	81,882	57,153	175,948	155,944	106,080
Portfolio Total	204,209	168,479	118,031	511,079	458,690	338,347

Table 18: Incremental Annual Energy Savings by Program – Penn Power

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	12,621	15,695	11,248	38,280	39,915	32,133
Energy Efficient Products	458	506	267	9,511	9,958	4,637
Low Income Program	201	146	146	6,256	5,573	5,573
C&I Solutions for Business Program - Small	9,073	8,520	6,446	36,158	33,353	26,860
C&I Solutions for Business Program - Large	24,637	24,024	16,108	53,845	52,113	37,181
Portfolio Total	46,990	48,891	34,215	144,051	140,913	106,384

Table 19: Incremental Annual Energy Savings by Program - WPP

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	50,522	43,779	30,839	138,753	107,886	93,385
Energy Efficient Products	10,566	8,652	4,830	38,563	38,743	22,558
Low Income Program	3,935	3,761	3,761	28,103	28,651	28,651
C&I Solutions for Business Program - Small	35,768	33,022	22,222	143,873	143,197	105,427
C&I Solutions for Business Program - Large	76,970	73,321	46,648	212,102	212,065	136,573
Portfolio Total	177,762	162,535	108,299	561,393	530,541	386,595

The previously reported VTD savings from prior years have not changed.

2.6.2 Lifetime Energy Savings by Program

Table 20, Table 21, Table 22, and Table 23 present the PYTD and Phase IV to date lifetime energy savings by program for Met-Ed, Penelec, Penn Power, and WPP respectively. Lifetime savings are calculated by using expected useful lives (EULs) listed in the PA TRM for each measure, subject to a 15-year cap. For commercial and industrial projects, the measure lives are first determined for each sampled project during gross impact evaluation. The measure lives are then weighted by sampling initiative and EDC as the ratio between verified lifetime energy savings and program-year verified savings. This step is conducted in part because measure lives, as determined post-verification, may differ from ex-ante measure lives in the tracking database⁹, and in part to maintain consistency between verified impacts, measure lives, and incremental costs for all sampled projects. For cases that involve early replacement, the measure life is adjusted to replicate the effect of a dual-baseline benefits stream. This involves calculating a discounted lifetime savings for the measure with the first period corresponding to the remaining useful life (RUL) of the supplanted equipment (taken to be 1/3 of the measure life) and using the supplanted equipment as the baseline, and with the second period using the prevailing code or standard at the end of the RUL as the baseline. The adjustment factor for measure life is the ratio of the discounted lifetime savings with the dual-baseline approach compared to the discounted lifetime savings as calculated by using the first-year savings for the duration of the nominal measure life.

Table 20: Lifetime Energy Savings by Program for Met-Ed

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Energy Efficient Homes	487,235	287,052	1,162,248	835,451
Energy Efficient Products	44,747	25,520	398,062	201,100
Low Income Energy Efficiency	28,346	28,346	182,573	182,573
C&I Energy Solutions for Business - Small	306,080	209,336	1,562,086	1,094,094
C&I Energy Solutions for Business - Large	524,806	370,673	2,915,165	1,795,090
Portfolio Total	1,391,214	920,926	6,220,133	4,108,308

⁹ For example, a project may consist of various measures with different lifetimes can have different realization rates by measure.

Table 21: Lifetime Energy Savings by Program for Penelec

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Energy Efficient Homes	405,021	280,793	1,013,168	857,383
Energy Efficient Products	69,029	37,736	286,902	159,514
Low Income Energy Efficiency	22,702	22,702	198,496	198,496
C&I Energy Solutions for Business - Small	624,941	416,405	2,258,653	1,578,722
C&I Energy Solutions for Business - Large	1,204,262	839,686	2,276,866	1,546,822
Portfolio Total	2,325,955	1,597,322	6,034,086	4,340,937

Table 22: Lifetime Energy Savings by Program for Penn Power

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Energy Efficient Homes	164,177	98,515	414,448	302,751
Energy Efficient Products	6,409	3,389	95,582	45,330
Low Income Energy Efficiency	293	293	37,942	37,942
C&I Energy Solutions for Business - Small	126,404	95,439	483,897	388,409
C&I Energy Solutions for Business - Large	350,225	233,555	758,257	537,128
Portfolio Total	647,507	431,190	1,790,126	1,311,559

Table 23: Lifetime Energy Savings by Program for WPP

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Energy Efficient Homes	535,868	345,651	1,220,304	1,005,621
Energy Efficient Products	82,937	44,731	351,724	194,407
Low Income Energy Efficiency	32,970	32,970	232,865	232,865
C&I Energy Solutions for Business - Small	487,947	327,459	2,076,243	1,516,814
C&I Energy Solutions for Business - Large	1,086,099	690,230	3,126,467	2,008,674
Portfolio Total	2,225,821	1,441,040	7,007,604	4,958,381

The previously reported VTD lifetime savings from prior years have not changed.

2.7 SUMMARY OF DEMAND IMPACTS BY PROGRAM

Act 129 defines peak demand savings from energy efficiency as the average expected reduction in electric demand from 2:00 p.m. to 6:00 p.m. EDT on non-holiday weekdays from June through August. The peak demand impacts from energy efficiency in this report are presented at the system level, meaning they have been adjusted to account for transmission and distribution losses. Table 24 lists the line loss multipliers by Rate District and by sector.

Table 24: Line Loss Multipliers by Rate District and Customer Sector

Sector	Met-Ed	Penelec	Penn Power	WPP
Residential	1.0945	1.0945	1.0949	1.0943
Small C&I	1.0720	1.0720	1.0545	1.0790
Large C&I	1.0720	1.0720	1.0545	1.0790

Summaries of the peak demand impacts by energy efficiency program through the current reporting period are presented in Table 25, Table 26, Table 27, and Table 28 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 25: Peak Demand Savings by Energy Efficiency Program for Met-Ed

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	10.40	10.09	5.90	25.92	19.37	13.83
Energy Efficient Products	1.38	1.51	0.91	8.86	9.31	4.67
Low Income Energy Efficiency	0.43	0.58	0.58	3.39	3.41	3.41
C&I Energy Solutions for Business - Small	4.83	4.70	3.02	22.43	21.32	14.46
C&I Energy Solutions for Business - Large	6.82	6.55	4.63	30.70	30.40	18.99
Portfolio Total	23.86	23.43	15.04	91.30	83.82	55.35

Table 26: Peak Demand Savings by Energy Efficiency Program for Penelec

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	7.57	8.24	4.87	17.93	15.85	12.18
Energy Efficient Products	1.69	1.67	0.93	7.16	7.18	4.11
Low Income Energy Efficiency	0.42	0.20	0.20	2.92	2.50	2.50
C&I Energy Solutions for Business - Small	13.25	10.29	6.70	40.03	34.22	23.66
C&I Energy Solutions for Business - Large	16.34	12.82	8.73	30.73	25.80	17.23
Portfolio Total	39.26	33.23	21.44	98.77	85.55	59.67

Table 27: Peak Demand Savings by Energy Efficiency Program for Penn Power

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	3.35	3.48	1.91	8.63	6.79	4.69
Energy Efficient Products	0.09	0.10	0.05	2.07	2.10	0.97
Low Income Energy Efficiency	0.02	0.03	0.03	1.09	0.82	0.82
C&I Energy Solutions for Business - Small	2.54	2.26	1.66	8.22	7.43	5.82
C&I Energy Solutions for Business - Large	4.32	4.00	2.65	8.79	8.36	5.95
Portfolio Total	10.32	9.88	6.31	28.81	25.49	18.25

Table 28: Peak Demand Savings by Energy Efficiency Program for WPP

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	10.13	11.69	7.24	27.89	21.47	16.58
Energy Efficient Products	2.06	1.92	1.12	8.43	8.38	4.99
Low Income Energy Efficiency	0.51	0.81	0.81	3.77	3.95	3.95
C&I Energy Solutions for Business - Small	9.99	8.06	5.30	31.96	28.00	19.87
C&I Energy Solutions for Business - Large	10.79	9.64	6.23	32.02	29.59	19.44
Portfolio Total	33.48	32.12	20.71	104.08	91.39	64.83

Penelec's previously reported VTD demand reductions have increased by 0.307. In PY15, Qualus evaluated a large solar project and determined that the annual generation exceeded the facility's energy usage. Qualus capped the facility's annual energy usage, and also capped the peak demand using the ratio of capped to uncapped energy savings. However, this is not consistent with the Solar Photovoltaic Interim Measure Protocol (IMP) rules. Consequently, Qualus resubmitted the energy and demand calculations to SWE. As a result of removing the cap on demand reduction, the VTD MW for Penelec increased by 0.307 MW, which is the product of 0.286 increased demand reduction at the meter and a 1.072 line loss factor for Penelec.

2.7.1 Peak Demand Savings Nominated to PJM Forward Capacity Market (FCM)

Table 29, Table 30, Table 31, and Table 32 summarize the potential PJM Phase IV peak demand savings by Act 129 program year and PJM delivery year for Met-Ed, Penelec, Penn Power, and West Penn Power. All values shown below represent installed capacity as defined in PJM Manual 18. Note that the only PY16 contributions reflected below are those that have been verified in time for the 2025/26 Post-Install report, which was due in early May 2025. Had there been a DY26/27, then more of the PY16, and some of the PY16 impacts would have been reflected in the tables.

Table 29: Met-Ed Potential FCM Nominations by PY & PJM Delivery Year

Act 129 Program Year	Estimated MW Acquisition for FCM	DY 23/24 MW Range	DY 24/25 MW Range	DY 25/26 MW Range	DY 26/27 MW Range	DY 27/28 MW Range	DY 28/29 MW Range	DY 29/30 MW Range
PY13	3.7	3.8	3.7	0.0				
PY14	3.2	2.5	3.2	0.0	0			
PY15	2.2		2.2	3.2	0	0		
PY16	2.4 to 4.2			0.6	0	0	0	
PY17	0				0	0	0	0
Phase IV Total	12.0 to 21.0	6.3	9.2	3.8	0 to 0	0 to 0	0 to 0	0 to 0

Table 30: Penelec Potential FCM Nominations by PY & PJM Delivery Year

Act 129 Program Year	Estimated MW Acquisition for FCM	DY 23/24 MW Range	DY 24/25 MW Range	DY 25/26 MW Range	DY 26/27 MW Range	DY 27/28 MW Range	DY 28/29 MW Range	DY 29/30 MW Range
PY13	3.1	2.5	3.1	0.0				
PY14	3.9	1.8	3.9	0.0	0			
PY15	2.1		2.1	2.4	0	0		
PY16	2.8 to 4.2			0.7	0	0	0	
PY17	0				0	0	0	0
Phase IV Total	14.0 to 21.0	4.2	9.2	3.1	0 to 0	0 to 0	0 to 0	0 to 0

Table 31: Penn Power Potential FCM Nominations by PY & PJM Delivery Year

Act 129 Program Year	Estimated MW Acquisition for FCM	DY 23/24 MW Range	DY 24/25 MW Range	DY 25/26 MW Range	DY 26/27 MW Range	DY 27/28 MW Range	DY 28/29 MW Range	DY 29/30 MW Range
PY13	0.6	0.8	0.6	0.0				
PY14	0.7	0.4	0.7	0.0	0			
PY15	0.5		0.5	1.1	0	0		
PY16	0.8 to 1.2			0.6	0	0	0	
PY17	0				0	0	0	0
Phase IV Total	4.0 to 6.0	1.2	1.8	1.7	0 to 0	0 to 0	0 to 0	0 to 0

Table 32: WPP Potential FCM Nominations by PY & PJM Delivery Year

Act 129 Program Year	Estimated MW Acquisition for FCM	DY 23/24 MW Range	DY 24/25 MW Range	DY 25/26 MW Range	DY 26/27 MW Range	DY 27/28 MW Range	DY 28/29 MW Range	DY 29/30 MW Range
PY13	2.5	3.3	2.5	0.0				
PY14	3.8	2.6	3.8	0.0	0			
PY15	2.9		2.9	5.6	0	0		
PY16	2.3 to 4.1			0.9	0	0	0	
PY17	0				0	0	0	0
Phase IV Total	11.5 to 20.5	6	9.2	6.6	0 to 0	0 to 0	0 to 0	0 to 0

The values in the tables above remain consistent with the original estimated ranges of the PJM Summer and Winter MW EE potential for each PJM delivery year as shown in Appendix C, Table C-3 based on the MWh savings as projected in the EE&C Plan, based on the following assumptions and modifications:

- Identified and removed energy savings of all measures not eligible for PJM including:
 - appliance recycling;
 - building lighting controls and occupancy sensors;
 - smart thermostats, energy management systems or smart homes;
 - behavioral and educational programs;
- Excluded some low-volume measures for which PJM-required M&V activities would likely cost more than the associated PJM revenues.

- The Rate Districts retain all Phase IV Plan program Capacity Rights to support their offered EE resources and to ensure no double counting of EE resources by third parties;
- Assigned an initial savings load shape to each PJM eligible EE measure; Estimated the potential kW savings values for each measure for the PJM defined Summer and Winter periods using the appropriate load shape curve; and
- Included T & D line losses to adjust retail kW values to wholesale kW values.

Offers associated with PY13 through PY16 reflect measurement and verification results from the DY 23/24 through DY 25/26 Post-Install Measurement and Verification reports.

DY 25/26 was the final year for which PJM accepted energy efficiency offers in the FCM. Additional offers are not anticipated beyond DY 25/26.

Revenues from PJM's FCM will be used to offset cost recovery on a per customer class basis. PJM revenues will be treated as program cost reductions, and market participation costs or deficiency charges (if any), will be treated as program cost increases.

2.8 SUMMARY OF FUEL SWITCHING IMPACTS

Act 129 allows EDCs to achieve electric savings by converting electric equipment to non-electric equipment. Table 33 summarizes for each Rate District, key fuel switching metrics to date in Phase IV. Combined Heat and Power (CHP), fuel cells, and solar water heating are the only fuel switching measures offered in Phase IV. In PY17, West Penn Power provided incentives for one fuel cell project.

Table 33: Phase IV to Date Fuel Switching Summary

	Met-Ed	Penelec	Penn Power	WPP
Fuel Switching Measures Offered	CHP, Solar Water Heaters			
Fuel Switching Measures Implemented in PY17	None	None	None	Fuel Cell
Fuel Switching Measures Implemented in Phase IV	CHP, Fuel Cell	CHP	None	CHP, Fuel Cell
PY17 Energy Savings Achieved via Fuel Switching (MWh/yr)	0	0	0	11,725
PY17 Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	0	0	0	85,779
PY17 Incentive Payments for Fuel Switching Measures (\$1000)	0	0	0	200
VTD Energy Savings Achieved via Fuel Switching (MWh/yr)	78,339	2,878	0	52,964
P4TD Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	425,106	92,381	0	295,529
P4TD Incentive Payments for Fuel Switching Measures (\$1000)	1,170	399	0	700

2.9 SUMMARY OF RENEWABLE ENERGY IMPACTS

Act 129 allows EDCs to incentivize behind-the-meter solar photovoltaics and other renewable energy generation measures that offset the need for electricity from the grid. Table 34 summarizes the energy savings, peak demand reduction, and incentive totals for renewable energy measures in PY17 and Phase IV to date.

Table 34: Renewables Summary

Metric	Met-Ed		Penelec		Penn Power		WPP	
	PY17	P4TD	PY17	P4TD	PY17	P4TD	PY17	P4TD
Renewable Energy Measures Implemented	Solar Power	Solar Power	Solar Power	Solar Power	Solar Power	Solar Power	Solar Power	Solar Power
VTD Residential Energy Savings Achieved via Renewables (MWh/yr)	18,713	18,801	15,067	15,166	5,951	5,951	19,055	19,105
VTD Residential Peak Demand Savings Achieved via Renewables (MW/yr)	5.87	5.89	5.31	5.33	2.15	2.15	6.37	6.39
Incentive Payments for Residential Renewable Energy Measures (\$1000)	105.35	108.35	72.20	74.70	26.75	26.75	79.85	81.85
VTD Non-Residential Energy Savings Achieved via Renewables (MWh/yr)	5,682	17,016	4,900	14,145	2,145	3,121	4,213	6,884
VTD Non-Residential Peak Demand Savings Achieved via Renewables (MW/yr)	2.03	4.83	3.50	6.38	0.86	1.20	1.72	2.44
Incentive Payments for Non-Residential Renewable Energy Measures (\$1000)	434.78	1,551.03	332.41	1,166.82	158.86	220.78	227.89	475.02

2.10 SUMMARY OF COST-EFFECTIVENESS RESULTS

A detailed breakdown of portfolio finances and cost-effectiveness is presented for Met-Ed, Penelec, Penn Power, and West Penn Power in Table 35, Table 36, Table 37, and Table 38. TRC benefits in these tables were calculated using gross verified impacts. Net present value (NPV) PY17 costs and benefits are expressed in 2025 dollars. Net present value costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 35: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)	
1	IMCs	74,293		178,428	
2	Rebates to Participants and Trade Allies	7,955		35,097	
3	Upstream / Midstream Incentives	319		4,802	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,219		10,499	
5	Direct Installation Program Materials and Labor	2,705		7,857	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	61,096		120,173	
		EDC	CSP	EDC	CSP
7	Program Design	2	0	31	51
8	Administration and Management	-234	449	2,889	13,451
9	Marketing	0	165	130	2,903
10	Program Delivery	662	11,415	769	13,599
11	EDC Evaluation Costs	1,154		3,955	
12	SWE Audit Costs	169		1,159	
13	Program Overhead Costs (Sum of rows 7 through 12)	13,781		38,938	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	88,074		217,365	
15	Total NPV Lifetime Electric Energy Benefits	45,879		171,113	
16	Total NPV Lifetime Electric Capacity Benefits	33,486		97,449	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	4,449		1,500	
18	Total NPV Lifetime Fossil Fuel Impacts	-307		-12,863	
19	Total NPV Lifetime Water Impacts	4,705		21,002	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	88,212		278,201	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	1.00		1.28	

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

Table 36: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)	
1	IMCs	76,754		147,297	
2	Rebates to Participants and Trade Allies	9,660		32,964	
3	Upstream / Midstream Incentives	5,214		9,389	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,294		10,280	
5	Direct Installation Program Materials and Labor	2,616		10,752	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	56,970		83,912	
		EDC	CSP	EDC	CSP
7	Program Design	2	0	28	47
8	Administration and Management	-181	983	2,806	12,177
9	Marketing	0	19	125	2,480
10	Program Delivery	640	8,978	731	11,105
11	EDC Evaluation Costs	1,014		3,592	
12	SWE Audit Costs	153		1,051	
13	Program Overhead Costs (Sum of rows 7 through 12)	11,607		34,142	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	88,361		181,439	
15	Total NPV Lifetime Electric Energy Benefits	76,664		166,570	
16	Total NPV Lifetime Electric Capacity Benefits	45,414		98,335	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	6,033		10,014	
18	Total NPV Lifetime Fossil Fuel Impacts	-1,344		-7,662	
19	Total NPV Lifetime Water Impacts	5,962		22,586	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	132,729		289,843	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	1.50		1.60	

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

Table 37: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)	
1	IMCs	21,959		53,248	
2	Rebates to Participants and Trade Allies	3,163		11,277	
3	Upstream / Midstream Incentives	708		2,213	
4	Material Cost for Self-Install Programs (EE&C Kits)	494		2,559	
5	Direct Installation Program Materials and Labor	131		2,608	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	17,464		34,591	
		EDC	CSP	EDC	CSP
7	Program Design	0	0	8	14
8	Administration and Management	-140	40	980	3,662
9	Marketing	0	1	38	751
10	Program Delivery	196	1,863	236	2,885
11	EDC Evaluation Costs	292		1,024	
12	SWE Audit Costs	48		326	
13	Program Overhead Costs (Sum of rows 7 through 12)	2,298		9,925	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	24,257		63,174	
15	Total NPV Lifetime Electric Energy Benefits	22,120		51,533	
16	Total NPV Lifetime Electric Capacity Benefits	9,433		19,796	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	546		6,086	
18	Total NPV Lifetime Fossil Fuel Impacts	4		-47	
19	Total NPV Lifetime Water Impacts	829		4,922	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	32,932		82,289	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	1.36		1.30	

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

Table 38: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)	
1	IMCs	76,329		161,642	
2	Rebates to Participants and Trade Allies	9,114		37,748	
3	Upstream / Midstream Incentives	3,137		7,208	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,932		11,272	
5	Direct Installation Program Materials and Labor	1,912		10,940	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	59,235		94,474	
		EDC	CSP	EDC	CSP
7	Program Design	2	0	29	49
8	Administration and Management	-545	319	2,628	13,810
9	Marketing	0	7	150	2,374
10	Program Delivery	623	6,311	711	9,727
11	EDC Evaluation Costs	1,055		3,693	
12	SWE Audit Costs	158		1,087	
13	Program Overhead Costs (Sum of rows 7 through 12)	7,929		34,258	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	84,258		195,900	
15	Total NPV Lifetime Electric Energy Benefits	77,039		202,871	
16	Total NPV Lifetime Electric Capacity Benefits	25,934		60,953	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	772		2,590	
18	Total NPV Lifetime Fossil Fuel Impacts	-384		-11,452	
19	Total NPV Lifetime Water Impacts	5,663		21,558	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	109,023		276,519	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	1.29		1.41	

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

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. It is important to note that TRC costs are materially different from the Rate District spending and rate recovery tables presented later in the report. TRC costs include estimates of the full incremental cost incurred by program participants to install efficient equipment, not just the portion covered by the Rate District rebate. Appendix D shows the TRC ratios by program and for the portfolio.

2.11 COMPARISON OF PERFORMANCE TO APPROVED EE&C PLAN

Table 39 presents PY17 expenditures compared to the budget estimates set forth in the EE&C plan for PY17 and P4TD. PY17 values are presented in 2025 dollars and P4TD values are presented in 2021 dollars. Program-level comparisons of expenditures to plans are presented in Appendix D.¹⁰

¹⁰ Phase IV expenditures for each rate district include costs as of 8/30/26. There may be negligible payments still outstanding which are not accounted for in this report, and will be included in the EEC Rider which will be filed at a later date.

Table 39: Comparison of Expenditures to Phase IV EE&C Plan (\$1,000)

Rate District	Expenditures	Budget from EE&C Plan	Actual Expenditures	Ratio (Actual/Plan)
Met-Ed	PY17 Portfolio	\$ 25,056.00	\$ 26,977.87	1.08
Met-Ed	P4TD	\$ 124,225.00	\$ 109,131.12	0.88
Penelec	PY17 Portfolio	\$ 23,197.00	\$ 31,390.80	1.35
Penelec	P4TD	\$ 114,817.00	\$ 109,976.59	0.96
Penn Power	PY17 Portfolio	\$ 6,703.00	\$ 6,793.15	1.01
Penn Power	P4TD	\$ 33,289.00	\$ 31,843.64	0.96
West Penn Power	PY17 Portfolio	\$ 23,718.00	\$ 25,023.25	1.06
West Penn Power	P4TD	\$ 117,756.00	\$ 113,472.73	0.96

Table 40 and Table 41 compare PY17 and P4TD verified gross program savings and demand reductions compared to the energy savings projections set forth in the EE&C plan. Program-level comparisons of expenditures to plans are presented in Appendix D.

Table 40: Comparison of Actual Portfolio Savings to Plan Projections

Rate District	Savings	EE&C Plan Projections	Gross MWh Savings	Ratio (Actual/Plan)
Met-Ed	PY17 Portfolio MWh	93,778	115,496	1.23
Met-Ed	P4TD MWh	464,367	495,408	1.07
Penelec	PY17 Portfolio MWh	90,371	168,479	1.86
Penelec	P4TD MWh	447,386	458,690	1.03
Penn Power	PY17 Portfolio MWh	25,784	48,891	1.90
Penn Power	P4TD MWh	129,062	140,913	1.09
West Penn Power	PY17 Portfolio MWh	94,402	162,535	1.72
West Penn Power	P4TD MWh	468,673	530,541	1.13

Table 41: Comparison of Actual Portfolio Demand Reductions to Plan Projections

Rate District	Savings	EE&C Plan Projections	Gross MW Savings	Ratio (Actual/Plan)
Met-Ed	PY17 Portfolio MW	16.9	23.4	1.38
Met-Ed	P4TD MW	84.0	83.8	1.00
Penelec	PY17 Portfolio MW	16.4	33.2	2.02
Penelec	P4TD MW	81.5	85.6	1.05
Penn Power	PY17 Portfolio MW	4.9	9.9	2.00
Penn Power	P4TD MW	24.8	25.5	1.03
West Penn Power	PY17 Portfolio MW	17.9	32.1	1.80
West Penn Power	P4TD MW	88.8	91.4	1.03

PY13 included significant challenges related to program startup and launch. The Rate Districts rolled out many new offerings and program elements and onboarded new ICSPs. The transition to new programs and ICSPs, though started as soon as plans and contracts were approved, necessarily required more time than continuing with the same programs and ICSPs as Phase III. Supply chain and labor shortages persisted into PY14 and impeded program implementation and participation rates. The interruption of the Appliance Recycling program component in PY15 adversely affected peak demand reductions in the residential sector, as that program component consistently delivered high demand reductions per dollar of program spend. However, FE PA worked with a new vendor to revive that program. FE PA expended considerable resources in developing new strategies and initiatives to increase demand reductions for the remaining duration of Phase IV and made significant progress toward their compliance targets in PY16, ultimately demonstrating compliance at the end of PY17.

Overall, expenditures, energy and demand savings were much higher in PY17 than in previous years and were, on average, 15%, 63%, and 76% higher respectively than corresponding values in the EE&C plan. The increase in impacts outpaced the increase in expenditures because the FE PA's compliance strategy emphasized historically cost-effective, scalable program components and benefited from economies of scale.

2.12 FINDINGS AND RECOMMENDATIONS

The impact and process evaluation activities completed by the Qualus team provided recommendations for program improvement. Table 42 lists the overarching recommendations that affect more than one program, the evaluation activity(ies) that uncovered the finding, and the Qualus team's recommendation(s) to FE PA to address the finding. All the overarching recommendations are intended to reduce impact evaluation risks and maintain cost-effectiveness for Phase V.

Table 42: Summary of Evaluation Recommendations

Evaluation Activity	Finding	Recommendation
Impact Evaluation	The evaluation team observed an increase in LED-to-LED replacements, particularly in linear fixtures retrofitted with TLEDs.	Consider lowering baseline wattage estimates, pre-screening large projects to remove baseline uncertainty, and adjusting incentives to promote lower lumen fixtures relative to higher lumen fixtures.
Cost-Effectiveness Evaluation	The expiration of residential solar tax credits in January 2026 reduced the cost-effectiveness of this measure during PY17.	Solar projects may continue to be included within a cost-effective portfolio; however, consider limiting total residential-sector rebates to maintain overall portfolio cost-effectiveness. In addition, monitor project-level incremental costs, as declining panel prices may improve cost-effectiveness over time.
Impact Evaluation	Although causality cannot be definitively established, the evaluation team observed that higher incentive levels were associated with increased participation but lower in-service rates for heavily-rebated measures such as advanced power strips and smart thermostats. While the overall incentive strategy appears effective, lower in-service rates may reflect participants purchasing products before they are prepared to install them.	Consider limiting incentives for self-installed, non-essential measures such as smart thermostats and advanced power strips to a specified percentage of incremental equipment costs.

3 Evaluation Results by Program

This section documents the gross impact, net impact, and process evaluation activities conducted in PY17 along with the outcomes of those activities. Not every program receives an evaluation every year. Planned evaluation activities for Phase IV are shown in Figure 6. Each row shows how savings from the initiative will be presented in that year's final annual report, where:

- V = verified using the results of the impact evaluation completed that year.
- H = verified using the results of a historic impact evaluation.
- U = unverified until the results of the impact evaluation are available.
- NA = the initiative is not offered in that program year.

The evaluation team plans on single-year sampling and data collection for any given evaluation effort denoted by the letter "V" in the table below.

Figure 6: Evaluation Activity Matrix

Sector	Initiative	Sub-Initiative	PY13	PY14	PY15	PY16	PY17
Residential	EE Kits	EE Kits	V	V	V	V	V
Residential	Home Energy Reports	Home Energy Reports	V	V	V	V	V
Residential	Home Energy Reports	LI - Home Energy Reports	V	V	V	V	V
Residential	LI Direct Install	LI Direct Install	V	V	H	V	V
Residential	Multifamily - Res	Multifamily - Res	V	V	H	V	V
Residential	New Homes	New Homes	V	V	H	V	V
Residential	Online Audits	LI - Online Audit	V	V	V	V	V
Residential	Online Audits	On-Line Audit	V	V	V	V	V
Residential	Residential Audit and DI	Residential Audit and DI	V	V	H	V	V
Residential	Residential Downstream Appliances	Downstream Appliances	V	V	V	V	V
Residential	Residential Downstream HVAC	Downstream HVAC	V	V	V	V	V
Residential	Residential Midstream Appliances	Midstream Appliances	V	V	V	V	V
Nonresidential	CI Custom	CI Custom	V	V	V	V	V
Nonresidential	CI EMNC	Building Improvements	V	V	V	V	V
Nonresidential	CI EMNC	Building Operations Training	V	V	V	V	V
Nonresidential	CI EMNC	Building Tune-Ups	V	V	V	V	V
Nonresidential	CI EMNC	Commissioning	NA	V	V	V	V
Nonresidential	CI EMNC	New Construction	V	V	H	V	V
Nonresidential	CI Multifamily	CI Multifamily	V	V	H	V	V
Nonresidential	CI Prescriptive	Downstream Lighting	V	V	V	V	V
Nonresidential	CI Prescriptive	Midstream Lighting	V	V	V	V	V
Nonresidential	CI Prescriptive	Downstream Nonlighting	V	V	V	V	V
Nonresidential	CI Prescriptive	Midstream Nonlighting	V	V	H	V	V
Cross-Cutting	Appliance Recycling	Appliance Recycling	V	V	V	V	V
Cross-Cutting	Appliance Recycling	Midstream Appliance Recycling	NA	V	V	V	V

3.1 ENERGY EFFICIENT HOMES PROGRAM

Energy Efficiency Homes Program has seven distinct components: Energy Efficiency Kits, School Education (with kits), Online Audits, Home Energy Reports, Residential Energy Audits and Direct Install, Multifamily Direct Install, and New Homes. Qualus evaluates the program through six initiatives by combining the similar (from an impact evaluation perspective) Energy Efficiency Kit and School Education program components into one initiative.

AM Conservation Group (AMCG) administers the School Education and Energy Efficiency Kits program components. In the Energy Efficiency Kits program component, participants receive energy conservation kits which include energy efficiency measures. As with Phase III, there are two kits aimed at homes with electric water heating and non-electric water heating. This program allows customers to receive one EE Kit per new account number at the time of move-in or eligible customers can request a kit for their home. The water heating fuel source is reported by the customer. In the School Education program component, students participate in a classroom-based presentation around energy conservation. Teachers also use a corresponding curriculum to continue to teach about energy conservation topics. New in Phase IV, all students receive a kit filled with energy-savings measures to install in their homes and are encouraged to continue discussions regarding energy conservation in the home.

The Home Energy Reports program component is administered by Oracle (formerly Opower). Home energy reports provide customers with comparative electric energy usage data and offer tips and advice on behavioral and low-cost energy saving measures. The number of participants for this program component is taken as the maximum number of participants in the treatment group during the year.

The Online Audit program component is also administered by Oracle and provides a web portal where customers can enter information about their home's envelope, HVAC systems, and plug loads to receive customized advice regarding their energy usage and ways to increase energy efficiency.

The Company has retained CLEAResult to administer the Direct Install (branded as the Residential Energy Audit Program) component in Phase IV. Through this program component, customers receive free diagnostic assessments, followed by the direct installation of low-cost measures. The program also offered incentives for capital cost measures such as solar panels, heat pump water heaters, air sealing, and insulation. Solar panels were an integral component of the Company's Phase IV compliance effort and comprised most of the demand reductions for the program in PY17. The participant count for this program component is equal to the number of homes treated in the program.

CLEAResult also administers the Multifamily Audit program, which provides low-cost measures like those offered in the Residential Energy Audit Program as well as refrigerator replacements to participants in individually metered multifamily dwellings.

The New Homes component is again administered by Performance System Development (PSD). The New Homes program component provides incentives to builders that choose to build new homes to higher efficiency standards through the installation of efficient building shell

measures, HVAC systems, appliances, lighting, smart thermostats, and other features. The participant count for the New Homes program component is equal to the number of houses (or in the case of multifamily housing, the number of dwelling units).

3.1.1 Participation and Reported Savings by Customer Segment

Table 43 presents the participation counts, reported energy and demand savings, and incentive payments for the Energy Efficient Homes Program in PY17 by Rate District. This program serves only the residential customer segment. The EE&C portfolios include separate and corresponding program components, administered by the same ICSPs, to serve the low-income residential customer segment.

Table 43: EEH Program Participation and Reported Impacts

Parameter	Met-Ed Residential (Non-LI)	Penelec Residential (Non-LI)	Penn Power Residential (Non-LI)	WPP Residential (Non-LI)
PYTD # Participants	199,742	188,072	79,885	240,231
PYRTD MWh/yr	46,208	37,933	12,621	50,522
PYRTD MW/yr	10.40	7.57	3.35	10.13
PYTD Incentives (\$1000)	2,585	2,088	965	3,216

3.1.2 Gross Impact Evaluation

Each program component is treated as a separate evaluation initiative. The impact evaluation of the HER Initiative is described in Appendix B. The impact evaluation of the EE Kits Initiative is described in Appendix E. The impact evaluation of the Res DI Initiative is described in Appendix F. The impact evaluation of the Res NC Initiative is described in Appendix G. The impact evaluation of the Res MF initiative is described in Appendix H. The impact evaluation of the Online Audit initiative is described in Appendix I. Table 44 summarizes program verified impacts and realization rates for each Rate District.

Table 44: EEH Program Gross Impact Evaluation Summary for PY17

Rate District	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	EE Kits	10,475	1.13	87.7%	88.0%
Met-Ed	Home Energy Reports	12,437	1.61	165.6%	510.5%
Met-Ed	Direct Install	19,094	6.48	81.5%	80.1%
Met-Ed	New Homes	2,705	0.69	101.3%	108.8%
Met-Ed	Multifamily	46	0.01	100.1%	76.7%
Met-Ed	Online Audits	959	0.17	158.8%	258.8%
Met-Ed Total		45,716	10.09	99%	97%
Penelec	EE Kits	12,526	1.23	97.6%	96.2%
Penelec	Home Energy Reports	3,759	0.93	52.1%	727.8%
Penelec	Direct Install	15,304	5.85	91.0%	97.6%
Penelec	New Homes	427	0.09	100.7%	90.8%
Penelec	Multifamily	86	0.01	98.3%	82.3%
Penelec	Online Audits	871	0.14	159.1%	231.6%
Penelec Total		32,973	8.24	87%	109%
Penn Power	EE Kits	2,623	0.28	87.3%	87.5%
Penn Power	Home Energy Reports	4,681	0.26	464.5%	185.7%
Penn Power	Direct Install	5,997	2.37	93.2%	101.3%
Penn Power	New Homes	2,026	0.50	103.6%	96.3%
Penn Power	Multifamily	3	0.00	106.2%	78.3%
Penn Power	Online Audits	365	0.07	167.9%	278.4%
Penn Power Total		15,695	3.48	124%	104%
WPP	EE Kits	14,028	1.60	89.3%	89.3%
WPP	Home Energy Reports	5,494	1.92	45.7%	253.2%
WPP	Direct Install	19,497	7.04	105.5%	105.7%
WPP	New Homes	3,586	0.92	100.9%	111.6%
WPP	Multifamily	62	0.01	98.3%	78.4%
WPP	Online Audits	1,112	0.19	158.1%	252.7%
WPP Total		43,779	11.69	87%	115%

The gross realization rates for energy savings were driven primarily by the three largest components: Home Energy Reports, EE Kits, and the solar power component of the Direct Install Initiative¹¹. Realization rates for kits were lower than 100% due to lower in-service rates than planning estimates. Home Energy Reports energy savings varied from reported values primarily due to methodological differences in calculations of reported and verified demand reductions, as well as cross-participation corrections. Realization rates for solar power were usually within $\pm 10\%$ of 100%, other than in Met-Ed, which tended to have lower verified installed capacity than reported installed capacity.

¹¹ While the initiative is named Direct Install, capital cost measures such as insulation, weatherization, and solar panels are not directly installed and receive downstream rebates.

3.1.3 Net Impact Evaluation

The impact evaluation methods for the Home Energy Reports and Online Audits initiatives result in NTG values of 1.0, their impact evaluation methods are described in Appendix B and Appendix I respectively. The impact evaluation of the EE Kits Initiative is described in Appendix E. The impact evaluation of the Res DI Initiative is described in Appendix F. The impact evaluation of the Res NC Initiative is described in Appendix G. The impact evaluation of the Res MF initiative is described in Appendix H. Net impact analysis for the New Homes initiative was evaluated for NTG in PY14, while in PY15 NTG analyses were conducted for the EE Kits, Direct Install, and Multifamily initiatives. Table 45 summarizes program verified gross and net energy impacts and net-to-gross ratios for each Rate District.

Table 45: EEH Program Net Impact Evaluation Summary for PY17

Rate District	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	EE Kits	10,475	83.1%	8,704	0.94
Met-Ed	Home Energy Reports	12,437	100.0%	12,437	1.61
Met-Ed	Direct Install	19,094	41.3%	7,877	2.67
Met-Ed	New Homes	2,705	72.0%	1,948	0.50
Met-Ed	Multifamily	46	99.5%	45	0.01
Met-Ed	Online Audits	959	100.0%	959	0.17
Met-Ed Total		45,716	69.9%	31,971	5.90
Penelec	EE Kits	12,526	106.7%	13,364	1.31
Penelec	Home Energy Reports	3,759	100.0%	3,759	0.93
Penelec	Direct Install	15,304	41.3%	6,314	2.41
Penelec	New Homes	427	72.0%	308	0.06
Penelec	Multifamily	86	99.5%	86	0.01
Penelec	Online Audits	871	100.0%	871	0.14
Penelec Total		32,973	74.9%	24,701	4.87
Penn Power	EE Kits	2,623	86.4%	2,266	0.25
Penn Power	Home Energy Reports	4,681	100.0%	4,681	0.26
Penn Power	Direct Install	5,997	41.3%	2,474	0.98
Penn Power	New Homes	2,026	72.0%	1,458	0.36
Penn Power	Multifamily	3	99.5%	3	0.00
Penn Power	Online Audits	365	100.0%	365	0.07
Penn Power Total		15,695	71.7%	11,248	1.91
WPP	EE Kits	14,028	96.6%	13,545	1.55
WPP	Home Energy Reports	5,494	100.0%	5,494	1.92
WPP	Direct Install	19,497	41.3%	8,044	2.91
WPP	New Homes	3,586	72.0%	2,582	0.66
WPP	Multifamily	62	99.5%	61	0.01
WPP	Online Audits	1,112	100.0%	1,112	0.19
WPP Total		43,779	70.4%	30,839	7.24

3.1.3.1 High-Impact Measure Research

No Initiatives from this program have been designated as high-impact measures for PY17.

3.1.4 Verified Savings Estimates

In Table 46 the realization rates and net-to-gross ratios determined by the Qualus and Tetra Tech team are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Energy Efficient Homes Program in PY17. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 46: PYTD and P4TD Savings Summary

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	46,208	10.40	37,933	7.57	12,621	3.35	50,522	10.13
PYVTD Gross	45,716	10.09	32,973	8.24	15,695	3.48	43,779	11.69
PYVTD Net	31,971	5.90	24,701	4.87	11,248	1.91	30,839	7.24
RTD	128,334	25.92	106,113	17.93	38,280	8.63	138,753	27.89
VTD Gross	116,586	19.37	89,389	15.85	39,915	6.79	107,886	21.47
VTD Net	93,349	13.83	78,703	12.18	32,133	4.69	93,385	16.58

3.1.5 Process Evaluation

Process evaluation activities were conducted for various components of this program in Phase IV, as summarized in Table 47 below. Process evaluation was not scheduled for this program in PY17.

Table 47: EEH Program Process Evaluation Sample Design

Rate District / Program Component	Latest Activity	Sample Target	Achieved Sample Size	Response Rate
ME - Home Energy Reports	Participant Surveys (PY13/14)	140	200	11%
PN - Home Energy Reports	Participant Surveys (PY13/14)	140	178	9%
PP - Home Energy Reports	Participant Surveys (PY13/14)	140	200	11%
WP - Home Energy Reports	Participant Surveys (PY13/14)	140	191	10%
ME - Comp Audits	Participant Surveys (PY15)	278	73	26%
PN - Comp Audits	Participant Surveys (PY15)	279	75	27%
PP - Comp Audits	Participant Surveys (PY15)	269	80	30%
WP - Comp Audits	Participant Surveys (PY15)	278	75	27%
All EDCs - Multifamily	Participant Surveys (PY15)	25	25	10%
All EDCs - Multifamily	Owner/Manager Surveys (PY15)	10	10	22%
ME - School Education	Participant Surveys (PY15)	276	24	9%
PN - School Education	Participant Surveys (PY15)	337	41	12%
PP - School Education	Participant Surveys (PY15)	41	3	7%
WP - School Education	Participant Surveys (PY15)	183	26	14%
All EDCs - School Education	School Coordinator Interviews (PY15)	31	8	26%
All EDCs - School Education	Teacher Surveys (PY15)	512	97	19%
ME - EE Kits	Participant Surveys (PY15)	310	47	15%
PN - EE Kits	Participant Surveys (PY15)	310	48	15%
PP - EE Kits	Participant Surveys (PY15)	310	53	17%
WP - EE Kits	Participant Surveys (PY15)	310	51	16%
ALL EDCs - In-Home Audits	Implementer and Subcontractor Interviews (PY14)	4	4	100%
All EDCs - New Homes	Builder Surveys (PY13/14)	15	14	41%
	Rater Surveys (PY13/14)	5	5	45%
Program Total		4,343	1,528	13.1%

3.1.5.1 Home Energy Reports (PY14)

The PY14 process evaluation included a quantitative survey of households that were randomly assigned to the treatment or control group. The survey design was informed by qualitative research completed in PY13; specifically, interviews with the FirstEnergy program manager (December 16, 2021, and May 26, 2022) and representatives from Oracle (January 19 and June 6, 2022). These interviews reviewed program design and any changes in Phase IV, discussed the details of program implementation, and captured evaluation priorities. The interview objectives and findings were reported in PY13 and guided the PY14 evaluation activities. The survey aimed to measure customers' awareness of energy efficiency programs and their own actions or efforts to reduce energy use. For control group customers, the survey effort sought to determine whether customers are aware of FirstEnergy/EDC-sponsored energy efficiency programs and actions they take to reduce their energy use. The survey was administered by web with telephone follow-up to maximize response. The survey was conducted from November 14, 2022, through January 10, 2023, at Tetra Tech's in-house Survey Research Center in its Madison, Wisconsin office, and hosted on a secure website. The target objective was to complete 70 interviews per stratum (participant type) and Rate District for treatment and control groups.

3.1.5.2 School Education Program (PY15)

Process evaluation activities for PY15 focused on understanding the subprogram design, any changes in design or implementation in Phase IV, and participant utilization and satisfaction with the kit contents. Tetra Tech staff interviewed the FirstEnergy program implementation manager (PIM), representatives of the American Conservation Group (AM Conservation), the CSP, and staff at its subcontractor, the National Education Foundation (NEF). Tetra Tech staff also reviewed program tracking data and conducted surveys with participating school coordinators and teachers. Lastly, Tetra Tech deployed a survey to gather feedback from households that received an energy efficiency kit.

3.1.5.3 Energy Efficiency Kits (PY15)

Process evaluation activities for the PY15 program year focused on understanding the program design, any changes in design or implementation in Phase IV, and participant utilization and satisfaction with the kit contents. Tetra Tech staff interviewed the FirstEnergy program manager and representatives of AM Conservation, the program CSP. Tetra Tech also reviewed program tracking data and deployed a survey to gather feedback from customers who were sent an energy efficiency kit.

3.1.5.4 In-Home Audits (PY15)

In PY15, evaluation activities focused on a follow-up interview with the PIM in October 2023 and quantitative surveys with program participants. The interview with the PIM focused on understanding the program design and identifying any program changes between PY14 and PY15, along with any changes since the last program evaluation conducted for PY9 and PY10. The PIM felt the program was operating well, participation was good, and FirstEnergy was happy with the implementer interaction. Tetra Tech also sought to identify any concerns related to meeting program goals, discuss and prioritize research activities, and identify any other areas of interest to explore during the evaluation. The PIM did not have any specific concerns or researchable issues for the evaluation beyond what was already planned. Finally, Tetra Tech conducted a quantitative survey to assess the experience of customers who have participated in the program. The purpose of the survey was to capture customer perceptions of and experiences with the program, awareness of and attitudes toward energy efficiency and conservation, participation in other FirstEnergy programs, customer satisfaction, and possible areas for improvement. The survey also included questions to support the analysis of NTG.

3.1.5.5 New Homes (PY14)

Tetra Tech's combined process and net impact evaluation effort included both rater and builder interviews in early 2023. Tetra Tech developed a sample frame in December 2022 of the 34 most active builders who, together accounted for 95% of program impacts in the prior 12 months. Tetra Tech interviewed 14 of those 34 builders as well as six active HERS raters in the program. The outreach effort started in March 2023 and included notifications from the program implementer to homebuilders followed by emails and calls from Tetra Tech. Tetra Tech also conducted a benchmarking study for the program, which compared incentive structures, outreach methods, and eligibility requirements for ten other new construction programs.

3.1.5.6 Multifamily Program (PY14 and PY15)

In PY14 Tetra Tech conducted a benchmarking study for all four multifamily programs offered by the Company:

- Energy Efficient Homes—Residential Multifamily (EE Homes Multifamily),
- Low-Income Energy Efficiency—Multifamily—Res (LI Res Multifamily),
- C&I Energy Solutions for Business—Multifamily—Small (C&I ESB Multifamily SCI), and
- C&I Energy Solutions for Business—Multifamily—Large (C&I ESB Multifamily LCI).

All four programs are implemented by CLEAResult, and together provide comprehensive coverage of both the low-income and market-rate multifamily sector, including common areas and master-metered and individually-metered dwelling units. The benchmarking reviewed various program aspects including overall program designs, incentive levels and structure, coordination with local community agencies, and marketing strategies.

In PY15, Tetra Tech continued process evaluation activities by interviewing program managers and CSP staff and conducting tenant and apartment owner/manager surveys. The interview with the program implementation manager (PIM) focused on understanding the program design and identifying any program changes between PY14 and PY15. The PIM indicated that FirstEnergy transitioned the delivery of the Multifamily subprograms to a one-stop-shop approach beginning in PY15. The one-stop-shop approach streamlines the participation experience by seamlessly connecting offerings available to multifamily properties across the residential and C&I multifamily subprograms. The interview with the CSP, CLEAResult, focused on understanding the redesign of the program, any barriers impacting the performance of the program, and their experiences with the program. CLEAResult indicated that building owners/managers have found the one-stop-shop approach of the program much easier to understand. Quantitative surveys of participating multifamily building tenants and building owners/managers investigated sources of awareness, preferred methods of communication, participation experiences, program satisfaction, and demographics. The surveys also gathered information on their decisions to participate, actions taken after the energy audit, and barriers to participating.

3.1.5.7 Behavioral Online Audits (PY14)

Tetra Tech completed a two-phase customer survey in PY14. Tetra Tech conducted an initial (Phase 1) survey soon after customers completed the audit to maximize recall of the online audit and any immediate energy-saving actions. A follow-up (Phase 2) survey, a few months later, assessed energy-saving actions since the online audit, awareness of energy-efficiency programs, and other program participation. Tetra Tech reached out to the census of PY14 participants to garner sufficient responses for the two-phase effort (there is attrition involved between the two phases due to response rates and selection criteria for eligibility in the second phase). The participation numbers shown in Table 47 reflect the first phase of the survey, since Phase 2 respondents are a subset of Phase 1 respondents.

3.1.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented Table 48, Table 49, Table 50, and Table 51 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2025 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 48: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	36,619		43,491		16,711		25,238	
2	Rebates to Participants and Trade Allies	824		3,026		824		3,026	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	1,937		8,828		1,937		8,828	
5	Direct Installation Program Materials and Labor	380		928		380		928	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	33,477		30,710		13,569		12,457	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	5	8	0	0	5	8
8	Administration and Management	-31	-3	468	1,868	-31	-3	468	1,868
9	Marketing	0	-1	54	495	0	-1	54	495
10	Program Delivery	111	3,079	130	3,544	111	3,079	130	3,544
11	EDC Evaluation Costs	184		644		184		644	
12	SWE Audit Costs	28		190		28		190	
13	Program Overhead Costs (Sum of rows 7 through 12)	3,368		7,407		3,368		7,407	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	39,987		50,898		20,079		32,645	
15	Total NPV Lifetime Electric Energy Benefits	16,210		32,584		9,587		23,535	
16	Total NPV Lifetime Electric Capacity Benefits	16,523		24,475		8,371		15,584	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	467		344		309		223	
19	Total NPV Lifetime Water Impacts	3,922		16,858		3,260		13,846	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	37,122		74,261		21,527		53,188	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.93		1.46		1.07		1.63	

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

Table 49: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	29,628		32,682		13,579		19,050	
2	Rebates to Participants and Trade Allies	128		399		128		399	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,137		8,748		2,137		8,748	
5	Direct Installation Program Materials and Labor	272		703		272		703	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	27,090		22,832		11,042		9,200	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	4	7	0	0	4	7
8	Administration and Management	-10	1	400	1,354	-10	1	400	1,354
9	Marketing	0	0	52	452	0	0	52	452
10	Program Delivery	96	2,301	112	2,460	96	2,301	112	2,460
11	EDC Evaluation Costs	147		533		147		533	
12	SWF Audit Costs	22		152		22		152	
13	Program Overhead Costs (Sum of rows 7 through 12)	2,557		5,526		2,557		5,526	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	32,185		38,209		16,136		24,577	
15	Total NPV Lifetime Electric Energy Benefits	13,589		28,603		9,491		24,311	
16	Total NPV Lifetime Electric Capacity Benefits	12,312		17,193		6,523		12,008	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	195		91		165		113	
19	Total NPV Lifetime Water Impacts	5,541		19,457		5,899		19,058	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	31,637		65,345		22,078		55,490	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.98		1.71		1.37		2.26	

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

Table 50: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	11,432		15,397		5,432		9,329	
2	Rebates to Participants and Trade Allies	612		1,942		612		1,942	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	494		2,399		494		2,399	
5	Direct Installation Program Materials and Labor	67		282		67		282	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	10,259		10,774		4,260		4,706	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	2	3	0	0	2	3
8	Administration and Management	-41	-2	196	773	-41	-2	196	773
9	Marketing	0	0	16	161	0	0	16	161
10	Program Delivery	42	750	52	960	42	750	52	960
11	EDC Evaluation Costs	62		213		62		213	
12	SWF Audit Costs	10		68		10		68	
13	Program Overhead Costs (Sum of rows 7 through 12)	821		2,444		821		2,444	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	12,253		17,841		6,253		11,772	
15	Total NPV Lifetime Electric Energy Benefits	5,778		12,308		3,489		9,049	
16	Total NPV Lifetime Electric Capacity Benefits	3,497		5,290		1,770		3,379	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	623		435		444		301	
19	Total NPV Lifetime Water Impacts	802		4,468		692		3,805	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	10,699		22,501		6,395		16,534	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.87		1.26		1.02		1.40	

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

Table 51: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	33,628		42,162		16,070		26,043	
2	Rebates to Participants and Trade Allies	991		3,222		991		3,222	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	2,543		9,297		2,543		9,297	
5	Direct Installation Program Materials and Labor	375		988		375		988	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	29,719		28,654		12,161		12,536	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	6	10	0	0	6	10
8	Administration and Management	-70	-4	531	2,370	-70	-4	531	2,370
9	Marketing	0	0	58	399	0	0	58	399
10	Program Delivery	123	2,768	148	3,401	123	2,768	148	3,401
11	EDC Evaluation Costs	202		716		202		716	
12	SWF Audit Costs	31		214		31		214	
13	Program Overhead Costs (Sum of rows 7 through 12)	3,051		7,852		3,051		7,852	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	36,679		50,013		19,121		33,895	
15	Total NPV Lifetime Electric Energy Benefits	18,734		35,834		12,159		29,721	
16	Total NPV Lifetime Electric Capacity Benefits	9,765		13,863		5,305		9,807	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	587		494		418		357	
19	Total NPV Lifetime Water Impacts	4,832		16,724		4,658		17,021	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	33,919		66,915		22,540		56,906	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.92		1.34		1.18		1.68	

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

3.1.7 Status of Recommendations

Process evaluation activities for this program concluded in late PY15. Findings and recommendations from previous process evaluation efforts can be found in the Company's previous annual reports.

3.2 ENERGY EFFICIENT PRODUCTS PROGRAM

Through the Residential Energy Efficient Products Program, customers receive incentives for installing ENERGY STAR® qualified appliances, energy efficient HVAC equipment, and energy efficient water heaters. Qualifying appliances include items such as clothes washers, dehumidifiers, and refrigerators. HVAC equipment qualifying as part of the program includes central air conditioners, air source heat pumps, ground source heat pumps, and mini-split heat pumps. A limited time Marketplace offering was opened in July 2025, which gave West Penn Power and Penelec customers the opportunity to purchase smart thermostats and advanced power strips at discounted amounts. The program also provides incentives to customers for the maintenance (tune-ups) of existing HVAC equipment. Water heaters rebated under the program include heat pump water heaters, efficient electric water heaters, and solar water heaters. The program also provides incentives to customers who recycle old, inefficient appliances. The Company has retained Franklin Energy Services to administer the rebate components of the program and with CLEAResult to administer the Appliance Recycling subprogram, and the program has resumed operations in all four Pennsylvania Rate Districts.

For the appliances component of the program, the participant count is equal to the sum of appliances rebated by the program. For the HVAC component, the participant count is equal to the sum of the distinct HVAC measures rebated by the program. For the appliance recycling component of the program, the participant count is equal to the number of unique account numbers of participants.

3.2.1 Participation and Reported Savings by Customer Segment

This program serves primarily the residential customer segment. Table 52, Table 53, Table 54, and Table 55 present the participation counts, reported energy and demand savings, and incentive payments for the EEP Program in PY17 by customer segment and Rate District.

Table 52: EEP Program Participation and Reported Impacts for Met-Ed

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	11,352	0	0	11,352
PYRTD MWh/yr	4,928	0	0	4,928
PYRTD MW/yr	1.38	0.00	0.00	1.38
PYTD Incentives (\$1000)	557	0.00	0.00	557

Table 53: EEP Program Participation and Reported Impacts for Penelec

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	35,316	0	0	35,316
PYRTD MWh/yr	8,369	0	0	8,369
PYRTD MW/yr	1.69	0.00	0.00	1.69
PYTD Incentives (\$1000)	1,334	0.00	0.00	1,334

Table 54: EEP Program Participation and Reported Impacts for Penn Power

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	2,522	0	0	2,522
PYRTD MWh/yr	458	0	0	458
PYRTD MW/yr	0.09	0.00	0.00	0.09
PYTD Incentives (\$1000)	89	0.00	0.00	89

Table 55: EEP Program Participation and Reported Impacts for WPP

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	41,904	0	0	41,904
PYRTD MWh/yr	10,566	0	0	10,566
PYRTD MW/yr	2.06	0.00	0.00	2.06
PYTD Incentives (\$1000)	1,707	0.00	0.00	1,707

3.2.2 Gross Impact Evaluation

This program is disaggregated into five initiatives for evaluation. The impact evaluation of the Appliance Recycling initiative is described in Appendix J. The impact evaluation of the Upstream Electronics initiative is described in detail in Appendix K. The impact evaluation of the Res HVAC initiative is described in detail in Appendix L. The impact evaluation of the Res Appliances initiative is described in detail in Appendix M. The impact evaluation of the Res Midstream Appliances initiative is described in detail in Appendix N. Table 56 summarizes program verified impacts and realization rates for each Rate District.

Table 56: EEP Program Gross Impact Evaluation Summary for PY17

Rate District	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliance Recycling	2,932	1.08	106.8%	108.0%
Met-Ed	HVAC	1,349	0.23	118.0%	129.1%
Met-Ed	Appliances	449	0.06	103.7%	106.4%
Met-Ed	Midstream Appliances	607	0.14	100.0%	98.0%
Met-Ed Total		5,337	1.51	108%	110%
Penelec	Appliance Recycling	2,250	0.92	97.9%	112.2%
Penelec	HVAC	989	0.09	103.8%	108.3%
Penelec	Appliances	1,803	0.16	64.5%	58.7%
Penelec	Midstream Appliances	2,337	0.51	100.7%	97.0%
Penelec Total		7,379	1.67	88%	99%
Penn Power	Appliance Recycling	0	0.00	100.0%	100.0%
Penn Power	HVAC	238	0.04	130.8%	139.8%
Penn Power	Appliances	98	0.01	95.8%	91.3%
Penn Power	Midstream Appliances	169	0.04	97.8%	96.5%
Penn Power Total		506	0.10	110%	110%
WPP	Appliance Recycling	2,437	0.92	95.4%	111.3%
WPP	HVAC	1,464	0.21	104.3%	105.3%
WPP	Appliances	2,009	0.24	51.7%	51.9%
WPP	Midstream Appliances	2,741	0.56	100.6%	96.9%
WPP Total		8,652	1.92	82%	93%

The gross realization rates for energy savings were driven primarily by the realization rates of the appliance recycling component, which has grown to become the largest program component in PY17. All program components had generally high energy and demand realization rates due to somewhat conservative assumptions in reported impacts.

3.2.3 Net Impact Evaluation

The impact evaluation of the Appliance Recycling initiative is described in Appendix J. The Upstream Electronics initiative is not active in Phase IV. The impact evaluation of the Res HVAC initiative is described in detail in Appendix L. The impact evaluation of the Res Appliances initiatives are described in detail in Appendix M and Appendix N. The Appliance Recycling initiative was evaluated for NTG in PY16, the Appliance Rebate initiative was evaluated for NTG in PY14, and the HVAC rebate initiative was evaluated for NTG in PY15. Table 57 summarizes program verified gross and net energy impacts and net-to-gross ratios for each Rate District.

Table 57: EEP Program Net Impact Evaluation Summary for PY17

Rate District	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	Appliance Recycling	2,932	62.0%	1,818	0.67
Met-Ed	HVAC	1,349	50.6%	682	0.12
Met-Ed	Appliances	449	67.9%	305	0.04
Met-Ed	Midstream Appliances	607	57.6%	350	0.08
Met-Ed Total		5,337	59.1%	3,155	0.91
Penelec	Appliance Recycling	2,250	60.0%	1,350	0.55
Penelec	HVAC	989	69.7%	689	0.06
Penelec	Appliances	1,803	49.4%	891	0.08
Penelec	Midstream Appliances	2,337	47.8%	1,117	0.24
Penelec Total		7,379	54.8%	4,047	0.93
Penn Power	Appliance Recycling	0	61.0%	0	0.00
Penn Power	HVAC	238	54.7%	130	0.02
Penn Power	Appliances	98	52.3%	51	0.01
Penn Power	Midstream Appliances	169	50.2%	85	0.02
Penn Power Total		506	52.7%	267	0.05
WPP	Appliance Recycling	2,437	66.0%	1,609	0.61
WPP	HVAC	1,464	54.8%	802	0.11
WPP	Appliances	2,009	52.2%	1,049	0.13
WPP	Midstream Appliances	2,741	50.0%	1,371	0.28
WPP Total		8,652	55.8%	4,830	1.12

3.2.3.1 High-Impact Measure Research

No Initiatives from this program have been designated as high-impact measures for PY17.

3.2.4 Verified Savings Estimates

In Table 58 the realization rates and net-to-gross ratios determined by the Qualus and Tetra Tech team are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Energy Efficient Products Program in PY17. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 58: PYTD and P4TD Savings Summary

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	4,928	1.38	8,369	1.69	458	0.09	10,566	2.06
PYVTD Gross	5,337	1.51	7,379	1.67	506	0.10	8,652	1.92
PYVTD Net	3,155	0.91	4,047	0.93	267	0.05	4,830	1.12
RTD	39,072	8.86	31,488	7.16	9,511	2.07	38,563	8.43
VTD Gross	43,491	9.31	31,480	7.18	9,958	2.10	38,743	8.38
VTD Net	21,722	4.67	17,893	4.11	4,637	0.97	22,558	4.99

3.2.5 Process Evaluation

Process evaluation activities were conducted for various components of this program in Phase IV, as shown in Table 59 below. Process evaluation was not scheduled for this program in PY17.

Table 59: EEP Program Process Evaluation Sample Design

Rate District	Program Component	Activity	Target Sample Size	Achieved Sample Size	Response Rate
Met-Ed	Appliance Recycling	In-Depth Interviews (PY16) Customer Surveys (PY16)	100	379	20.3%
Penelec	Appliance Recycling		100	288	21.8%
Penn Power	Appliance Recycling		100	115	22.2%
WPP	Appliance Recycling		100	354	22.7%
Met-Ed	Downstream Appliances	Customer Surveys (PY14)	70	69	25.0%
Penelec	Downstream Appliances		70	71	25.5%
Penn Power	Downstream Appliances		70	74	26.4%
WPP	Downstream Appliances		70	72	28.6%
Met-Ed	Downstream Appliances	General Population Survey (PY14)	70	74	10.6%
Penelec	Downstream Appliances		70	72	9.0%
Penn Power	Downstream Appliances		70	76	10.9%
WPP	Downstream Appliances		70	71	10.1%
Met-Ed	Downstream HVAC	Participant Surveys (PY15)	299	65	22%
Penelec	Downstream HVAC		280	73	26%
Penn Power	Downstream HVAC		283	71	25%
WPP	Downstream HVAC		300	73	24%
All	Midstream Appliances	Retailed Interviews (PY14)	6	6	21.4%
Program Total			2,128	2,003	21.6%

Process evaluation efforts for each program component are summarized below.

3.2.5.1 Appliance Recycling (PY16)

The Appliance Recycling program process evaluation in PY16 relied on program staff and ICSP interviews as well as participant customer surveys. Tetra Tech conducted semi-structured interviews with 15 small C/I participants who recycled 21 appliances to understand their program experience and identify potential avenues to expand participation in this sector. The researchable issues for process evaluation related to customer satisfaction and program awareness. The results of both of these metrics remain similar to the earlier PY13 evaluation. The results are also similar across the FirstEnergy Rate Districts. The sample for the survey was randomly selected for each Rate District. The team also reviewed program tracking data and program materials, including the program website, marketing calendar, and sample content of email notifications and social media ads. The program materials were consistently clear and concise.

3.2.5.2 Downstream and Midstream Appliances (PY14)

Tetra Tech conducted process evaluation for both the downstream and midstream appliance rebate components of the EEP program in PY14. The process evaluation included downstream rebate participant surveys, in-depth interviews of retailers that participate in the midstream program, a general population survey of residential customers, and a benchmarking analysis. The participant surveys were administered by telephone in spring of 2023 and also included a net impact evaluation battery. The survey effort was preceded by a postcard invitation campaign to explain the purpose of the study and to ask for cooperation in completing the telephone survey. The general population survey targeted a sample of FirstEnergy residential customers, regardless of prior participation in an energy efficiency program or energy-saving actions, and yielded insights into customers' awareness, usage, and satisfaction with energy-efficient products. In addition, the survey sought to assess nonparticipant spillover, which was used in conjunction with the participant survey to estimate a net-to-gross ratio. The survey also included questions related to the PY15 HVAC process and NTG evaluation. Retailer interviews occurred in July 2023 and represented each of the main retail chains that participate in the midstream program component. Key findings and recommendations for the Appliances component are listed in the Company's PY14 annual report.

3.2.5.3 HVAC (PY15)

Tetra Tech conducted process evaluation for the HVAC program component in PY15. The effort included qualitative interviews with program staff and participating HVAC contractors, and quantitative surveys of participating customers. The process evaluation gauged program awareness and customer satisfaction, and researched issues such as rebate processing times and supply chain constraints. Key findings and recommendations for the HVAC component are listed in the Company's PY15 annual report.

3.2.5.4 Midstream Electronics

The midstream electronics sub-program has not been offered in Phase IV.

3.2.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 60, Table 61, Table 62, and Table 63 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2025 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 60: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	3,485		21,951		1,877		11,423	
2	Rebates to Participants and Trade Allies	593		3,169		593		3,169	
3	Upstream / Midstream Incentives	84		2,731		84		2,731	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	2,808		16,052		1,200		5,523	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	5	8	0	0	5	8
8	Administration and Management	-46	-23	426	2,198	-46	-23	426	2,198
9	Marketing	0	-3	74	569	0	-3	74	569
10	Program Delivery	88	1,373	98	2,373	88	1,373	98	2,373
11	EDC Evaluation Costs	141		466		141		466	
12	SWE Audit Costs	27		182		27		182	
13	Program Overhead Costs (Sum of rows 7 through 12)	1,557		6,399		1,557		6,399	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	5,042		28,350		3,434		17,822	
15	Total NPV Lifetime Electric Energy Benefits	1,582		11,720		901		5,920	
16	Total NPV Lifetime Electric Capacity Benefits	1,378		9,123		800		4,584	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	134		1,113		83		617	
19	Total NPV Lifetime Water Impacts	88		651		60		421	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	3,182		22,607		1,843		11,541	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.63		0.80		0.54		0.65	
* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = \$2021									

Table 61: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	3,368		15,288		1,881		8,703	
2	Rebates to Participants and Trade Allies	1,048		2,316		1,048		2,316	
3	Upstream / Midstream Incentives	573		2,238		573		2,238	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	1,747		10,734		260		4,149	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	5	8	0	0	5	8
8	Administration and Management	5	-16	473	1,320	5	-16	473	1,320
9	Marketing	0	-2	73	428	0	-2	73	428
10	Program Delivery	94	1,425	104	2,038	94	1,425	104	2,038
11	EDC Evaluation Costs	138		434		138		434	
12	SWE Audit Costs	26		176		26		176	
13	Program Overhead Costs (Sum of rows 7 through 12)	1,670		5,058		1,670		5,058	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	5,038		20,346		3,552		13,761	
15	Total NPV Lifetime Electric Energy Benefits	2,481		8,338		1,359		4,646	
16	Total NPV Lifetime Electric Capacity Benefits	1,493		6,195		805		3,427	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	644		1,593		308		795	
19	Total NPV Lifetime Water Impacts	53		393		26		201	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	4,671		16,519		2,499		9,069	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.93		0.81		0.70		0.66	

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

Table 62: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	485		4,338		261		2,211	
2	Rebates to Participants and Trade Allies	87		645		87		645	
3	Upstream / Midstream Incentives	22		771		22		771	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	376		2,922		153		795	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	1	2	0	0	1	2
8	Administration and Management	-6	0	177	499	-6	0	177	499
9	Marketing	0	0	21	184	0	0	21	184
10	Program Delivery	30	233	35	488	30	233	35	488
11	EDC Evaluation Costs	40		129		40		129	
12	SWE Audit Costs	8		55		8		55	
13	Program Overhead Costs (Sum of rows 7 through 12)	305		1,592		305		1,592	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	790		5,930		566		3,803	
15	Total NPV Lifetime Electric Energy Benefits	236		2,951		125		1,403	
16	Total NPV Lifetime Electric Capacity Benefits	94		1,342		49		627	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	14		878		8		423	
19	Total NPV Lifetime Water Impacts	27		201		14		106	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	371		5,372		196		2,559	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.47		0.91		0.35		0.67	
* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = \$2021									

Table 63: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	4,751		18,383		2,535		9,902	
2	Rebates to Participants and Trade Allies	1,416		3,561		1,416		3,561	
3	Upstream / Midstream Incentives	659		2,187		659		2,187	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	2,676		12,636		461		4,155	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	6	10	0	0	6	10
8	Administration and Management	-18	7	546	1,792	-18	7	546	1,792
9	Marketing	0	2	89	494	0	2	89	494
10	Program Delivery	104	1,853	116	2,690	104	1,853	116	2,690
11	EDC Evaluation Costs	161		525		161		525	
12	SWE Audit Costs	31		211		31		211	
13	Program Overhead Costs (Sum of rows 7 through 12)	2,139		6,478		2,139		6,478	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	6,890		24,861		4,675		16,380	
15	Total NPV Lifetime Electric Energy Benefits	3,133		10,864		1,689		6,007	
16	Total NPV Lifetime Electric Capacity Benefits	1,077		4,193		596		2,356	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	683		1,774		342		911	
19	Total NPV Lifetime Water Impacts	145		757		75		409	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	5,036		17,588		2,703		9,682	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.73		0.71		0.58		0.59	
* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = \$2021									

3.2.7 Status of Recommendations

The process evaluation activities in PY16 led to the following findings and recommendations from Tetra Tech to the Company, along with a summary of how the Company plans to address the recommendations in program delivery. Findings and recommendations from previous process evaluation efforts can be found in the Company's PY13 and PY14 annual reports.

3.2.7.1 Appliance Recycling

Finding #1: *Relaunching the program with a new CSP has been smooth, with no reported issues.* FirstEnergy reported that CLEAResult has managed the program's relaunch well. The program restarted in May 2024 after it had been inactive for 10 months. CLEAResult took over as the CSP from ARCA, which previously implemented the program. FirstEnergy reported that CLEAResult is effective, with good communication, timely and accurate reporting, and high customer satisfaction. Additionally, CLEAResult reported no issues in their first year

implementing the program. CLEAResult also believes that the relationship with FirstEnergy is also running smoothly. They indicated that the program runs well from enrollment to receiving rebates in a timely manner.

Finding #2: *CLEAResult reports that standalone pickups of room air conditioners were successful for the program.* They noted a high number of requests for standalone air conditioners, so they tried it as a limited-time offering (LTO) and found it successful. CLEAResult continued the offering for the rest of the survey year.

Finding #3: *Bill inserts continue to be the most common source of program information.* Almost one-half of residential respondents (46 percent) indicated bill inserts as a source of program information, consistent with prior evaluations. Emails from the Company were the second most common source of program awareness, mentioned by 19 percent of residential respondents. This pattern is also reflected in responses from the small C&I participants, who also indicated that bill inserts and emails were their most common sources of program awareness. The team asked small C&I participants what their preferred source of awareness is, and respondents confirmed that bill inserts and emails are preferred. In addition to marketing sources, participants are also using the Company's websites to get information about energy efficiency programs.

Finding #4: *Satisfaction with the program remains high, with a slight downward shift, due to dissatisfaction with the timing of rebate receipt.* Of the program components, satisfaction with the time it took to receive the rebate was noticeably lower than in past evaluations. We found that dissatisfaction with the timing of the rebate arose because not enough time was being allowed between appliance pickup and the survey request, and this was driving lower satisfaction with the program overall.

Finding #5: *Net-to-gross ratios are higher, rising from 55 percent in PY13 to 62 percent.* We observed a higher frequency of those who would have removed their appliance without the program, but not within a year, resulting in 100 percent NTG for those cases. In addition, the range of NTG across Rate Districts is more consistent than in PY13. PY16 NTG ranges from 60 to 65 percent compared with a range of 38 to 70 percent in PY13. More details on the NTG algorithm and calculations are in the Net-to-Gross Results section.

Finding #6: *Some participants in both residential and commercial sectors do not remember which appliances are eligible.* Participants were asked what appliances they would like to recycle through the program that are not already offered. Respondents from both the residential survey and small C&I calling effort noted appliances that are already offered through the program (e.g., freezer, room air conditioner), suggesting they are not completely familiar with which appliances are eligible.

Finding #7: *The tracking data shows a few instances of households recycling more than the allowed number of appliances.* The review revealed 35 accounts in the residential and small C&I tracking data that were recorded to have recycled more than five appliances during PY16 (0.4 percent of accounts). Based on program enrollment requirements, the maximum number of appliances recycled should be five (two large and three small appliances).

Recommendation #1: *Continue offering standalone pickups of room air conditioners.*

CLEAResult reported that these standalone pickups were a success and valuable for the program. They started as a LTO and were extended to include pickups for the whole program year. We recommend that this offering be continued in future program years.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Make rebate timing a priority and increase communication about when the check will come and whether it is still coming.*

Participants reported lower satisfaction with the program overall due to slow rebate delivery after participation. To keep satisfaction high, we recommend communicating throughout the rebate delivery process with participants so that even if the rebate takes longer than expected, participants still know that it is being processed and will arrive in the future.

EDC Status Report #2: Recommendation accepted.

Recommendation #3: *Continue to advertise the program with bill inserts and emails.*

Utility bill inserts and emails continue to be the highest source of program awareness, with 45 percent and 19 percent of participants citing them as their source of awareness, respectively. We recommend that these methods continue to be used for outreach, supplemented by increased social media use. With customers visiting the EDC websites for information, more details could be added there for customers looking for program specifics.

EDC Status Report #3: Recommendation accepted.

Recommendation #4: *Revisit the number of applications accepted by household per year or edit the website requirement.*

A few households in the tracking data had more than the allowed five total appliances or the maximum number allowed by appliance type. This may be a difference in the timing, as the program year runs across calendar years, and the restriction on the website is listed per calendar year.

EDC Status Report #4: Recommendation accepted.

3.3 LOW-INCOME ENERGY EFFICIENCY PROGRAM

The Low-Income Energy Efficiency Program (LIEEP) has seven distinct initiatives, each described below.

The *Low-Income Direct Install* (LI DI) component is administered by the Company, and has three distinct components:

- *WARM Plus* low-income weatherization
- *WARM Extra Measures* low-income weatherization
- *WARM Multifamily*

These programs provide for direct installation of energy efficiency measures within customers' homes and tenants' apartments. The WARM Plus and WARM Multifamily components provide for audits and direct installation of energy efficient equipment and envelope upgrades. WARM *Extra Measures* is similar to WARM Plus, except that it provides for additional measures that are Act 129 funded to be installed in homes that participate in the Company's non-Act 129 Low-Income Usage Reduction Programs. The Company's tracking and reporting system can cross reference account numbers with previous years to generate a list of unique, new participants for each program year. For sampling and reporting purposes, however, Qualus selects to treat each unique account in the tracking data for the program year as one participant.

Each of these program components are similar to their corresponding non-Low-Income components in the Energy Efficient Homes Program, but they are targeted to low-income customers.

The *Low-Income Appliance Recycling* (LI ATI) component is administered by CLEAResult. The program is implemented in parallel with the main residential Appliance Recycling program but provides targeted marketing and enhanced incentives to income qualified customers. Each rebate application (which corresponds to an appliance pick-up event, and may involve multiple appliances) is treated as one participant.

The *Low-Income Kits* (LI Kit) component includes two subcomponents, both administered by AMCG:

- Low-Income EE Kits
- Low-Income School Education Program

The low-income kits contained Advanced Power Strips instead of Electrical Outlet Gaskets. Each kit is treated as a participant.

The *Low-Income Appliance Rebates* (LI Appliances) component is administered by Franklin Energy Services and provides targeted marketing and enhanced downstream rebates on appliances.

The *Low-Income Home Energy Reports* (LI HER) component is similar to the HER component in the Energy Efficient Homes Program but is targeted at low-income qualified customers.

The *Low-Income Online Audits* (LI Online Audit) component is similar to the Online Audit component in the Energy Efficient Homes Program but is targeted to low-income qualified customers.

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

3.3.1 Participation and Reported Savings by Customer Segment

Table 64 presents the participation counts, reported energy and demand savings, and incentive payments for the Low-Income Energy Efficiency Program in PY17 by customer segment and Rate District. This program serves only the low-income residential customer segment.

Table 64: LIEEP Participation and Reported Impacts

Parameter	Met-Ed LI Residential	Penelec LI Residential	Penn Power LI Residential	WPP LI Residential
PYTD # Participants	22,823	24,455	2,880	37,086
PYRTD MWh/yr	3,039	2,579	201	3,935
PYRTD MW/yr	0.43	0.42	0.02	0.51
PYTD Incentives (\$1000)	2,095	1,950	27	1,489

3.3.2 Gross Impact Evaluation

The impact evaluation of the Res Appliances initiative is described in detail in Appendix M. The impact evaluation of the LI Appliance Recycling sub-initiative is described in detail in Appendix O. The impact evaluation of the LI DI initiative is described in Appendix P. The impact evaluation of the HER initiative is described in Appendix B. The impact evaluation of the LI EE Kits sub-initiative is described in Appendix Q. The impact evaluation of the Res NC initiative is described in Appendix G. The impact evaluation of the Online Audit initiative is described in Appendix I. Table 65 summarizes program verified impacts and realization rates for each Rate District.

Table 65: LIEEP Gross Impact Evaluation Summary for PY17

Rate District	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliances	12	0.00	103.7%	106.4%
Met-Ed	Appliance Turn-In	115	0.05	101.1%	123.0%
Met-Ed	Direct Install	1,219	0.16	97.7%	99.8%
Met-Ed	Home Energy Reports	1,783	0.16	-2866.4%	499.5%
Met-Ed	Kits	1,612	0.18	97.2%	101.2%
Met-Ed	New Homes	8	0.00	101.3%	108.8%
Met-Ed	Online Audits	116	0.02	189.2%	277.0%
Met-Ed Total		4,866	0.58	160%	136%
Penelec	Appliances	7	0.00	64.5%	58.7%
Penelec	Appliance Turn-In	134	0.06	103.4%	117.2%
Penelec	Direct Install	1,546	0.21	104.2%	104.9%
Penelec	Home Energy Reports	694	-0.22	-815.1%	-450.2%
Penelec	Kits	984	0.11	108.7%	114.4%
Penelec	New Homes	10	0.00	100.7%	90.8%
Penelec	Online Audits	281	0.04	225.5%	306.4%
Penelec Total		3,655	0.20	142%	49%
Penn Power	Appliances	0	0.00	95.8%	91.3%
Penn Power	Appliance Turn-In	0	0.00	100.0%	100.0%
Penn Power	Direct Install	0	0.00	0.0%	0.0%
Penn Power	Home Energy Reports	102	0.03	56.9%	135.2%
Penn Power	Kits	0	0.00	100.0%	100.0%
Penn Power	New Homes	0	0.00	103.6%	96.3%
Penn Power	Online Audits	44	0.01	201.0%	301.9%
Penn Power Total		146	0.03	72%	154%
WPP	Appliances	7	0.00	51.7%	51.9%
WPP	Appliance Turn-In	153	0.07	112.9%	129.6%
WPP	Direct Install	929	0.14	103.8%	105.4%
WPP	Home Energy Reports	67	0.29	13.6%	585.1%
WPP	Kits	2,432	0.29	105.4%	107.7%
WPP	New Homes	3	0.00	100.9%	111.6%
WPP	Online Audits	170	0.03	197.5%	290.5%
WPP Total		3,761	0.81	96%	159%

The gross realization rates for energy savings were driven primarily by the three largest components: Kits, Home Energy Reports and Direct Install. Home Energy Reports had the greatest variability in realization rates. The relatively small cohort sizes, alongside extrinsic adjustments for dual participation and avoided decay, combine to create significantly different results from different methodologies that were used to measure reported and verified impacts.

3.3.3 Net Impact Evaluation

Net impact evaluation was not formally conducted for this program in PY17, in accordance with our evaluation plan. The NTG for the Low-Income Energy Efficiency Program is estimated as 1.0 for the purpose of net cost effectiveness calculations.

3.3.4 Verified Savings Estimates

In Table 66 the realization rates determined by Qualus are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Low-Income Energy Efficiency Program in PY17. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 66: PYTD and P4TD Savings Summary

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	3,039	0.43	2,579	0.42	201	0.02	3,935	0.51
PYVTD Gross	4,866	0.58	3,655	0.20	146	0.03	3,761	0.81
PYVTD Net	4,866	0.58	3,655	0.20	146	0.03	3,761	0.81
RTD	22,460	3.39	23,113	2.92	6,256	1.09	28,103	3.77
VTD Gross	25,315	3.41	25,913	2.50	5,573	0.82	28,651	3.95
VTD Net	25,315	3.41	25,913	2.50	5,573	0.82	28,651	3.95

3.3.5 Process Evaluation

Process evaluation activities were conducted for various components of this program in Phase IV, as summarized in Table 67 and described below. Process evaluation was not scheduled for this program in PY17.

Table 67: LIEEP Program Process Evaluation Sample Design

Rate District	Program Component	Activity	Target Sample Size	Achieved Sample Size	Response Rate
Met-Ed	Direc Install (WARM)	Customer Surveys (PY14)	70	71	36.8%
Penelec			70	70	29.8%
Penn Power			59	76	39.2%
WPP			70	75	38.5%
Met-Ed	Direc Install (Multifamily)	Customer Surveys (PY14)	20	15	31.9%
Penelec			35	28	15.9%
Penn Power			5	2	20.0%
WPP			35	31	17.2%
All EDCs	Direc Install (Multifamily)	Participant Surveys (PY15)	25	25	10.0%
All EDCs		Owner/Manager Surveys (PY15)	10	10	21.7%
Met-Ed	School Education	Participant Surveys (PY15)	21	2	9.5%
Penelec			224	27	12.1%
Penn Power			0	0	NA
WPP			157	19	12.1%
Met-Ed	EE Kits	Participant Surveys (PY15)	210	27	12.9%
Penelec			150	210	140.0%
Penn Power			0	0	NA
WPP			150	210	140.0%
Met-Ed	Hone Energy Reports	Participant Surveys (PY13/14)	140	148	7.8%
Penelec			140	138	7.3%
Penn Power			140	178	9.4%
WPP			140	148	7.8%
All EDCs	Direc Install (WARM)	Auditor Interviews (OY14)	8	8	100.0%
All EDCs	Direc Install (Multifamily)		5	5	100.0%
Program Total			1,884	1,523	16.6%

3.3.5.1 Downstream Appliances (PY14)

Tetra Tech conducted a combined process evaluation of the residential and low-income residential appliance rebate programs in PY14. The evaluation is described in Section 3.2.5.2.

3.3.5.2 Appliance Recycling (PY13)

The Appliance Recycling program process evaluation in PY13 relied on program staff and ICSP interviews as well as participant customer surveys. The researchable issues for process evaluation related to customer satisfaction and program awareness. The results of both of these metrics remain similar to Phase III. The results are also similar across the FirstEnergy Rate Districts. The sample for the survey was randomly selected for each Rate District. Key findings and recommendations for the Appliance Recycling component are available in the Company's PY13 annual report.

3.3.5.3 Direct Install (PY14)

Tetra Tech conducted a process evaluation for the WARM Plus/Extra Measures program component and the Multifamily program component (which together comprise the Low-Income Direct Install initiative). While there were separate samples for each program component, data collection occurred concurrently with participant surveys in February and March of 2023, and contractor interviews between February and April of 2023. In addition to surveys and interviews, Tetra Tech combined a benchmarking study for the Company's Multifamily programs, including the low-income component.

3.3.5.4 Multifamily Direct Install (PY14 and PY15)

Tetra Tech conducted a combined process evaluation of the nonresidential, residential market-rate, and residential low-income Multifamily Direct Install programs in PY14 and PY15. The evaluation is described in Section 3.1.5.6.

3.3.5.5 Home Energy Reports (PY14)

Tetra Tech conducted a combined process evaluation of the residential and low-income Home Energy Report programs in PY14. The evaluation is described in Section 3.1.5.1.

3.3.5.6 School Education Program (PY15)

Tetra Tech conducted a combined process evaluation of the residential and low-income School Education programs in PY15. The evaluation is described in Section 3.1.5.2.

3.3.5.7 Energy Efficiency Kits (PY15)

Tetra Tech conducted a combined process evaluation of the residential and low-income Energy Efficiency Kits programs in PY15. The evaluation is described in Section 3.1.5.3.

3.3.5.8 New Homes (PY14)

Tetra Tech conducted a combined process evaluation of the residential and low-income New Homes programs in PY14. The evaluation is described in Section 3.1.5.5.

3.3.5.9 Behavioral Online Audits (PY14)

Tetra Tech conducted a combined process evaluation of the residential and low-income Behavioral Online Audit programs in PY14. The evaluation is described in Section 3.1.5.7.

3.3.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 68, Table 69, Table 70, and Table 71 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2025 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 68: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	2,640		9,054		2,640		9,054	
2	Rebates to Participants and Trade Allies	-60		421		-60		421	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	282		1,671		282		1,671	
5	Direct Installation Program Materials and Labor	2,324		6,690		2,324		6,690	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	94		271		94		271	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	3	5	0	0	3	5
8	Administration and Management	-3	4	361	1,138	-3	4	361	1,138
9	Marketing	0	0	2	177	0	0	2	177
10	Program Delivery	73	515	74	912	73	515	74	912
11	EDC Evaluation Costs	66		329		66		329	
12	SWF Audit Costs	16		112		16		112	
13	Program Overhead Costs (Sum of rows 7 through 12)	673		3,112		673		3,112	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	3,313		12,166		3,313		12,166	
15	Total NPV Lifetime Electric Energy Benefits	999		5,261		999		5,261	
16	Total NPV Lifetime Electric Capacity Benefits	490		2,937		490		2,937	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-25		-128		-25		-128	
19	Total NPV Lifetime Water Impacts	694		3,473		694		3,473	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	2,158		11,544		2,158		11,544	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.65		0.95		0.65		0.95	

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

Table 69: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	2,538		11,341		2,538		11,341	
2	Rebates to Participants and Trade Allies	-131		471		-131		471	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	157		1,532		157		1,532	
5	Direct Installation Program Materials and Labor	2,343		9,157		2,343		9,157	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	168		180		168		180	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	3	5	0	0	3	5
8	Administration and Management	-18	5	425	1,336	-18	5	425	1,336
9	Marketing	0	1	0	286	0	1	0	286
10	Program Delivery	70	613	73	951	70	613	73	951
11	EDC Evaluation Costs	66		367		66		367	
12	SWE Audit Costs	18		121		18		121	
13	Program Overhead Costs (Sum of rows 7 through 12)	755		3,568		755		3,568	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	3,293		14,909		3,293		14,909	
15	Total NPV Lifetime Electric Energy Benefits	795		5,745		795		5,745	
16	Total NPV Lifetime Electric Capacity Benefits	265		2,385		265		2,385	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-30		-215		-30		-215	
19	Total NPV Lifetime Water Impacts	368		2,733		368		2,733	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	1,398		10,649		1,398		10,649	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.42		0.71		0.42		0.71	

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

Table 70: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	64		2,549		64		2,549	
2	Rebates to Participants and Trade Allies	-31		109		-31		109	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		160		0		160	
5	Direct Installation Program Materials and Labor	64		2,258		64		2,258	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	31		21		31		21	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	1	2	0	0	1	2
8	Administration and Management	-4	0	141	455	-4	0	141	455
9	Marketing	0	0	1	59	0	0	1	59
10	Program Delivery	22	24	24	253	22	24	24	253
11	EDC Evaluation Costs	22		110		22		110	
12	SWE Audit Costs	6		39		6		39	
13	Program Overhead Costs (Sum of rows 7 through 12)	70		1,084		70		1,084	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	133		3,634		133		3,634	
15	Total NPV Lifetime Electric Energy Benefits	12		1,169		12		1,169	
16	Total NPV Lifetime Electric Capacity Benefits	6		349		6		349	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	0		-52		0		-52	
19	Total NPV Lifetime Water Impacts	0		252		0		252	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	18		1,718		18		1,718	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.14		0.47		0.14		0.47	

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

Table 71: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	1,963		11,027		1,963		11,027	
2	Rebates to Participants and Trade Allies	-116		386		-116		386	
3	Upstream / Midstream Incentives	0		0		0		0	
4	Material Cost for Self-Install Programs (EE&C Kits)	389		1,974		389		1,974	
5	Direct Installation Program Materials and Labor	1,537		8,561		1,537		8,561	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	152		105		152		105	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	3	5	0	0	3	5
8	Administration and Management	-20	4	384	1,217	-20	4	384	1,217
9	Marketing	0	0	3	275	0	0	3	275
10	Program Delivery	72	480	74	850	72	480	74	850
11	EDC Evaluation Costs	72		354		72		354	
12	SWE Audit Costs	17		118		17		118	
13	Program Overhead Costs (Sum of rows 7 through 12)	626		3,284		626		3,284	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	2,588		14,310		2,588		14,310	
15	Total NPV Lifetime Electric Energy Benefits	1,194		7,057		1,194		7,057	
16	Total NPV Lifetime Electric Capacity Benefits	353		1,911		353		1,911	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
18	Total NPV Lifetime Fossil Fuel Impacts	-42		-248		-42		-248	
19	Total NPV Lifetime Water Impacts	686		4,022		686		4,022	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	2,191		12,743		2,191		12,743	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.85		0.89		0.85		0.89	

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

3.3.7 Status of Recommendations

The process evaluation activities in PY16 led to the following findings and recommendations from Tetra Tech to the Company, along with a summary of how the Company plans to address the recommendations in program delivery. Findings and recommendations from previous process evaluation efforts can be found in the Company's PY13 and PY14 annual reports.

3.3.7.1 Appliance Recycling

Findings and recommendations from the PY16 evaluation are presented in Section 3.2.7.1.

3.4 C&I ENERGY SOLUTIONS FOR BUSINESS PROGRAM - SMALL

The C&I Solutions for Business Program – Small (referred to as ESB-Small Program) is offered to small commercial and industrial customers and was implemented jointly by Franklin Energy Services, Willdan, and CLEAResult for PY17. The Franklin Energy Services portion of the program includes downstream and midstream incentives for customers that install energy efficient equipment. The Willdan portion of the program includes incentives for Commercial New Construction, Custom Building Upgrades, Building Operator Certification, and the Building Tune-Up direct install program in PY17. CLEAResult staff conduct most of the audits and direct installations for the CI Multifamily initiative. CLEAResult administered the Appliance Recycling program component.

3.4.1 Participation and Reported Savings by Customer Segment

Table 72 and Table 73 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Small Program in PY17 by customer segment and Rate District. This program serves the Small C&I and GNI customer segments. Each separate rebate application is counted as one participant.

Table 72: ESB-Small Program Participation and Reported Impacts for Met-Ed and Penelec

Parameter	Met-Ed Small C&I (Non-GNI)	Met-Ed GNI	Met-Ed Total	Penelec Small C&I (Non-GNI)	Penelec GNI	Penelec Total
PYTD # Participants	583	18	601	1,840	60	1,900
PYRTD MWh/yr	20,551	1,311	21,862	53,407	2,105	55,513
PYRTD MW/yr	4.22	0.28	4.50	11.89	0.47	12.36
PYTD Incentives (\$1000)	1,992	205	2,197	3,800	375	4,176

Table 73: ESB-Small Program Participation and Reported Impacts for Penn Power and WPP

Parameter	Penn Power Small C&I (Non-GNI)	Penn Power GNI	Penn Power Total	WPP Small C&I (Non-GNI)	WPP GNI	WPP Total
PYTD # Participants	359	7	366	867	36	903
PYRTD MWh/yr	8,655	418	9,073	35,169	599	35,768
PYRTD MW/yr	2.32	0.09	2.41	9.12	0.13	9.26
PYTD Incentives (\$1000)	736	79	815	2,537	86	2,622

3.4.2 Gross Impact Evaluation

The ESB-Small Program was disaggregated into five sampling initiatives for gross impact evaluation. Downstream and midstream lighting improvements and downstream prescriptive rebates for efficient equipment such as HVAC systems, food service, refrigeration, appliances, and agricultural measures were grouped into the CI Prescriptive initiative and evaluated

according to PA TRM protocols as described in detail in Appendix R. Within the Prescriptive initiative, lighting and non-lighting, and downstream and midstream components each had distinct sampling strata. Custom projects include combinations of measures that serve multiple end-uses, as well as custom projects that involve combined heat and power, motors and drives, industrial process improvements, refrigeration, retro-commissioning, compressed air upgrades, data centers, and custom HVAC and chillers. The impact evaluation for the custom initiative is described in Appendix S. The Energy Management and New Construction (CI EMNC) initiative includes the Building Tune-Up direct install component, incentives for efficient new construction, and additional components such as building operator certification, retro and virtual commissioning, and incentives for building improvements. Qualus placed each component into one or more dedicated sampling strata. The impact evaluation for the CI EMNC initiative is described in Appendix T. The Master Metered Multifamily Direct Install (CI Multifamily) initiative targets low-income customers in master-metered communities. Evaluation activities for the CI Multifamily initiative are described in Appendix U. Appendix V describes the evaluation of the Appliance Recycling initiative. Table 74 summarizes program verified impacts and realization rates for each Rate District.

Table 74: ESB-Small Program Gross Impact Evaluation Summary for PY17

Rate District	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	CI Prescriptive	5,034	0.91	95%	84.7%
Met-Ed	CI Custom	4,782	1.81	101%	101.2%
Met-Ed	CI EMNC	11,059	1.89	98%	100.7%
Met-Ed	CI Multifamily	449	0.06	101%	91.1%
Met-Ed	Appliance Recycling	91	0.03	107%	108.0%
Met-Ed Total		21,415	4.70	98%	97%
Penelec	CI Prescriptive	28,900	6.96	70%	74%
Penelec	CI Custom	4,526	1.73	93%	97%
Penelec	CI EMNC	9,112	1.58	97%	79%
Penelec	CI Multifamily	0	0.00	0%	0%
Penelec	Appliance Recycling	51	0.02	98%	112%
PenelecTotal		42,589	10.29	77%	78%
Penn Power	CI Prescriptive	5,977	1.50	94%	87%
Penn Power	CI Custom	1,491	0.60	104%	104%
Penn Power	CI EMNC	977	0.15	81%	65%
Penn Power	CI Multifamily	75	0.01	103%	103%
Penn Power	Appliance Recycling	0	0.00	100%	100%
Penn PowerTotal		8,520	2.26	94%	89%
WPP	CI Prescriptive	25,079	5.51	91%	74%
WPP	CI Custom	4,037	1.79	101%	102%
WPP	CI EMNC	3,791	0.73	90%	100%
WPP	CI Multifamily	98	0.02	97%	97%
WPP	Appliance Recycling	18	0.01	95%	111%
WPP Total		33,022	8.06	92%	81%

The gross realization rates for energy savings were driven primarily by variances between assumed lighting hours of use in advance of rebate approval and hours of use that were determined through impact evaluation activities. For Met-Ed and Penelec, the MODIFY program, which provided direct delivery of TLEDs to small commercial businesses, had lower realization rates than other program components. This was primarily due to optimistic assumptions regarding lamp in-service rates. Midstream lighting realization rates tended to be lower for Rate Districts with significant manufacturing or industrial sectors. One reason for this is that the default baseline wattage assumptions in the TRM for highbay fixtures tend to be higher than what are verified on site. A second reason is that storage and manufacturing facilities are often found to be unconditioned, which lowers the demand interactive effect relative to those used in reporting assumptions. Despite these factors, the midstream lighting program is generally more cost-effective than the downstream program due to lower overall implementation cost.

3.4.3 Net Impact Evaluation

The net impact evaluation of the Prescriptive initiative is described in Appendix R. The net impact evaluation of the Custom initiative is described in Appendix S. The net impact evaluation of the CI EMNC initiative is described in Appendix T. Net impact evaluation was not conducted for the CI Multifamily initiative since that is a dedicated low-income program. The NTG for the Appliance Recycling Initiative is estimated to be the same as the NTG of the residential Appliance Recycling Initiative, as described in Appendix V.

All initiatives other than CI Multifamily were evaluated for NTG in PY14. The CI Multifamily initiative was evaluated in PY15, and the CI Custom and EMNC initiatives were evaluated in PY16. Results are shown in Table 75.

Table 75: ESB-Small Program Net Impact Evaluation Summary for PY17

Rate District	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	CI Prescriptive	5,034	70.8%	3,566	0.64
Met-Ed	CI Custom	4,782	47.6%	2,276	0.86
Met-Ed	CI EMNC	11,059	76.2%	8,425	1.44
Met-Ed	CI Multifamily	449	99.5%	447	0.06
Met-Ed	Appliance Recycling	91	62.0%	57	0.02
Met-Ed Total		21,415	69.0%	14,770	3.02
Penelec	CI Prescriptive	28,900	65.9%	19,035	4.58
Penelec	CI Custom	4,526	49.9%	2,260	0.86
Penelec	CI EMNC	9,112	78.5%	7,150	1.24
Penelec	CI Multifamily	0	0.0%	0	0.00
Penelec	Appliance Recycling	51	60.0%	31	0.01
Penelec Total		42,589	66.9%	28,475	6.70
Penn Power	CI Prescriptive	5,977	80.1%	4,786	1.20
Penn Power	CI Custom	1,491	55.7%	830	0.33
Penn Power	CI EMNC	977	77.3%	755	0.12
Penn Power	CI Multifamily	75	99.5%	75	0.01
Penn Power	Appliance Recycling	0	61.0%	0	0.00
Penn Power Total		8,520	75.7%	6,446	1.66
WPP	CI Prescriptive	25,079	67.4%	16,905	3.71
WPP	CI Custom	4,037	55.7%	2,248	1.00
WPP	CI EMNC	3,791	78.1%	2,960	0.57
WPP	CI Multifamily	98	99.5%	98	0.02
WPP	Appliance Recycling	18	66.0%	12	0.00
WPP Total		33,022	67.3%	22,222	5.30

3.4.3.1 High-Impact Measure Research

No Initiatives from this program have been designated as high-impact measures for PY17.

3.4.4 Verified Savings Estimates

In Table 76 the realization rates and net-to-gross ratios determined by Qualus and Tetra Tech are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the ESB-Small Program in PY17. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 76: PYTD and P4TD Savings Summary

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	21,862	4.83	55,513	13.25	9,073	2.54	35,768	9.99
PYVTD Gross	21,415	4.70	42,589	10.29	8,520	2.26	33,022	8.06
PYVTD Net	14,770	3.02	28,475	6.70	6,446	1.66	22,222	5.30
RTD	109,963	22.43	174,417	40.03	36,158	8.22	143,873	31.96
VTD Gross	109,398	21.32	155,964	34.22	33,353	7.43	143,197	28.00
VTD Net	77,368	14.46	109,758	23.66	26,860	5.82	105,427	19.87

3.4.5 Process Evaluation

Process evaluation activities were conducted for various components of this program in Phase IV, as summarized in Table 77 below. Process evaluation was not scheduled for this program in PY17.

Table 77: Combined C&I Program Process Evaluation Sample Design

Stratum	Population Size	Sample Size (Census Att)	Response Rate
Met-Ed Custom (PY16)	53	11	21%
Met-Ed Prescriptive (PY14)	161	41	25%
Met-Ed Midstream (PY14)	64	16	25%
Met-Ed EMNC (PY16)	227	21	9%
Penelec Custom (PY16)	61	8	13%
Penelec Prescriptive (PY14)	200	70	35%
Penelec Midstream (PY14)	162	39	24%
Penelec EMNC (PY16)	228	47	21%
Penn Power Custom (PY16)	9	1	11%
Penn Power Prescriptive (PY14)	91	35	38%
Penn Power Midstream (PY14)	8	1	13%
Penn Power EMNC (PY16)	51	9	18%
WPP Custom (PY16)	60	4	7%
WPP Prescriptive (PY14)	272	97	36%
WPP Midstream (PY14)	93	20	22%
WPP EMNC (PY16)	228	38	17%
Trade Ally Surveys (PY14)	165	51	31%
Trade Ally Surveys (PY16)	84	25	30%
Midstream Distributor Interviews	17	15	88%
All EDCs MF Participant Surveys (PY15)	249	25	10%
All EDCs MF Owner/Manager Surveys (PY15)	46	10	22%
Program Total	2,529	549	22%

3.4.5.1 Custom, Energy Management, and Prescriptive Components (PY14)

In PY14 Tetra Tech conducted participant surveys, trade ally surveys, and midstream distributor interviews. Process evaluation activities were combined for the ESB Small and ESB Large programs. Tetra Tech opted to survey and interview the census of program participants, trade allies, and distributors. To further increase the number of survey participants, Tetra Tech drew from both PY13 and PY14 participants. Response rates varied but were generally higher than expected, which resulted in robust overall samples. Table 77 shows the sample design for the PY14 process evaluation effort. After review of the tracking and reporting system and the gross impact evaluation sample design, Tetra Tech applied a similar stratification approach as the gross impact evaluation at the initiative level. However, downstream and midstream sub-initiatives were not further disaggregated into lighting and non-lighting components. In Table 77 below, the Prescriptive stratum includes both lighting and non-lighting downstream projects, while the Midstream stratum includes both lighting and non-lighting midstream projects. Participant telephone surveys combined net impact and process evaluation and were fielded in May and June 2023. An email campaign preceded the surveys to notify customers of the upcoming survey effort and to increase response rates. Trade ally surveys and distributor interviews occurred in July 2023.

3.4.5.2 Multifamily Direct Install (PY14 and PY15)

Tetra Tech conducted a combined process evaluation of the nonresidential, residential market-rate, and residential low-income Multifamily Direct Install programs in PY14 and PY15. The evaluation is described in Section 3.1.5.6.

3.4.5.3 Custom and Energy Management Initiatives (PY16)

Tetra Tech conducted a combined process evaluation of the custom and Energy Management initiatives in PY16. When process evaluations were previously conducted in PY14, some of the Energy Management components had not fully launched. The process evaluation of the Custom initiative provided an opportunity to follow up on findings from the PY14 evaluation and to include the more recent solar program component.

3.4.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 78, Table 79, Table 80, and Table 81 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2025 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 78: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	10,648		36,132		7,460		25,168	
2	Rebates to Participants and Trade Allies	2,534		17,606		2,534		17,606	
3	Upstream / Midstream Incentives	137		1,222		137		1,222	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		239		0		239	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	7,978		17,065		4,790		6,101	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	8	13	0	0	8	13
8	Administration and Management	-119	27	679	3,631	-119	27	679	3,631
9	Marketing	0	1	0	392	0	1	0	392
10	Program Delivery	173	1,186	217	1,826	173	1,186	217	1,826
11	EDC Evaluation Costs	268		1,069		268		1,069	
12	SWEE Audit Costs	43		295		43		295	
13	Program Overhead Costs (Sum of rows 7 through 12)	1,580		8,130		1,580		8,130	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	12,228		44,262		9,040		33,298	
15	Total NPV Lifetime Electric Energy Benefits	10,017		42,763		6,858		30,011	
16	Total NPV Lifetime Electric Capacity Benefits	8,920		34,828		5,695		23,469	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	3,934		5,402		3,042		4,103	
18	Total NPV Lifetime Fossil Fuel Impacts	-261		-1,565		-201		-1,129	
19	Total NPV Lifetime Water Impacts	0		20		0		20	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	22,609		81,448		15,394		56,474	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	1.85		1.84		1.70		1.70	

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

Table 79: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	18,904		52,618		12,339		36,374	
2	Rebates to Participants and Trade Allies	2,132		18,557		2,132		18,557	
3	Upstream / Midstream Incentives	2,944		4,946		2,944		4,946	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		892		0		892	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	13,829		28,223		7,263		11,980	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	1	0	9	14	1	0	9	14
8	Administration and Management	-83	70	836	4,329	-83	70	836	4,329
9	Marketing	0	2	0	461	0	2	0	461
10	Program Delivery	208	1,883	250	3,058	208	1,883	250	3,058
11	EDC Evaluation Costs	298		1,184		298		1,184	
12	SWF Audit Costs	47		326		47		326	
13	Program Overhead Costs (Sum of rows 7 through 12)	2,426		10,467		2,426		10,467	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	21,331		63,085		14,765		46,842	
15	Total NPV Lifetime Electric Energy Benefits	20,619		62,208		13,743		43,529	
16	Total NPV Lifetime Electric Capacity Benefits	17,459		49,319		11,344		34,050	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,832		4,773		1,354		3,504	
18	Total NPV Lifetime Fossil Fuel Impacts	-189		-5,157		-132		-4,287	
19	Total NPV Lifetime Water Impacts	0		3		0		3	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	39,721		111,145		26,310		76,799	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	1.86		1.76		1.78		1.64	

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

Table 80: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	2,508		10,531		1,720		8,558	
2	Rebates to Participants and Trade Allies	472		4,741		472		4,741	
3	Upstream / Midstream Incentives	519		1,026		519		1,026	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		67		0		67	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	1,517		4,697		729		2,723	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	2	4	0	0	2	4
8	Administration and Management	-48	0	260	940	-48	0	260	940
9	Marketing	0	0	0	107	0	0	0	107
10	Program Delivery	56	374	70	645	56	374	70	645
11	EDC Evaluation Costs	76		305		76		305	
12	SWF Audit Costs	13		88		13		88	
13	Program Overhead Costs (Sum of rows 7 through 12)	472		2,422		472		2,422	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	2,980		12,953		2,192		10,979	
15	Total NPV Lifetime Electric Energy Benefits	4,305		13,820		3,254		11,116	
16	Total NPV Lifetime Electric Capacity Benefits	2,487		6,873		1,827		5,380	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	270		977		245		841	
18	Total NPV Lifetime Fossil Fuel Impacts	-86		-463		-68		-378	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	6,977		21,206		5,258		16,959	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	2.34		1.64		2.40		1.54	

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

Table 81: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	10,474		41,327		7,044		32,217	
2	Rebates to Participants and Trade Allies	1,076		17,886		1,076		17,886	
3	Upstream / Midstream Incentives	2,111		3,877		2,111		3,877	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		1,391		0		1,391	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	7,287		18,172		3,857		9,062	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	7	13	0	0	7	13
8	Administration and Management	-287	80	577	4,478	-287	80	577	4,478
9	Marketing	0	4	0	372	0	4	0	372
10	Program Delivery	68	-158	121	1,190	68	-158	121	1,190
11	EDC Evaluation Costs	238		1,036		238		1,036	
12	SWEE Audit Costs	21		266		21		266	
13	Program Overhead Costs (Sum of rows 7 through 12)	-35		8,059		-35		8,059	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	10,439		49,386		7,010		40,276	
15	Total NPV Lifetime Electric Energy Benefits	16,922		60,226		11,362		44,117	
16	Total NPV Lifetime Electric Capacity Benefits	8,068		23,738		5,301		16,789	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,083		5,027		871		3,868	
18	Total NPV Lifetime Fossil Fuel Impacts	-356		-2,113		-252		-1,593	
19	Total NPV Lifetime Water Impacts	0		54		0		54	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	25,717		86,933		17,281		63,236	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	2.46		1.76		2.47		1.57	

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

3.4.7 Status of Recommendations

The process evaluation activities in PY16 led to the following findings and recommendations from Tetra Tech to the Company, along with a summary of how the Company plans to address the recommendations in program delivery. Findings and recommendations from previous process evaluation efforts can be found in the Company's prior annual reports.

3.4.7.1 Custom and EMNC Programs

Finding #1: *Satisfaction among participating customers and vendors remains high.* The average participant rating across all program aspects was 3.9 or higher for customers and 3.2 or higher for vendors on a 1 to 5 scale, where 1 was *not at all satisfied*, and 5 was *very satisfied*. More than half of participating customers have recommended the program to others, and 78 percent said they were very likely to participate again.

Finding #2: *Trade allies (contractors and vendors) continue to be the most common source of respondent awareness.* Nearly half of customer respondents learned about the program from their contractor or vendor. Alternatively, more than two-thirds of customers said they *prefer* to receive information about energy efficiency programs from FirstEnergy, specifically electronically through an email or a direct mail piece. Vendors echoed this feedback, saying they felt the most effective communication was from FirstEnergy (i.e., account manager, call center, bill inserts).

Finding #3: *The application process received positive feedback from the participating customers, but vendor respondents had some suggestions.* Nearly all program participants (97 percent) had no problems completing the program application. However, the application was mentioned by a few participants and some vendors as one of the program features that needs improvement. Simplifying the process and adding an electronic signature option were mentioned by both respondent groups. The application process was rated highly in satisfaction amongst customers, receiving an average score of 4.3 on a scale ranging from one to five. However, vendor respondents provided the lowest scores (3.2 on the same one to five scale) for time it took to complete the paperwork and the amount of paperwork required by the program.

Finding #4: *Nearly two-thirds of the customer respondents had no recommended improvements or changes to the program, while half of the vendor respondents offered suggestions.* Customers with recommendations most frequently mentioned expanding service offerings (31 percent), increasing program awareness (28 percent), and improving communication (17 percent). Vendor recommendations mostly involved reducing administrative burden, including simplifying processes and paperwork (four respondents), program requirements, and calculation tools (four respondents), and decreasing the preapproval and processing time (three respondents). Vendors also suggested limiting changes in incentive amounts to ensure stability and good customer relationships (two respondents).

Finding #5: *Incomplete and generic contact information limited survey reach.* A significant barrier to achieving the expected response rate was the lack of accurate contact information in the tracking data. Most records were missing individual contact names and included only generic phone numbers, which led to difficulties in reaching program participants and a high rate of refusals or incomplete attempts. Even after requesting additional contact details from the conservation service providers (CSPs), the improvement in response rates was minimal.

Finding #6: *The evaluation activities resulted in NTG ratios ranging from 48 to 78 percent across Rate Districts and initiatives for the PY16 program.* NTG ratios ranged from 48 to 55 percent for the Custom initiative and 68 to 78 percent for the Energy Management initiative. In the Custom Initiative, solar projects had distinctly lower NTGs than non-solar projects. In the Energy Management Initiative, Building Operator Certification, Building Improvements, and Building Tune-Ups had particularly high NTG values, while Commercial New Construction had a far lower NTG than other components.

Finding #7: *Program motivated participation in the Building Operator Training (BOT). Participants were highly satisfied with the training and found it valuable.* All four BOT respondents were aware of FirstEnergy's \$1,000 incentive before enrolling in the BOC training, and it played a significant role in their decision to participate. Despite challenges such as

balancing the training with full-time work, participants reported that the training was valuable. It increased their understanding of building systems, control strategies, and energy efficiency, which they have begun applying in their facilities. Satisfaction with the training and its relevance was consistently high.

Recommendation #1: *Increase awareness and continue to utilize multiple strategies to promote the programs, especially among trade allies.* FirstEnergy and the CSPs use many different outreach strategies to market the programs; this can be seen in the variety of sources customers reported hearing about the program, but a preference for direct communication from FirstEnergy (mailing, email, or electronic newsletters) is among the lowest actual sources of awareness. In addition, trade allies (contractors and vendors) continue to be the most common source of awareness and are identified by the CSPs as an effective channel for identifying and bringing new projects into the FirstEnergy programs. Since the CSPs indicated awareness among trade allies as a key barrier to participation, more marketing activities directed to trade allies is needed. Attending more trade shows and providing more updates to vendors were some of the recommended activities.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: *Continue to seek opportunities to simplify the application process for trade allies.* Most recommendations for improvement from customers and vendors involved reducing administrative burden by streamlining the process, simplifying the required paperwork and allowing digital signatures. The vendors also suggested improvements to the application process where FirstEnergy and program implementers could help by providing user-friendly calculation and tracking tools, along with streamlined materials that detail product and customer eligibility. Other recommendations from vendors included limiting changes in incentive amounts.

EDC Status Report #2: Recommendation accepted.

Recommendation #3: *Improve data collection protocols for contact information.* Future tracking efforts may benefit from placing greater emphasis on collecting complete and specific contact details, such as direct phone numbers and names of individuals familiar with program participation. Establishing these data protocols upfront with CSPs can enhance respondent accessibility and increase the likelihood of successful survey completions.

EDC Status Report #3: Recommendation accepted.

3.5 C&I ENERGY SOLUTIONS FOR BUSINESS PROGRAM - LARGE

The C&I Solutions for Business Program – Large (referred to as ESB-Large Program) is offered to large commercial and industrial customers and was implemented jointly by Franklin Energy Services and Willdan for PY17. The Franklin Energy Services portion of the program includes downstream and midstream incentives for customers that install custom and prescriptive energy efficient equipment. The Willdan portion of the program includes incentives for efficient new construction, the Building Tune-Up direct install program, custom building retrofits, retro commissioning, and building operator certification in PY17.

3.5.1 Participation and Reported Savings by Customer Segment

Table 82 and Table 83 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Large Program in PY17 by customer segment and Rate District. This program serves the Large C&I and GNI customer segments. Each separate rebate application is counted as one participant.

Table 82: ESB-Large Program Participation and Reported Impacts for Met-Ed and Penelec

Parameter	Met-Ed Large C&I (Non-GNI)	Met-Ed GNI	Met-Ed Total	Penelec Large C&I (Non-GNI)	Penelec GNI	Penelec Total
PYTD # Participants	270	5	275	608	23	631
PYRTD MWh/yr	38,601	611	39,212	96,314	3,501	99,815
PYRTD MW/yr	6.20	0.17	6.36	14.65	0.59	15.24
PYTD Incentives (\$1000)	3,363	60	3,423	6,169	560	6,729

Table 83: ESB-Large Program Participation and Reported Impacts for Penn Power and WPP

Parameter	Penn Power Large C&I (Non-GNI)	Penn Power GNI	Penn Power Total	WPP Large C&I (Non-GNI)	WPP GNI	WPP Total
PYTD # Participants	65	2	67	282	1	283
PYRTD MWh/yr	24,045	593	24,637	76,970	1	76,970
PYRTD MW/yr	3.93	0.17	4.10	10.00	0.00	10.00
PYTD Incentives (\$1000)	1,699	103	1,802	5,029	0	5,030

3.5.2 Gross Impact Evaluation

The ESB-Large Program is disaggregated into three sampling initiatives for gross impact evaluation. Each of these initiatives spans both the ESB-Large and ESB-Small programs. The gross impact evaluation of the Prescriptive initiative is described in Appendix R. The gross impact evaluation of the Custom initiative is described in Appendix S. The gross impact

evaluation of the CI EMNC initiative is described in Appendix T. Table 84 summarizes program verified impacts and realization rates for each Rate District.

Table 84: ESB-Large Program Gross Impact Evaluation Summary for PY17

Rate District	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	CI Prescriptive	11,877	1.71	95%	85%
Met-Ed	CI Custom	4,792	0.93	101%	101%
Met-Ed	CI EMNC	21,493	3.91	98%	101%
Met-Ed	Appliance Recycling	0	0.00	107%	108%
Met-Ed Total		38,162	6.55	97.3%	96.0%
Penelec	CI Prescriptive	37,907	6.28	70%	74%
Penelec	CI Custom	8,129	1.86	93%	97%
Penelec	CI EMNC	35,846	4.68	97%	79%
Penelec	Appliance Recycling	0	0.00	98%	112%
Penelec Total		81,882	12.82	82.0%	78.5%
Penn Power	CI Prescriptive	9,380	1.39	94%	87%
Penn Power	CI Custom	12,592	2.24	104%	104%
Penn Power	CI EMNC	2,053	0.37	81%	65%
Penn Power	Appliance Recycling	0	0.00	100%	100%
Penn Power Total		24,024	4.00	97.5%	92.6%
WPP	CI Prescriptive	29,920	3.40	91%	74%
WPP	CI Custom	33,085	4.15	101%	102%
WPP	CI EMNC	10,316	2.09	90%	100%
WPP	Appliance Recycling	0	0.00	95%	111%
WPP Total		73,321	9.64	95.3%	89.3%

The gross realization rates for energy savings were driven primarily by variances between assumed operational characteristics in advance of rebate approval and operational characteristics that were determined through impact evaluation activities. Key operational characteristics include lighting hours of use and equivalent full load hours for chillers, air compressors, and motors. The midstream lighting program tended to have lower realization rates than other program components, largely due to lower verified baseline watts than the values assumed in Section 3.1.7 of the PA TRM for highbay fixtures, and higher incidences of fixtures installed in unconditioned spaces than assumed in reported impact calculations.

3.5.3 Net Impact Evaluation

The net impact evaluation of the Prescriptive initiative is described in Appendix R. The net impact evaluation of the Custom initiative is described in Appendix S. The net impact evaluation of the CI EMNC initiative is described in Appendix T. The NTG for the Appliance Recycling Initiative is estimated to be the same as the NTG of the residential Appliance Recycling Initiative, as described in Appendix V.

All initiatives were evaluated for NTG in PY14, and the CI Custom and CI EMNC initiatives were also evaluated in PY16. Results are shown in Table 85.

Table 85: ESB-Large Program Net Impact Evaluation Summary for PY17

Rate District	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh	Net Verified MW
Met-Ed	CI Prescriptive	11,877	70.8%	8,415	1.21
Met-Ed	CI Custom	4,792	47.6%	2,280	0.44
Met-Ed	CI EMNC	21,493	76.2%	16,373	2.98
Met-Ed	Appliance Recycling	0	62.0%	0	0.00
Met-Ed Total		38,162	70.9%	27,069	4.63
Penelec	CI Prescriptive	37,907	65.9%	24,967	4.14
Penelec	CI Custom	8,129	49.9%	4,058	0.93
Penelec	CI EMNC	35,846	78.5%	28,128	3.67
Penelec	Appliance Recycling	0	60.0%	0	0.00
Penelec Total		81,882	69.8%	57,153	8.73
Penn Power	CI Prescriptive	9,380	80.1%	7,510	1.12
Penn Power	CI Custom	12,592	55.7%	7,012	1.25
Penn Power	CI EMNC	2,053	77.3%	1,586	0.29
Penn Power	Appliance Recycling	0	61.0%	0	0.00
Penn Power Total		24,024	67.0%	16,108	2.65
WPP	CI Prescriptive	29,920	67.4%	20,169	2.29
WPP	CI Custom	33,085	55.7%	18,424	2.31
WPP	CI EMNC	10,316	78.1%	8,055	1.63
WPP	Appliance Recycling	0	66.0%	0	0.00
WPP Total		73,321	63.6%	46,648	6.23

3.5.3.1 High-Impact Measure Research

No Initiatives from this program have been designated as high-impact measures for PY17.

3.5.4 Verified Savings Estimates

In Table 86 the realization rates and net-to-gross ratios determined by Qualus and Tetra Tech are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for ESB-Large Program in PY17. These totals are added to the verified savings achieved in previous program years to calculate the P4TD program impacts.

Table 86: PYTD and P4TD Savings Summary

Savings Type	Met-Ed		Penelec		Penn Power		WPP	
	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	39,212	6.82	99,815	16.34	24,637	4.32	76,970	10.79
PYVTD Gross	38,162	6.55	81,882	12.82	24,024	4.00	73,321	9.64
PYVTD Net	27,069	4.63	57,153	8.73	16,108	2.65	46,648	6.23
RTD	200,187	30.70	175,948	30.73	53,845	8.79	212,102	32.02
VTD Gross	200,617	30.40	155,944	25.80	52,113	8.36	212,065	29.59
VTD Net	124,129	18.99	106,080	17.23	37,181	5.95	136,573	19.44

3.5.5 Process Evaluation

The process evaluation effort for both C&I Programs is described in Sections 3.4.5 and 3.4.7. Most practical aspects of the programs are managed as one general effort rather than distinct programs, but applications are placed in one of the two programs according to their associated rate classes.

3.5.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 87, Table 88, Table 89, and Table 90 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2025 dollars. NPV costs and benefits for P4TD financials are expressed in 2021 dollars.

Table 87: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	20,901		67,800		14,396		41,819	
2	Rebates to Participants and Trade Allies	4,063		10,875		4,063		10,875	
3	Upstream / Midstream Incentives	98		849		98		849	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	16,740		56,075		10,235		30,094	
		EDC		CSP		EDC		CSP	
7	Program Design	1	0	10	17	1	0	10	17
8	Administration and Management	-35	442	955	4,616	-35	442	955	4,616
9	Marketing	0	167	0	1,270	0	167	0	1,270
10	Program Delivery	215	5,263	249	4,944	215	5,263	249	4,944
11	EDC Evaluation Costs	495		1,448		495		1,448	
12	SWE Audit Costs	55		380		55		380	
13	Program Overhead Costs (Sum of rows 7 through 12)	6,603		13,890		6,603		13,890	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	27,504		81,689		20,999		55,708	
15	Total NPV Lifetime Electric Energy Benefits	17,071		78,786		12,056		48,542	
16	Total NPV Lifetime Electric Capacity Benefits	6,175		26,085		4,341		16,188	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	515		-3,902		429		-1,844	
18	Total NPV Lifetime Fossil Fuel Impacts	-621		-12,628		-444		-7,230	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	23,140		88,341		16,382		55,655	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	0.84		1.08		0.78		1.00	

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

Table 88: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	22,316		35,369		14,207		23,073	
2	Rebates to Participants and Trade Allies	6,483		11,220		6,483		11,220	
3	Upstream / Midstream Incentives	1,697		2,206		1,697		2,206	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	14,137		21,943		6,028		9,647	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	7	12	0	0	7	12
8	Administration and Management	-76	923	672	3,837	-76	923	672	3,837
9	Marketing	0	19	0	854	0	19	0	854
10	Program Delivery	171	2,756	192	2,598	171	2,756	192	2,598
11	EDC Evaluation Costs	365		1,073		365		1,073	
12	SWE Audit Costs	40		276		40		276	
13	Program Overhead Costs (Sum of rows 7 through 12)	4,199		9,522		4,199		9,522	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	26,515		44,891		18,405		32,595	
15	Total NPV Lifetime Electric Energy Benefits	39,180		61,675		27,292		41,878	
16	Total NPV Lifetime Electric Capacity Benefits	13,885		23,244		9,446		15,489	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	4,201		5,241		3,114		3,836	
18	Total NPV Lifetime Fossil Fuel Impacts	-1,965		-3,974		-1,411		-2,755	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	55,301		86,186		38,442		58,448	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	2.09		1.92		2.09		1.79	
* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = \$2021									

Table 89: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	7,470		20,432		4,924		13,860	
2	Rebates to Participants and Trade Allies	2,023		3,840		2,023		3,840	
3	Upstream / Midstream Incentives	167		416		167		416	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	5,280		16,176		2,734		9,604	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	0	0	2	3	0	0	2	3
8	Administration and Management	-42	41	207	995	-42	41	207	995
9	Marketing	0	1	0	241	0	1	0	241
10	Program Delivery	46	481	56	540	46	481	56	540
11	EDC Evaluation Costs	92		267		92		267	
12	SWE Audit Costs	11		74		11		74	
13	Program Overhead Costs (Sum of rows 7 through 12)	631		2,384		631		2,384	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	8,101		22,816		5,555		16,244	
15	Total NPV Lifetime Electric Energy Benefits	11,789		21,286		7,890		15,120	
16	Total NPV Lifetime Electric Capacity Benefits	3,349		5,942		2,208		4,224	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	276		5,109		242		3,338	
18	Total NPV Lifetime Fossil Fuel Impacts	-547		-844		-438		-700	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	14,867		31,493		9,902		21,983	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	1.84		1.38		1.78		1.35	
* Rows 1-13 are presented in nominal dollars (PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025); P4TD = \$2021									

Table 90: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P4TD (\$1,000)		Net PYTD (\$1,000)		Net P4TD (\$1,000)	
1	IMCs	25,514		48,744		15,432		31,283	
2	Rebates to Participants and Trade Allies	5,747		12,693		5,747		12,693	
3	Upstream / Midstream Incentives	366		1,144		366		1,144	
4	Material Cost for Self-Install Programs (EE&C Kits)	0		0		0		0	
5	Direct Installation Program Materials and Labor	0		0		0		0	
6	Participant Costs (Row 1 minus the sum of Rows 2 through 5)	19,400		34,907		9,318		17,445	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
7	Program Design	1	0	7	12	1	0	7	12
8	Administration and Management	-150	233	589	3,954	-150	233	589	3,954
9	Marketing	0	1	0	834	0	1	0	834
10	Program Delivery	256	1,368	254	1,595	256	1,368	254	1,595
11	EDC Evaluation Costs	381		1,062		381		1,062	
12	SWE Audit Costs	59		278		59		278	
13	Program Overhead Costs (Sum of rows 7 through 12)	2,148		8,585		2,148		8,585	
14	Total NPV TRC Costs (Sum of rows 1 and 13)	27,661		57,329		17,580		39,868	
15	Total NPV Lifetime Electric Energy Benefits	37,056		88,889		23,566		57,217	
16	Total NPV Lifetime Electric Capacity Benefits	6,671		17,249		4,311		11,313	
17	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	-311		-2,438		-73		-912	
18	Total NPV Lifetime Fossil Fuel Impacts	-1,256		-11,360		-896		-6,952	
19	Total NPV Lifetime Water Impacts	0		0		0		0	
20	Total NPV TRC Benefits (Sum of rows 15 through 19)	42,160		92,341		26,907		60,665	
21	TRC Benefit-Cost Ratio (Row 20 divided by Row 14)	1.52		1.61		1.53		1.52	

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

3.5.7 Status of Recommendations

Recommendations for other nonresidential program components are listed in Section 3.4.7.

4 Portfolio Finances and Cost Recovery

This section provides an overview of the expenditures associated with the Company's portfolio and the recovery of those costs from ratepayers.

4.1 PROGRAM FINANCES

Program-specific and portfolio total finances for PY17 are shown in Table 91, Table 92, Table 93, and Table 94 for Met-Ed, Penelec, Penn Power, and WPP. The columns in these tables Table 91 through Table 98 are adapted from the 'Direct Program Cost' categories in the Commission's EE&V Plan template¹² for Phase IV. Non-incentives include EDC Materials, Labor, and Administration costs (including costs associated with an EDC's own employees) as well as ICSP Materials, Labor, and Administration costs (including both the program implementation contractor and the costs of any other outside vendors and EDCs employs to support program delivery). The dollar figures shown in Table 91 through Table 98 are based on EDC tracking of expenditures with no adjustments to account for inflation.¹³

Table 91: Met-Ed PY17 Program and Portfolio total Finances (\$1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	3,142	3,340	6,482
Energy Efficient Products	677	1,530	2,208
Low Income Energy Efficiency	2,546	657	3,203
C&I Energy Solutions for Business - Small	2,671	1,537	4,208
C&I Energy Solutions for Business - Large	4,161	6,547	10,708
Common Portfolio Costs ¹		0	0
Portfolio Total	13,197	13,612	26,809
SWE Costs ²	N/A	N/A	169
Total	13,197	13,612	26,978
1. Common portfolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.			
2. Statewide Evaluation costs are outside of the 2% spending cap.			

¹² <https://www.puc.pa.gov/pcdocs/1676672.docx>

¹³ The cost-recovery of program expenses through riders generally happens promptly so that costs are being recovered from ratepayers in the same dollars that they are incurred.

Table 92: Penelec PY17 Program and Portfolio total Finances (\$1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	2,537	2,535	5,072
Energy Efficient Products	1,621	1,645	3,266
Low Income Energy Efficiency	2,370	737	3,107
C&I Energy Solutions for Business - Small	5,075	2,379	7,454
C&I Energy Solutions for Business - Large	8,179	4,158	12,338
Common Portfolio Costs¹		0	0
Portfolio Total	19,783	11,454	31,238
SWE Costs²	N/A	N/A	153
Total	19,783	11,454	31,391

1. Common portfolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

Table 93: Penn Power PY17 Program and Portfolio total Finances (\$1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	1,172	811	1,983
Energy Efficient Products	109	297	406
Low Income Energy Efficiency	33	64	97
C&I Energy Solutions for Business - Small	991	459	1,450
C&I Energy Solutions for Business - Large	2,190	620	2,810
Common Portfolio Costs¹		0	0
Portfolio Total	4,495	2,250	6,746
SWE Costs²	N/A	N/A	48
Total	4,495	2,250	6,793

1. Common portfolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

Table 94: WPP PY17 Program and Portfolio total Finances (\$1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	3,909	3,020	6,928
Energy Efficient Products	2,075	2,108	4,183
Low Income Energy Efficiency	1,810	609	2,419
C&I Energy Solutions for Business - Small	3,187	-55	3,132
C&I Energy Solutions for Business - Large	6,114	2,089	8,203
Common Portfolio Costs¹		0	0
Portfolio Total	17,094	7,771	24,865
SWE Costs²	N/A	N/A	158
Total	17,094	7,771	25,023

1. Common portfolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.
2. Statewide Evaluation costs are outside of the 2% spending cap.

Program-specific and portfolio total finances since the inception of Phase IV are shown in Table 95, Table 96, Table 97, and Table 98 for Met-Ed, Penn Power, Penelec, and WPP.

Table 95: Met-Ed P4TD Program and Portfolio total Finances (\$1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	14,160	8,167	22,327
Energy Efficient Products	6,382	6,864	13,246
Low Income Energy Efficiency	9,864	3,305	13,169
C&I Energy Solutions for Business - Small	21,351	8,718	30,070
C&I Energy Solutions for Business - Large	13,460	15,593	29,052
Common Portfolio Costs ¹		0	0
Portfolio Total	65,218	42,646	107,864
SWE Costs ²	N/A	N/A	1,267
Total	65,218	42,646	109,131
1. Common portfolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.			
2. Statewide Evaluation costs are outside of the 2% spending cap.			

Table 96: Penelec P4TD Program and Portfolio total Finances (\$1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	10,952	6,111	17,063
Energy Efficient Products	5,062	5,425	10,486
Low Income Energy Efficiency	12,452	3,798	16,250
C&I Energy Solutions for Business - Small	27,459	11,286	38,746
C&I Energy Solutions for Business - Large	15,658	10,625	26,283
Common Portfolio Costs ¹		0	0
Portfolio Total	71,584	37,245	108,828
SWE Costs ²	N/A	N/A	1,148
Total	71,584	37,245	109,977
1. Common portfolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.			
2. Statewide Evaluation costs are outside of the 2% spending cap.			

Table 97: Penn Power P4TD Program and Portfolio total Finances (\$1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	5,147	2,657	7,804
Energy Efficient Products	1,527	1,685	3,212
Low Income Energy Efficiency	2,771	1,129	3,899
C&I Energy Solutions for Business - Small	6,507	2,580	9,087
C&I Energy Solutions for Business - Large	4,886	2,599	7,485
Common Portfolio Costs¹		0	0
Portfolio Total	20,839	10,648	31,487
SWE Costs²	N/A	N/A	356
Total	20,839	10,648	31,844
1. Common portfolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.			
2. Statewide Evaluation costs are outside of the 2% spending cap.			

Table 98: WPP P4TD Program and Portfolio total Finances (\$1,000)

Program	Incentives	Non-Incentives	Total Cost
Energy Efficient Homes	15,055	8,599	23,655
Energy Efficient Products	6,398	6,966	13,364
Low Income Energy Efficiency	12,140	3,480	15,620
C&I Energy Solutions for Business - Small	25,774	8,504	34,278
C&I Energy Solutions for Business - Large	15,939	9,430	25,368
Common Portfolio Costs¹		0	0
Portfolio Total	75,305	36,980	112,285
SWE Costs²	N/A	N/A	1,188
Total	75,305	36,980	113,473
1. Common portfolio costs are zero because all costs are distributed among programs as in the Company's EE&C plan.			
2. Statewide Evaluation costs are outside of the 2% spending cap.			

4.2 COST RECOVERY

Act 129 allows Pennsylvania EDCs to recover EE&C plan costs through a cost-recovery mechanism. Each EDC's cost-recovery charges are organized separately by four customer sectors to ensure that the electric rate classes that finance the programs are the rate classes that receive the direct energy and conservation benefits. Cost-recovery is governed by tariffed rate class, so it is necessarily tied to the way customers are metered and charged for electric service. Readers should be mindful of the differences between the tables below and Section 2.3. For example, the low-income customer segments are subsets of the residential tariff(s) and therefore not listed separately in Table 99, Table 100, Table 101, and Table 102.

Table 99: Met-Ed EE&C Expenditures by Cost-Recovery Category¹⁴ (\$1,000)

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000)	P4TD \$ Spending (\$1,000)
Residential (incl Low Income)	Rate RS	\$11,964	\$49,271
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	\$4,245	\$30,331
Large C&I	Rate GS-Large, Rate GP and Rate TP	\$10,764	\$29,468
Street Lighting	Street Lighting Service, LED Street Lighting Service and Ornamental Street Lighting Service	\$5	\$61
Portfolio Total		\$26,978	\$109,131

Table 100: Penelec EE&C Expenditures by Cost-Recovery Category¹⁵ (\$1,000)

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000)	P4TD \$ Spending (\$1,000)
Residential (incl Low Income)	Rate RS	\$11,511	\$44,290
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	\$7,499	\$39,074
Large C&I	Rate GS-Large, Rate GP, and Rate LP	\$12,378	\$26,585
Street Lighting	Street Lighting Service, LED Street Lighting Service, and Ornamental Street Lighting Service	\$2	\$28
Portfolio Total		\$31,391	\$109,977

Table 101: Penn Power EE&C Expenditures by Cost-Recovery Category¹⁶ (\$1,000)

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000)	P4TD \$ Spending (\$1,000)
Residential (incl Low Income)	Rate RS	\$2,509	\$15,094
Small C&I	Rate GS, GS Special Rider GSDS, Rate GM, Rate GS-Large and POL	\$1,462	\$9,175
Large C&I	Rate GP, and Rate GT	\$2,821	\$7,567
Street Lighting	Rate Schedules SV, SVD, SM and LED	\$1	\$9
Portfolio Total		\$6,793	\$31,844

¹⁴ Includes SWE costs¹⁵ Includes SWE costs¹⁶ Includes SWE costs

Table 102: WPP EE&C Expenditures by Cost-Recovery Category¹⁷ (\$1,000)

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000)	P4TD \$ Spending (\$1,000)
Residential (incl Low Income)	Rate 10	\$13,609	\$53,232
Small C&I	Rate GS 20, Rate GS 30	\$3,151	\$34,554
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	\$8,261	\$25,674
Street Lighting	Rate Schedules 51 through 58, 71, 72	\$2	\$12
Portfolio Total		\$25,023	\$113,473

For Phase IV of Act 129, the Company nominated a portion of peak demand reduction (PDR) acquired via EE&C programs into the PJM Forward Capacity Market. Proceeds from resources that clear in the FCM flow back to the rate class that generated the savings to offset cost recovery. Table 103, Table 104, Table 105, and Table 106, show the proceeds received in PY17 and P4TD net of CSP fees and other administrative costs for Met-Ed, Penelec, Penn Power, and West Penn Power respectively.

Table 103: Met-Ed FCM Proceeds from Recognized PDR (\$1000)

Cost Recovery Sector	Rate Classes Included	PY17 Proceeds	P4TD PJM Proceeds
Residential (incl Low Income)	Rate 10	\$177.31	\$228.92
Small C&I	Rate GS 20, Rate GS 30	\$97.02	\$127.25
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	\$127.45	\$166.40
Street Lighting	Rate Schedules 51 through 58, 71, 72	\$0.00	\$0.00
Portfolio Total		\$401.79	\$522.58

Table 104: Penelec FCM Proceeds from Recognized PDR (\$1000)

Cost Recovery Sector	Rate Classes Included	PY17 Proceeds	P4TD PJM Proceeds
Residential (incl Low Income)	Rate 10	\$141.74	\$181.51
Small C&I	Rate GS 20, Rate GS 30	\$79.29	\$100.89
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	\$114.11	\$132.06
Street Lighting	Rate Schedules 51 through 58, 71, 72	\$0.00	\$0.00
Portfolio Total		\$335.14	\$414.46

¹⁷ Includes SWE costs

Table 105: Penn Power FCM Proceeds from Recognized PDR (\$1,000)

Cost Recovery Sector	Rate Classes Included	PY17 Proceeds	P4TD PJM Proceeds
Residential (incl Low Income)	Rate 10	\$78.81	\$84.67
Small C&I	Rate GS 20, Rate GS 30	\$33.74	\$35.85
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	\$72.66	\$77.97
Street Lighting	Rate Schedules 51 through 58, 71, 72	\$0.00	\$0.00
Portfolio Total		\$185.21	\$198.49

Table 106: WPP FCM Proceeds from Recognized PDR (\$1,000)

Cost Recovery Sector	Rate Classes Included	PY17 Proceeds	P4TD PJM Proceeds
Residential (incl Low Income)	Rate 10	\$275.34	\$313.03
Small C&I	Rate GS 20, Rate GS 30	\$167.76	\$190.41
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	\$382.12	\$401.31
Street Lighting	Rate Schedules 51 through 58, 71, 72	\$0.00	\$0.00
Portfolio Total		\$825.23	\$904.75

At the portfolio level, PY17 cost recovery requirements were lowered by the percentages shown in the fifth row of Table 107 due to the FCM proceeds received from recognition of demand reductions shown in the sixth row of Table 107 for the 2025-2026 delivery year. P4TD cost recovery requirements have been lowered by the percentage amounts shown in the second to last row of Table 107 and corresponding FCM proceeds received from recognition of demand reductions shown in the last row. Beginning in the 2026/2027 delivery year, peak demand reduction from energy efficiency is no longer an eligible resource so Phase V cost recovery will be unaffected by proceeds from Phase IV peak demand reductions

Table 107: Cost Recovery Offsets from Recognized FCM PDR

EDC	Met-Ed	Penelec	Penn Power	West Penn Power
PY15 Cost Recovery Reduction (%)	0.5%	0.3%	0.2%	0.3%
DY 2023/24 MW	6.33	4.22	1.19	5.97
PY16 Cost Recovery Reduction (%)	0.5%	0.6%	0.3%	0.3%
DY 2024/25 MW	9.18	9.18	1.84	9.18
PY17 Cost Recovery Reduction (%)	1.5%	1.1%	2.7%	3.3%
DY 2025/26 MW	3.75	3.10	1.69	6.57
P4TD Cost Recovery Reduction (%)	0.6%	0.5%	0.7%	0.9%
P4TD MW	19.26	16.50	4.72	21.71

Appendix A Site Inspection Summary

Table 108: PY17 Site Visit Summary

Rate District	Program	Inspection Firm	Number of Inspections Conducted	Number of Virtual Inspections Conducted	Number of Sites with Discrepancies from Reported Values	Summary of Common Discrepancies
Met-Ed	Energy Efficient Products Program - HVAC Rebates (CAC, ASHP, Mini-Splits)	Franklin	651	0	9	Physical address or phone number differed from contact information on rebate application. Typo in serial number. Resident turnover resulting in account number changes..
Penelec		Franklin	320	0	2	
Penn Power		Franklin	221	0	6	
WPP		Franklin	695	0	17	
Met-Ed	Energy Efficient Products Program - Appliance Rebates (Clothes Washer, Clothes Dryer, Dishwasher, Refrigerator and Freezer)	Franklin	243	0	6	Site address or phone number differed from contact information listed on rebate application. Error in serial number. Customer moved in between product installation and inspection, resulting in a different customer living at home at time of inspection.
Penelec		Franklin	143	0	4	
Penn Power		Franklin	47	0	0	
WPP		Franklin	212	0	3	
Met-Ed	Energy Efficient Homes Program - New Construction	PSD	36	0	Please refer to the gross realization rates as a measure of consistency between reported and verified values.	The most common discrepancies are incorrect equipment capacities, using defaults for furnace fan energy usage rating rather than looking them up by model #, estimating the % of lamps that are efficient, window sizes, and building orientation.
Penelec		PSD	9	0		
Penn Power		PSD	38	0		
WPP		PSD	48	0		
Met-Ed	Low Income Direct Install Programs	PSD, Honeywell	295	0	Please refer to gross realization rates as a measure of reporting discrepancies.	The most common discrepancies are quantities of showerheads, aerators, lamps, and smart power strips. Good correspondence between reported and verified impacts overall.
Penelec			398	0		
Penn Power			3	0		
WPP			309	0		
Met-Ed	C/I Programs	Qualus	41	0	Please refer to gross realization rates as a measure of consistency.	The main discrepancy is lamp fixture counts/types. Other measures are verified essentially 100% of the time.
Penelec	C/I Programs	Qualus	57	0		
Penn Power	C/I Programs	Qualus	28	0		
WPP	C/I Programs	Qualus	38	0		
TOTAL	TOTAL		3832	0	n/a	

Appendix B HER Impact Evaluation Detail

B.1 GROSS IMPACT EVALUATION

The Behavioral Modification subprogram provides home energy reports to residential customers in the FirstEnergy PA service territory. These reports detail customers' historical energy usage, providing tips on ways customers can save energy, and promoting other programs in FirstEnergy's residential energy efficiency portfolio. The subprogram is divided between standard residential customers and Low-Income customers, with Low-Income customers receiving reports more frequently than participants in the standard residential subprogram and exclusively receiving low-cost or no-cost tips in their reports. The subprogram is administered as a randomized control trial (RCT) and participants are enrolled in experimental cohorts, with the frequency and start date of each cohort differing for the four Rate Districts. A monthly billing analysis regression is the primary activity used to calculate savings. Each participant cohort is modeled separately to generate verified gross usage savings. The following section describes Qualus' gross impact evaluation methodology.

B.1.1 Data Preparation and Analysis Procedure

B.1.1.1 Data Gathering

Monthly billing data dating back to 12 months prior to each experimental cohort's treatment start date through May 2026 was provided by FirstEnergy and Oracle for all participants. Monthly billing data was provided with indicators identifying whether the monthly bill was estimated or based on an actual meter read. Control vs. treatment indicators were also provided in the billing data set. Demographic information such as participant account number, etc. was masked in the billing data set. Oracle provided a map of unique identifiers to customer account numbers for all treatment and control customers.

In Phase III of Act 129, FirstEnergy converted all residential accounts to AMI meters. Thus, FirstEnergy also provided hourly interval meter data extracts for all customers. For all Phase IV cohorts, AMI data was available beginning with the 12-month period prior to treatment start to present. For all legacy cohorts, AMI data was available beginning with PY13 of Phase IV.

Additionally, FirstEnergy provided extracts of tracking data for all other residential programs for dual participation analysis.

B.1.1.2 Data Preparation

Qualus' prepared AMI data in the following manner:

- Residential AMI data was filtered by cohort by the treatment and control group account numbers.
- AMI data included actual reads and estimated reads. Rather than interpolating estimated AMI data, estimated AMI data and any calendar day containing estimated AMI data was removed from the data set on a per-customer basis.

- The total daily kWh per customer was taken for each customer for each day by summing across the kWh for each calendar day.
- An outlier filter of +/- 300 kWh per day was applied to the data set.

An average daily kWh per month for each customer was taken by averaging the total daily kWh for each customer for each calendar month. This was done to interpolate across any missing days in the calendar month.

In discussions with the SWE for PY16, the SWE recommended re-baselining cohorts that had stopped receiving treatment for a minimum of three years and resetting their treatment start date to the date at which they resumed treatment. Qualus noted concerns of potential inequivalence in re-baselining customers in the PY15 window due to continued persistence in PY15. Thus, based on an assessment of pre-treatment equivalence and data quality, Qualus and the SWE agreed to re-baseline one Penelec and two West Penn Power cohorts in the PY15 window only. These three cohorts remained active in PY17 and continued to be evaluated with their pre-treatment window re-baselined in the PY15 window.

Additionally, two cohorts fell out of equivalence for average annual pre-treatment consumption at the 90% confidence level. For these two cohorts, Qualus rebalanced the cohorts using with-replacement propensity score matching and included the matching weights in the regression analysis and peak demand savings calculation. These cohorts included one cohort for Met-Ed and one cohort for Penelec.

B.1.1.3 Billing Analysis

Qualus utilized a lagged seasonal (LS) multivariate regression model to estimate program savings for all experimental cohorts. The LS model is specified in the equation below:

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

Equation 1: Formula specifying the lagged seasonal regression model

The variables above are defined in Table 109 below. The regression coefficient of the interaction between the month post-treatment and the treatment dummy variable represents the average treatment effect per home for that given month. A negative regression coefficient represents a savings in the overall billed usage for the treatment group. Taking the negative of that coefficient will represent the daily kWh savings attributable to the treatment effect for that month per home.

Table 109: Definition of variables in the lagged seasonal regression model

Variable	Definition
kWh_{imy}	Customer i's average daily energy usage in bill month m in year y.
β_0	Intercept of the regression equation.
I_{my}	Equal to one for each monthly bill month m, year y, and zero otherwise.
β_{mys}	The coefficient on the bill month m, year y indicator variable interacted with season s.
$AvgPre_i$	Average daily usage for customer i in the pre-treatment period.
$AvePreSummer_i$	Average daily usage for customer i in the pre-treatment period during June through September.
$AvePreWinter_i$	Average daily usage for customer i in the pre-treatment period during December through March.
$treatment_{imy}$	The treatment indicator variable. Equal to one when the treatment is in effect for the treatment group. Zero otherwise. Always zero for the control group.
τ_{my}	The estimated treatment effect in kWh per day per customer; the main parameter of interest.
ε_{imy}	The error terms.

B.1.1.4 Dual Participation Analysis

Participants in both the treatment and control groups participate in other FirstEnergy energy efficiency programs. Furthermore, the “Home Energy Report” measure received by participants in the treatment group may cause treatment group participants to seek out other programs and measures offered in the FirstEnergy efficiency portfolio to a greater extent than the control group. To the extent that the treatment group participates in other FirstEnergy programs at a rate above and beyond that of the control group, those incremental savings will be reflected in the gross energy savings calculated using the method above. However, savings for these items will also have been attributed to their respective programs and subprograms. Qualus corrected for dual participation that occurred after treatment began to the extent that the treatment group participated at a higher rate than the control group.

Adjustment for Downstream Measures

For downstream measures, Qualus conducted a review of the tracking and reporting system for each experimental cohort to identify EE program participation that occurred from the treatment start date onwards. The following steps detail the process of correcting for these measures:

1. The measures for the treatment group and control group were assigned to an appropriate month based on the reported date of installation for measures installed after the treatment start date.
2. For each month of the program year, the annual savings for all measures installed prior to the month of interest dating back to the treatment start date that had not yet reached the end of their effective useful life were summed for all active participants for each group. For measures installed prior to the current

Program Year, Qualus used verified savings for dual participation analysis. For measures installed during the Program Year, Qualus utilized reported savings as verification activities occurred concurrently to the evaluation of the Behavioral Modification subprogram.

3. The totaled savings for each group was then divided by 365.25 and then divided by the number of active customers in each group to create a daily average dual participation savings value per home.
4. For each month, the daily average dual participation savings value per home for the control group was then subtracted from the daily average dual participation savings value per home from the treatment group. This resulted in an adjustment factor which was then subtracted from the daily savings value extrapolated from the billing analysis prior to using these values to calculate gross verified energy savings.

Adjustment for Upstream Measures

Adjustments for upstream measures were conducted in accordance with the Phase IV Evaluation Framework. As noted in the Phase IV Evaluation Framework, the upstream measures adjustment applied only to cohorts that began treatment prior to Phase IV due to the sunsetting of upstream lighting programs in Phase IV.

The adjustment was cast as a multiplier and applied after the correction for the downstream energy efficiency programs and the initial calculation of annual savings for the program year for a given participant wave. The multiplier values depended on the number of years since program enrollment for a given participation wave and are summarized in Table 110 below.

Table 110: Adjustment factors for dual participation in upstream programs.

Years Since Enrollment	Adjustment multiplier for upstream program
1	99.25%
2	98.5%
3	97.75%
4 or more	97%

B.1.1.5 Gross Energy Savings Calculation

Gross energy savings can be calculated by taking the treatment effect in a given month (the negative of the regression coefficient of the treatment effect for a given month minus the downstream dual participation adjustment factor for that month), multiplying it by the number of days in the month, the number of active treatment group participants in that month, and the upstream adjustment multiplier. Equation 2 demonstrates the algorithm for calculating verified savings for the model for each month in the program year.

$$kWh\ savings_{my} = \tau_{my} \times days_{my} \times number\ of\ participants_{my} \times upstream\ adjustment\ multiplier$$

Equation 2: kWh savings calculation

The variables in the above equation are defined in Table 111 below.

Table 111: Definition of variables for kWh savings calculation

Variable	Definition
τ_{my}	The average daily treatment effect for month <i>my</i> —the inverse of the regression coefficient from the regression model minus the downstream dual participation correction factor.
<i>my</i>	The month of interest.
<i>upstream adjustment multiplier</i>	The upstream adjustment multiplier for the experimental cohort.

Savings were calculated for each wave separately and then summed together to determine the total savings for each initiative (standard residential v. Low-Income) per Rate District. Monthly savings were added together to generate annual savings.

Table 112: Dual participation correction results by Rate District and participation wave

Wave	Treat	Control	Delta	Wave	Treat	Control	Delta
ME-1	2,332	2,380	-48	PP-2	748	866	-119
ME-3	13,060	12,746	314	PP-3	3,532	3,585	-53
ME-5	20,988	20,103	885	PP-4	1,609	1,509	99
ME-6	1,968	1,878	90	PP-2-LI	191	182	10
ME-4-LI	592	528	64	WP-3	3,592	3,399	193
ME-5-LI	4,331	4,302	30	WP-5	24,674	23,302	1,372
PN-2	13,333	12,505	828	WP-6	877	584	293
PN-3	716	767	-51	WP-7	1,859	1,733	126
PN-5	4,451	4,360	92	WP-1-LI	762	892	-130
PN-6	1,988	1,872	117	WP-2-LI	685	653	32
PN-1-LI	898	980	-82	WP-3-LI	53	66	-13
PN-2-LI	425	430	-4				
PN-3-LI	3,051	3,109	-58				
PN-5-LI	40	50	-10				
PP-1	1,171	922	249				

B.1.1.6 Gross Demand Savings Calculation

For cohorts established in Phase IV of Act 129, Qualus leveraged advanced metering infrastructure (AMI) data to measure gross demand savings by modifying the LS model for use in the measurement of demand savings, as shown in the following equation:

$$kWh_{i,peak} = \beta_0 + \beta_1 * AvgPre_i + \tau * treatment_i + \varepsilon_{imy}$$

Equation 3: Formula specifying the lagged peak demand regression model

Table 113: Definition of variables in the lagged peak demand regression model

Variable	Definition
$kWh_{i,peak}$	Customer i's hourly energy usage during the peak demand window (non-holiday weekdays between 2 p.m. to 6 p.m. from June through August) during the post-period only.
β_0	Intercept of the regression equation.
β_1	The coefficient of the lagged pre-usage term.
$AvgPre_i$	The lagged pre-usage term, representing the average hourly consumption during the peak demand window of the pre-treatment period. I.e., the average hourly consumption from June through August on non-holiday weekdays from 2 p.m. to 6 p.m.
$treatment_i$	The treatment indicator variable. Equal to one when the treatment is in effect for the treatment group. Zero otherwise. Always zero for the control group.
τ	The estimated treatment effect in kWh per hour per customer during the peak demand window; the main parameter of interest.
ε_{imy}	The error terms.

As shown in the table above, the parameter τ represents the peak demand savings out of the regression equation and simply needs to be multiplied by the number of participants and the sign inverted to obtain the cohort-level peak demand savings.

Eleven legacy cohorts (excluding the three cohorts that were re-baselined in the PY15 window) received treatment in PY17 (three for Met-Ed, four for Penelec, two for Penn Power, and two for West Penn Power). These legacy cohorts began receiving treatment in Phase I and II of Act 129, during which AMI meters had yet to be established in the FirstEnergy service territory. Therefore, Qualus followed the Phase IV Evaluation Framework guidance for measuring demand savings for customers without AMI data in the pre-treatment period by checking the equivalence in the average daily kWh during the summer pre-treatment period. Once this pre-summer equivalence was confirmed, Qualus used a simple subtraction method for determining the gross demand savings for these cohorts.

B.1.1.1 Adjustment for Persistence in Energy and Demand Savings

Consistent with Section 6.1.9 of the Phase IV TRM, Qualus adjusted savings for any cohorts with greater than two years of exposure for persistence savings (i.e., the savings that treatment customers would have continued to accrue had they no longer received treatment). Twenty-five cohorts required such an adjustment in PY17. The equations below have been recreated from the TRM for reference:

- For $y=1$ or 2 , i.e., the first or second year of exposure:

$$\Delta kWh_y = ATE_y * Treatment\ Accounts_y * Days_y$$

$$FYSATE_y = ATE_y$$

- For y=3, i.e., the third year of exposure:

$$FYSATE_y = ATE_y - \sum_{x=1}^{x=1} FYSATE_{y-x} - FYSATE_{y-x} * Decay * (X - 0.5)$$

$$\Delta kWh_y = FYSATE_y * Treatment\ Accounts_y * Days_y$$

- For y=4, i.e., the fourth year of exposure:

$$FYSATE_y = ATE_y - \sum_{x=1}^{x=2} FYSATE_{y-x} - FYSATE_{y-x} * Decay * (X - 0.5)$$

$$\Delta kWh_y = FYSATE_y * Treatment\ Accounts_y * Days_y$$

- And for y>=5, i.e., the fifth year of exposure and beyond:

$$FYSATE_y = ATE_y - \sum_{x=1}^{x=3} FYSATE_{y-x} - FYSATE_{y-x} * Decay * (X - 0.5)$$

$$\Delta kWh_y = FYSATE_y * Treatment\ Accounts_y * Days_y$$

In the above equations ATE_y is the average daily savings as estimated through the regression analysis and adjusted for dual participation. Y is the year of the program being evaluated; equivalently, the number of years the program has been in effect for that cohort. Qualus applied the TRM's default decay rate of 31.3%.

In addition to adjusting annual savings, lifetime savings were also adjusted using the formulas below:

- For y=1:

$$\Delta kWh_{y,lifetime} = ATE_y * Treatment\ Accounts_y * Days_y$$

- For y=2 and beyond:

$$\Delta kWh_{y,lifetime} = \Delta kWh_y + \sum_{x=1}^{x=3} \left((FYSATE_y - FYSATE_y * Decay * (X - 0.5)) * (1 - Churn)^X \right) * Days_{y+x} * Treatment\ Accounts_y$$

- Where Churn rate is taken to be 6%.

Adjustments to peak demand savings were applied in the same manner as the energy savings adjustments detailed above.

B.1.2 Program Participation Levels

Table 114 provides a table of the participation levels. The nomenclature in the table includes a prefix to denote the Rate District, a suffix of “-LI” for low-income groups, and a number that identifies waves of participants sequentially.

Table 114: PY17 Participation Bill Counts by Month and Cohort

Wave	Jun-25	Jul-25	Aug-25	Sep-25	Oct-25	Nov-25	Dec-25	Jan-26	Feb-26	Mar-26	Apr-26	May-26
ME-1	24,683	24,522	24,349	24,201	24,058	23,920	23,803	23,684	23,584	23,475	23,352	23,229
ME-3	34,645	34,541	34,389	34,284	34,160	34,049	33,938	33,853	33,751	33,676	33,592	33,497
ME-5	55,828	55,652	55,467	55,290	55,120	54,950	54,819	54,683	54,563	54,461	54,326	54,197
ME-6	18,138	17,998	17,866	17,720	17,598	17,486	17,395	17,290	17,218	17,136	17,045	16,957
ME-1-LI	0	0	0	0	0	0	0	0	0	0	0	0
ME-4-LI	7,081	6,958	6,829	6,731	6,623	6,518	6,457	6,381	6,325	6,275	6,198	6,116
ME-5-LI	6,420	6,400	6,365	6,334	6,311	6,276	6,253	6,228	6,208	6,194	6,183	6,152
PN-2	37,636	37,544	37,437	37,343	37,233	37,106	37,017	36,916	36,833	36,775	36,700	36,607
PN-3	10,741	10,652	10,571	10,467	10,363	10,286	10,230	10,160	10,108	10,067	9,998	9,947
PN-7	9,762	9,588	9,352	9,125	8,919	8,698	8,560	8,426	8,322	8,238	8,100	7,959
PN-5	17,593	17,503	17,400	17,324	17,215	17,144	17,063	16,993	16,949	16,906	16,843	16,783
PN-6	40,306	39,974	39,636	39,338	39,033	38,740	38,500	38,249	38,081	37,898	37,693	37,451
PN-3-LI	4,321	4,302	4,283	4,267	4,253	4,237	4,222	4,209	4,198	4,187	4,177	4,160
PN-1-LI	6,121	6,067	6,005	5,960	5,892	5,816	5,774	5,737	5,699	5,654	5,604	5,544
PN-2-LI	6,136	6,044	5,940	5,855	5,760	5,681	5,636	5,582	5,536	5,491	5,436	5,367
PN-5-LI	934	932	923	921	914	909	907	905	903	900	897	893
PP-1	13,830	13,754	13,659	13,581	13,496	13,425	13,364	13,291	13,261	13,237	13,166	13,110
PP-2	15,002	14,863	14,728	14,620	14,530	14,456	14,391	14,316	14,253	14,199	14,134	14,060
PP-3	13,037	13,008	12,949	12,915	12,870	12,825	12,791	12,761	12,729	12,703	12,663	12,627
PP-4	5,233	5,223	5,212	5,198	5,182	5,169	5,158	5,145	5,134	5,123	5,112	5,096
PP-5	14,873	14,650	14,394	14,192	13,985	13,825	13,712	13,583	13,471	13,377	13,247	13,136
PP-2-LI	2,713	2,675	2,634	2,591	2,561	2,534	2,515	2,495	2,481	2,465	2,444	2,412
WP-3	13,493	13,454	13,419	13,390	13,339	13,314	13,282	13,247	13,233	13,214	13,188	13,152
WP-5	88,637	88,337	88,047	87,805	87,553	87,301	87,090	86,886	86,725	86,552	86,389	86,183
WP-6	19,342	19,271	19,195	19,145	19,091	19,031	18,973	18,925	18,883	18,842	18,791	18,745
WP-7	32,474	32,275	32,044	31,840	31,656	31,467	31,340	31,202	31,098	30,981	30,844	30,693
WP-1-LI	5,379	5,328	5,266	5,206	5,150	5,104	5,074	5,027	4,993	4,966	4,916	4,876
WP-2-LI	8,037	7,950	7,843	7,724	7,610	7,516	7,448	7,381	7,311	7,258	7,166	7,091
WP-3-LI	2,217	2,206	2,196	2,184	2,168	2,159	2,150	2,148	2,139	2,133	2,125	2,115
WP-4-LI	9,953	9,825	9,703	9,569	9,434	9,301	9,220	9,118	9,047	8,987	8,894	8,796

B.1.3 Results

The reported and verified energy savings are shown in Table 115 below. The values below include dual participation adjustments. The last column of the table shows the precision of the savings estimate at the 95% confidence level normalized to an absolute precision value for each cohort and combined for each distinct initiative. Table 116 shows the reported and verified demand reduction for each Rate District and initiative.

Table 115: Verified Energy Savings and Absolute Precisions by R and Wave

Operating Company	Experimental Cohort	PYRTD (MWh)	PYVTD (MWh)	Relative Savings (%)	Absolute Precision at 95% CL
Met-Ed	ME-1	1,391	2,554	1.05%	0.36%
Met-Ed	ME-3	1,953	741	0.17%	0.54%
Met-Ed	ME-5	3,146	7,715	1.12%	0.25%
Met-Ed	ME-6	1,022	1,426	0.43%	0.21%
Met-Ed	Total for EEH Program	7,513	12,437	0.74%	0.18%
Met-Ed	ME-4-LI	-33	554	0.67%	0.51%
Met-Ed	ME-5-LI	-30	1,229	1.44%	0.87%
Met-Ed	Total for LI Program	-62	1,783	1.06%	0.51%
Penelec	PN-2	2,341	1,052	0.25%	0.29%
Penelec	PN-3	668	355	0.39%	0.44%
Penelec	PN-5	1,094	948	0.77%	0.57%
Penelec	PN-6	2,507	876	0.22%	0.21%
Penelec	PN-7	607	528	0.61%	0.38%
Penelec	Total for EEH Program	7,217	3,759	0.33%	0.15%
Penelec	PN-3-LI	-21	364	0.71%	1.06%
Penelec	PN-1-LI	-30	-132	-0.23%	0.59%
Penelec	PN-2-LI	-30	400	0.65%	0.54%
Penelec	PN-5-LI	-5	62	0.53%	0.90%
Penelec	Total for LI Program	-85	694	0.38%	0.40%
Penn Power	PP-1	225	52	0.04%	0.36%
Penn Power	PP-2	244	189	0.12%	0.31%
Penn Power	PP-3	212	2,188	1.57%	0.39%
Penn Power	PP-4	85	1,644	1.97%	0.55%
Penn Power	PP-5	242	608	0.40%	0.24%
Penn Power	Total for EEH Program	1,008	4,681	0.89%	0.19%
Penn Power	PP-2-LI	180	102	0.31%	0.78%
Penn Power	Total for LI Program	180	102	0.31%	0.78%
WPP	WP-3	1,053	318	0.14%	0.52%
WPP	WP-5	6,917	3,114	0.26%	0.43%
WPP	WP-6	1,509	77	0.03%	0.28%
WPP	WP-7	2,534	1,986	0.37%	0.17%
WPP	Total for EEH Program	12,014	5,494	0.25%	0.24%
WPP	WP-1-LI	104	321	0.50%	0.54%
WPP	WP-2-LI	156	-48	-0.05%	0.45%
WPP	WP-3-LI	43	-261	-0.94%	0.64%
WPP	WP-4-LI	193	55	0.04%	0.45%
WPP	Total for LI Program	496	67	0.04%	0.31%

Table 116: Reported and verified demand reductions for the HER Initiative

Operating Company	Experimental Cohort	PYRTD (MW)	PYVTD (MW)	Demand Realization Rate
Met-Ed	ME-1	0.06	0.49	839%
Met-Ed	ME-3	0.08	-0.43	-522%
Met-Ed	ME-5	0.13	1.38	1044%
Met-Ed	ME-6	0.04	0.17	395%
Met-Ed	Total for EEH Program	0.32	1.61	511%
Met-Ed	ME-4-LI	0.02	0.11	622%
Met-Ed	ME-5-LI	0.02	0.06	364%
Met-Ed	Total for LI Program	0.03	0.16	499%
Penelec	PN-2	0.04	0.47	1122%
Penelec	PN-3	0.01	0.08	652%
Penelec	PN-5	0.02	0.06	293%
Penelec	PN-6	0.04	0.36	808%
Penelec	PN-7	0.01	-0.03	-256%
Penelec	Total for EEH Program	0.13	0.93	728%
Penelec	PN-3-LI	0.00	-0.14	-7890%
Penelec	PN-1-LI	0.00	-0.08	-3063%
Penelec	PN-2-LI	0.00	0.00	28%
Penelec	PN-5-LI	0.00	0.00	470%
Penelec	Total for LI Program	0.05	-0.22	-450%
Penn Power	PP-1	0.03	-0.09	-296%
Penn Power	PP-2	0.03	0.05	136%
Penn Power	PP-3	0.03	-0.02	-53%
Penn Power	PP-4	0.01	0.29	2441%
Penn Power	PP-5	0.03	0.03	100%
Penn Power	Total for EEH Program	0.14	0.26	186%
Penn Power	PP-2-LI	0.02	0.03	135%
Penn Power	Total for LI Program	0.02	0.03	135%
WPP	WP-3	0.07	0.13	189%
WPP	WP-5	0.44	1.82	416%
WPP	WP-6	0.10	-0.22	-226%
WPP	WP-7	0.16	0.20	122%
WPP	Total for EEH Program	0.76	1.92	253%
WPP	WP-1-LI	0.01	0.02	147%
WPP	WP-2-LI	0.02	0.09	601%
WPP	WP-3-LI	0.00	-0.03	-669%
WPP	WP-4-LI	0.02	0.21	1088%
WPP	Total for LI Program	0.05	0.29	585%

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

Table 117 presents a summary of the programs, components / initiatives and customer segments that contribute to the low-income carveout in PY17 and P4TD.

Table 117: Summary of Low-Income Carveout Energy Savings (MWh/Year)

Rate District	Program	Component / Initiative	Customer Segment	PYVTD Gross (MWh/yr)	VTD Gross (MWh/yr)
Met-Ed	Low Income Energy Efficiency	Appliances	Residential	12	1,252
Met-Ed	Low Income Energy Efficiency	Appliance Turn-In	Residential	115	1,539
Met-Ed	Low Income Energy Efficiency	Direct Install	Residential	1,219	5,542
Met-Ed	Low Income Energy Efficiency	Home Energy Reports	Residential	1,783	5,677
Met-Ed	Low Income Energy Efficiency	Kits	Residential	1,612	10,261
Met-Ed	Low Income Energy Efficiency	New Homes	Residential	8	237
Met-Ed	Low Income Energy Efficiency	Online Audits	Residential	116	814
Met-Ed	C&I ESB - Small	CI Multifamily	Master Metered MF	449	2,371
Met-Ed Total				5,316	27,693
Penelec	Low Income Energy Efficiency	Appliances	Residential	7	1,703
Penelec	Low Income Energy Efficiency	Appliance Turn-In	Residential	134	1,598
Penelec	Low Income Energy Efficiency	Direct Install	Residential	1,546	8,419
Penelec	Low Income Energy Efficiency	Home Energy Reports	Residential	694	3,228
Penelec	Low Income Energy Efficiency	Kits	Residential	984	9,516
Penelec	Low Income Energy Efficiency	New Homes	Residential	10	30
Penelec	Low Income Energy Efficiency	Online Audits	Residential	281	1,326
Penelec	C&I ESB - Small	CI Multifamily	Master Metered MF	0	2,563
Penelec Total				3,655	28,383
Penn Power	Low Income Energy Efficiency	Appliances	Residential	0	495
Penn Power	Low Income Energy Efficiency	Appliance Turn-In	Residential	0	321
Penn Power	Low Income Energy Efficiency	Direct Install	Residential	0	2,201
Penn Power	Low Income Energy Efficiency	Home Energy Reports	Residential	102	1,413
Penn Power	Low Income Energy Efficiency	Kits	Residential	0	891
Penn Power	Low Income Energy Efficiency	New Homes	Residential	0	0
Penn Power	Low Income Energy Efficiency	Online Audits	Residential	44	242
Penn Power	C&I ESB - Small	CI Multifamily	Master Metered MF	75	273
Penn Power Total				221	5,836
WPP	Low Income Energy Efficiency	Appliances	Residential	7	1,452
WPP	Low Income Energy Efficiency	Appliance Turn-In	Residential	153	1,511
WPP	Low Income Energy Efficiency	Direct Install	Residential	929	8,304
WPP	Low Income Energy Efficiency	Home Energy Reports	Residential	67	3,252
WPP	Low Income Energy Efficiency	Kits	Residential	2,432	13,270
WPP	Low Income Energy Efficiency	New Homes	Residential	3	9
WPP	Low Income Energy Efficiency	Online Audits	Residential	170	848
WPP	C&I ESB - Small	CI Multifamily	Master Metered MF	98	2,180
WPP Total				3,859	30,826

Appendix D Summary of Program-Level Impacts, Cost-Effectiveness, and HIM NTG

D.1 PROGRAM AND INITIATIVE-LEVEL IMPACTS SUMMARY

A summary of energy impacts by program and component / initiative through PY17 is presented in Table 118, Table 119, Table 120, and Table 121.

Table 118: Met-Ed Annual Energy Savings by Program & Initiative (MWh/Year)

Program	Initiative	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	EE Kits	11,939	10,475	8,704	60,194	49,211	40,419
Energy Efficient Homes	Home Energy Reports	7,513	12,437	12,437	28,811	33,538	33,538
Energy Efficient Homes	Direct Install	23,436	19,094	7,877	24,695	20,411	9,052
Energy Efficient Homes	New Homes	2,671	2,705	1,948	11,009	11,073	7,994
Energy Efficient Homes	Multifamily	46	46	45	136	141	135
Energy Efficient Homes	Online Audits	604	959	959	3,487	2,211	2,211
Energy Efficient Products	Appliance Recycling	2,745	2,932	1,818	14,459	15,707	7,517
Energy Efficient Products	HVAC	1,143	1,349	682	5,712	7,918	4,009
Energy Efficient Products	Appliances	433	449	305	2,995	3,284	2,149
Energy Efficient Products	Midstream Appliances	607	607	350	15,906	16,582	8,047
Low Income Program	Appliances	12	12	12	1,134	1,252	1,252
Low Income Program	Appliance Turn-In	114	115	115	1,324	1,539	1,539
Low Income Program	Direct Install	1,248	1,219	1,219	5,498	5,542	5,542
Low Income Program	Home Energy Reports	-62	1,783	1,783	3,265	5,677	5,677
Low Income Program	Kits	1,658	1,612	1,612	10,695	10,261	10,261
Low Income Program	New Homes	8	8	8	231	231	231
Low Income Program	Online Audits	61	116	116	313	814	814
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	17,729	16,911	11,981	106,516	110,820	72,781
C&I Solutions for Business Programs - Small and Large	CI Custom	9,445	9,573	4,556	122,466	123,522	68,231
C&I Solutions for Business Programs - Small and Large	CI EMNC	33,368	32,552	24,798	78,492	73,009	57,974
C&I Solutions for Business Program - Small	CI Multifamily	445	449	447	2,404	2,371	2,360
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	85	91	57	271	294	151
Portfolio Total		115,249	115,496	81,831	500,016	495,408	341,884

Table 119: Penelec Annual Energy Savings by Program & Initiative (MWh/Year)

Program	Initiative	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	EE Kits	12,832	12,526	13,364	57,235	55,919	54,644
Energy Efficient Homes	Home Energy Reports	7,217	3,759	3,759	26,896	13,797	13,797
Energy Efficient Homes	Direct Install	16,824	15,304	6,314	17,696	16,281	7,290
Energy Efficient Homes	New Homes	424	427	308	1,478	1,478	1,066
Energy Efficient Homes	Multifamily	88	86	86	270	295	286
Energy Efficient Homes	Online Audits	548	871	871	2,538	1,620	1,620
Energy Efficient Products	Appliance Recycling	2,299	2,250	1,350	10,828	11,318	7,145
Energy Efficient Products	HVAC	953	989	689	3,236	3,510	2,231
Energy Efficient Products	Appliances	2,796	1,803	891	3,973	2,994	1,493
Energy Efficient Products	Midstream Appliances	2,322	2,337	1,117	13,452	13,658	7,025
Low Income Program	Appliances	11	7	7	1,670	1,703	1,703
Low Income Program	Appliance Turn-In	130	134	134	1,475	1,598	1,598
Low Income Program	Direct Install	1,484	1,546	1,546	8,366	8,419	8,419
Low Income Program	Home Energy Reports	-85	694	694	1,594	3,228	3,228
Low Income Program	Kits	905	984	984	9,383	9,516	9,516
Low Income Program	New Homes	9	10	10	127	123	123
Low Income Program	Online Audits	125	281	281	498	1,326	1,326
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	95,168	66,808	44,002	219,346	189,016	125,087
C&I Solutions for Business Programs - Small and Large	CI Custom	13,611	12,655	6,317	39,382	38,016	22,682
C&I Solutions for Business Programs - Small and Large	CI EMNC	46,497	44,957	35,277	88,600	82,115	65,390
C&I Solutions for Business Program - Small	CI Multifamily	0	0	0	2,847	2,563	2,555
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	52	51	31	191	198	124
Portfolio Total		204,209	168,479	118,031	511,079	458,690	338,347

**Table 120: Penn Power Annual Energy Savings by Program & Initiative
(MWh/Year)**

Program	Initiative	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	EE Kits	3,005	2,623	2,266	15,971	14,739	12,540
Energy Efficient Homes	Home Energy Reports	1,008	4,681	4,681	7,330	10,763	10,763
Energy Efficient Homes	Direct Install	6,432	5,997	2,474	6,820	6,424	2,885
Energy Efficient Homes	New Homes	1,955	2,026	1,458	7,203	7,324	5,280
Energy Efficient Homes	Multifamily	3	3	3	48	48	48
Energy Efficient Homes	Online Audits	217	365	365	908	616	616
Energy Efficient Products	Appliance Recycling	0	0	0	2,834	2,875	1,257
Energy Efficient Products	HVAC	182	238	130	915	1,181	647
Energy Efficient Products	Appliances	103	98	51	773	817	428
Energy Efficient Products	Midstream Appliances	173	169	85	4,990	5,085	2,305
Low Income Program	Appliances	0	0	0	465	495	495
Low Income Program	Appliance Turn-In	0	0	0	299	321	321
Low Income Program	Direct Install	0	0	0	2,154	2,201	2,201
Low Income Program	Home Energy Reports	180	102	102	2,319	1,413	1,413
Low Income Program	Kits	0	0	0	914	891	891
Low Income Program	New Homes	0	0	0	10	10	10
Low Income Program	Online Audits	22	44	44	95	242	242
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	16,329	15,357	12,296	44,043	41,639	33,189
C&I Solutions for Business Programs - Small and Large	CI Custom	13,559	14,083	7,842	29,852	30,317	18,735
C&I Solutions for Business Programs - Small and Large	CI EMNC	3,750	3,029	2,341	15,763	13,173	11,817
C&I Solutions for Business Program - Small	CI Multifamily	73	75	75	283	273	273
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	0	0	0	63	64	27
Portfolio Total		46,990	48,891	34,215	144,051	140,913	106,384

Table 121: WPP Annual Energy Savings by Program & Initiative (MWh/Year)

Program	Initiative	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Energy Efficient Homes	EE Kits	15,707	14,028	13,545	63,944	54,293	54,870
Energy Efficient Homes	Home Energy Reports	12,014	5,494	5,494	38,945	17,622	17,622
Energy Efficient Homes	Direct Install	18,483	19,497	8,044	19,612	20,723	9,204
Energy Efficient Homes	New Homes	3,553	3,586	2,582	12,461	12,639	9,115
Energy Efficient Homes	Multifamily	63	62	61	435	461	426
Energy Efficient Homes	Online Audits	703	1,112	1,112	3,356	2,149	2,149
Energy Efficient Products	Appliance Recycling	2,554	2,437	1,609	14,326	14,730	10,110
Energy Efficient Products	HVAC	1,404	1,464	802	4,995	6,293	3,382
Energy Efficient Products	Appliances	3,884	2,009	1,049	6,250	4,521	2,397
Energy Efficient Products	Midstream Appliances	2,725	2,741	1,371	12,992	13,198	6,669
Low Income Program	Appliances	13	7	7	1,367	1,452	1,452
Low Income Program	Appliance Turn-In	136	153	153	1,330	1,511	1,511
Low Income Program	Direct Install	895	929	929	8,304	8,304	8,304
Low Income Program	Home Energy Reports	496	67	67	3,997	3,252	3,252
Low Income Program	Kits	2,307	2,432	2,432	12,763	13,270	13,270
Low Income Program	New Homes	3	3	3	14	13	13
Low Income Program	Online Audits	86	170	170	328	848	848
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	60,198	55,000	37,074	185,450	183,957	123,465
C&I Solutions for Business Programs - Small and Large	CI Custom	36,801	37,121	20,672	103,904	104,661	58,504
C&I Solutions for Business Programs - Small and Large	CI EMNC	15,620	14,107	11,015	63,798	64,283	57,729
C&I Solutions for Business Program - Small	CI Multifamily	101	98	98	2,649	2,180	2,178
C&I Solutions for Business Programs - Small and Large	Appliance Recycling	18	18	12	173	181	124
Portfolio Total		177,762	162,535	108,299	561,393	530,541	386,595

Table 122, Table 123, Table 124, and Table 125 present summaries of the peak demand impacts by energy efficiency program and initiative through the current reporting period.

Table 122: Met-Ed Peak Demand Savings by Program & Initiative (MW/Year)

Program	Initiative	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	EE Kits	1.29	1.13	0.94	6.47	5.40	4.43
Energy Efficient Homes	Home Energy Reports	0.32	1.61	1.61	7.54	4.19	4.19
Energy Efficient Homes	Direct Install	8.09	6.48	2.67	8.32	6.65	2.82
Energy Efficient Homes	New Homes	0.63	0.69	0.50	3.27	2.73	1.97
Energy Efficient Homes	Multifamily	0.01	0.01	0.01	0.02	0.02	0.02
Energy Efficient Homes	Online Audits	0.07	0.17	0.17	0.30	0.39	0.39
Energy Efficient Products	Appliance Recycling	1.00	1.08	0.67	4.14	4.48	2.21
Energy Efficient Products	HVAC	0.18	0.23	0.12	0.95	1.17	0.59
Energy Efficient Products	Appliances	0.06	0.06	0.04	0.46	0.51	0.34
Energy Efficient Products	Midstream Appliances	0.14	0.14	0.08	3.30	3.14	1.53
Low Income Program	Appliances	0.00	0.00	0.00	0.15	0.16	0.16
Low Income Program	Appliance Turn-In	0.04	0.05	0.05	0.37	0.44	0.44
Low Income Program	Direct Install	0.16	0.16	0.16	0.76	0.77	0.77
Low Income Program	Home Energy Reports	0.03	0.16	0.16	0.87	0.68	0.68
Low Income Program	Kits	0.18	0.18	0.18	1.17	1.19	1.19
Low Income Program	New Homes	0.00	0.00	0.00	0.04	0.03	0.03
Low Income Program	Online Audits	0.01	0.02	0.02	0.03	0.13	0.13
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	3.09	2.62	1.85	19.88	18.69	12.28
C&I Solutions for Business Programs - Small and Large	CI Custom	2.71	2.74	1.30	19.32	20.25	11.08
C&I Solutions for Business Programs - Small and Large	CI EMNC	5.75	5.79	4.41	13.52	12.39	9.73
C&I Solutions for Business Program - Small	CI Multifamily	0.07	0.06	0.06	0.34	0.33	0.32
C&I Solutions for Business Program - Small	Appliance Recycling	0.03	0.03	0.02	0.07	0.08	0.04
Portfolio Total		23.86	23.43	15.04	91.30	83.84	55.37

Table 123: Penelec Peak Demand Savings by Program & Initiative (MW/Year)

Program	Initiative	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	EE Kits	1.28	1.23	1.31	5.70	5.65	5.51
Energy Efficient Homes	Home Energy Reports	0.13	0.93	0.93	5.37	3.60	3.60
Energy Efficient Homes	Direct Install	5.99	5.85	2.41	6.16	5.97	2.53
Energy Efficient Homes	New Homes	0.10	0.09	0.06	0.45	0.35	0.25
Energy Efficient Homes	Multifamily	0.01	0.01	0.01	0.03	0.03	0.03
Energy Efficient Homes	Online Audits	0.06	0.14	0.14	0.23	0.26	0.26
Energy Efficient Products	Appliance Recycling	0.82	0.92	0.55	3.11	3.27	2.05
Energy Efficient Products	HVAC	0.08	0.09	0.06	0.30	0.41	0.26
Energy Efficient Products	Appliances	0.27	0.16	0.08	0.46	0.36	0.18
Energy Efficient Products	Midstream Appliances	0.52	0.51	0.24	3.29	3.15	1.62
Low Income Program	Appliances	0.00	0.00	0.00	0.22	0.22	0.22
Low Income Program	Appliance Turn-In	0.05	0.06	0.06	0.44	0.45	0.45
Low Income Program	Direct Install	0.20	0.21	0.21	1.06	1.07	1.07
Low Income Program	Home Energy Reports	0.05	-0.22	-0.22	0.18	-0.45	-0.45
Low Income Program	Kits	0.09	0.11	0.11	0.96	1.00	1.00
Low Income Program	New Homes	0.00	0.00	0.00	0.02	0.02	0.02
Low Income Program	Online Audits	0.01	0.04	0.04	0.05	0.19	0.19
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	17.98	13.24	8.72	44.00	36.12	23.70
C&I Solutions for Business Programs - Small and Large	CI Custom	3.70	3.59	1.79	11.04	11.05	6.71
C&I Solutions for Business Programs - Small and Large	CI EMNC	7.87	6.25	4.91	15.26	12.42	10.08
C&I Solutions for Business Program - Small	CI Multifamily	0.00	0.00	0.00	0.39	0.35	0.35
C&I Solutions for Business Program - Small	Appliance Recycling	0.02	0.02	0.01	0.06	0.06	0.04
Portfolio Total		39.26	33.23	21.44	98.77	85.55	59.67

Table 124: Penn Power Peak Demand Savings by Program & Initiative (MW/Year)

Program	Initiative	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	EE Kits	0.33	0.28	0.25	1.73	1.57	1.33
Energy Efficient Homes	Home Energy Reports	0.14	0.26	0.26	2.30	1.00	1.00
Energy Efficient Homes	Direct Install	2.34	2.37	0.98	2.40	2.42	1.02
Energy Efficient Homes	New Homes	0.52	0.50	0.36	2.12	1.69	1.22
Energy Efficient Homes	Multifamily	0.00	0.00	0.00	0.01	0.00	0.00
Energy Efficient Homes	Online Audits	0.02	0.07	0.07	0.08	0.11	0.11
Energy Efficient Products	Appliance Recycling	0.00	0.00	0.00	0.66	0.67	0.29
Energy Efficient Products	HVAC	0.03	0.04	0.02	0.16	0.21	0.11
Energy Efficient Products	Appliances	0.01	0.01	0.01	0.12	0.13	0.07
Energy Efficient Products	Midstream Appliances	0.05	0.04	0.02	1.12	1.09	0.49
Low Income Program	Appliances	0.00	0.00	0.00	0.06	0.06	0.06
Low Income Program	Appliance Turn-In	0.00	0.00	0.00	0.08	0.08	0.08
Low Income Program	Direct Install	0.00	0.00	0.00	0.28	0.29	0.29
Low Income Program	Home Energy Reports	0.02	0.03	0.03	0.56	0.25	0.25
Low Income Program	Kits	0.00	0.00	0.00	0.10	0.10	0.10
Low Income Program	New Homes	0.00	0.00	0.00	0.00	0.00	0.00
Low Income Program	Online Audits	0.00	0.01	0.01	0.01	0.04	0.04
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	3.32	2.90	2.32	9.29	8.35	6.65
C&I Solutions for Business Programs - Small and Large	CI Custom	2.73	2.84	1.58	4.95	5.21	3.13
C&I Solutions for Business Programs - Small and Large	CI EMNC	0.81	0.52	0.40	2.73	2.27	2.04
C&I Solutions for Business Program - Small	CI Multifamily	0.01	0.01	0.01	0.04	0.04	0.04
C&I Solutions for Business Program - Small	Appliance Recycling	0.00	0.00	0.00	0.01	0.01	0.01
Portfolio Total		10.32	9.88	6.31	28.81	25.58	18.34

Table 125: WPP Peak Demand Savings by Program & Initiative (MW/Year)

Program	Initiative	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Energy Efficient Homes	EE Kits	1.79	1.60	1.55	7.27	6.34	6.41
Energy Efficient Homes	Home Energy Reports	0.76	1.92	1.92	9.85	4.59	4.59
Energy Efficient Homes	Direct Install	6.66	7.04	2.91	6.86	7.21	3.06
Energy Efficient Homes	New Homes	0.82	0.92	0.66	3.54	2.91	2.10
Energy Efficient Homes	Multifamily	0.01	0.01	0.01	0.06	0.05	0.05
Energy Efficient Homes	Online Audits	0.08	0.19	0.19	0.30	0.37	0.37
Energy Efficient Products	Appliance Recycling	0.83	0.92	0.61	3.81	4.00	2.74
Energy Efficient Products	HVAC	0.20	0.21	0.11	0.75	0.83	0.45
Energy Efficient Products	Appliances	0.47	0.24	0.13	0.83	0.63	0.34
Energy Efficient Products	Midstream Appliances	0.58	0.56	0.28	3.04	2.91	1.47
Low Income Program	Appliances	0.00	0.00	0.00	0.18	0.18	0.18
Low Income Program	Appliance Turn-In	0.05	0.07	0.07	0.39	0.44	0.44
Low Income Program	Direct Install	0.13	0.14	0.14	1.16	1.16	1.16
Low Income Program	Home Energy Reports	0.05	0.29	0.29	0.54	0.46	0.46
Low Income Program	Kits	0.27	0.29	0.29	1.47	1.57	1.57
Low Income Program	New Homes	0.00	0.00	0.00	0.00	0.00	0.00
Low Income Program	Online Audits	0.01	0.03	0.03	0.03	0.13	0.13
C&I Solutions for Business Programs - Small and Large	CI Prescriptive	12.08	8.91	6.00	37.36	31.96	21.47
C&I Solutions for Business Programs - Small and Large	CI Custom	5.86	5.95	3.31	14.84	14.88	8.33
C&I Solutions for Business Programs - Small and Large	CI EMNC	2.83	2.82	2.20	11.40	10.44	9.21
C&I Solutions for Business Program - Small	CI Multifamily	0.02	0.02	0.02	0.35	0.27	0.27
C&I Solutions for Business Program - Small	Appliance Recycling	0.01	0.01	0.00	0.04	0.05	0.03
Portfolio Total		33.48	32.12	20.71	104.08	91.39	64.83

D.2 PROGRAM-LEVEL COST-EFFECTIVENESS SUMMARY

Table 126, Table 127, Table 128, and Table 129 show the TRC ratios by program and for the portfolio for Met-Ed, Penelec, Penn Power, and WPP respectively. The benefits in the tables were calculated using gross verified impacts. PYTD costs and benefits are expressed in the base dollars for the calendar year in which the program starts. For PY17, cost and benefits are expressed in 2025 dollars.

Table 126: PY17 Gross TRC Ratios by Program (\$1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$37,122	\$39,987	0.93	-\$2,864
Energy Efficient Products	\$3,182	\$5,042	0.63	-\$1,860
Low Income Energy Efficiency	\$2,158	\$3,313	0.65	-\$1,155
Residential Subtotal	\$42,463	\$48,342	0.88	-\$5,879
C&I Energy Solutions for Business - Small	\$22,609	\$12,228	1.85	\$10,381
C&I Energy Solutions for Business - Large	\$23,140	\$27,504	0.84	-\$4,364
Non-Residential Subtotal	\$45,749	\$39,732	1.15	\$6,017
Portfolio Total	\$88,212	\$88,074	1.00	\$138
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 127: PY17 Gross TRC Ratios by Program (\$1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$31,637	\$32,185	0.98	-\$548
Energy Efficient Products	\$4,671	\$5,038	0.93	-\$367
Low Income Energy Efficiency	\$1,398	\$3,293	0.42	-\$1,894
Residential Subtotal	\$37,707	\$40,516	0.93	-\$2,809
C&I Energy Solutions for Business - Small	\$39,721	\$21,331	1.86	\$18,391
C&I Energy Solutions for Business - Large	\$55,301	\$26,515	2.09	\$28,786
Non-Residential Subtotal	\$95,022	\$47,846	1.99	\$47,177
Portfolio Total	\$132,729	\$88,361	1.50	\$44,368
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 128: PY17 Gross TRC Ratios by Program (\$1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$10,699	\$12,253	0.87	-\$1,553
Energy Efficient Products	\$371	\$790	0.47	-\$419
Low Income Energy Efficiency	\$18	\$133	0.14	-\$115
Residential Subtotal	\$11,089	\$13,176	0.84	-\$2,087
C&I Energy Solutions for Business - Small	\$6,977	\$2,980	2.34	\$3,997
C&I Energy Solutions for Business - Large	\$14,867	\$8,101	1.84	\$6,765
Non-Residential Subtotal	\$21,843	\$11,081	1.97	\$10,762
Portfolio Total	\$32,932	\$24,257	1.36	\$8,675
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 129: PY17 Gross TRC Ratios by Program (\$1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$33,919	\$36,679	0.92	-\$2,760
Energy Efficient Products	\$5,036	\$6,890	0.73	-\$1,853
Low Income Energy Efficiency	\$2,191	\$2,588	0.85	-\$397
Residential Subtotal	\$41,146	\$46,157	0.89	-\$5,011
C&I Energy Solutions for Business - Small	\$25,717	\$10,439	2.46	\$15,277
C&I Energy Solutions for Business - Large	\$42,160	\$27,661	1.52	\$14,499
Non-Residential Subtotal	\$67,877	\$38,101	1.78	\$29,776
Portfolio Total	\$109,023	\$84,258	1.29	\$24,765
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 130, Table 131, Table 132, and Table 133 present PY17 cost-effectiveness for Met-Ed, Penelec, Penn Power, and WPP respectively, using net verified savings to calculate benefits.

Table 130: PY17 Net TRC Ratios by Program (\$1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$21,527	\$20,079	1.07	\$1,448
Energy Efficient Products	\$1,843	\$3,434	0.54	-\$1,591
Low Income Energy Efficiency	\$2,158	\$3,313	0.65	-\$1,155
Residential Subtotal	\$25,528	\$26,826	0.95	-\$1,298
C&I Energy Solutions for Business - Small	\$15,394	\$9,040	1.70	\$6,354
C&I Energy Solutions for Business - Large	\$16,382	\$20,999	0.78	-\$4,616
Non-Residential Subtotal	\$31,776	\$30,039	1.06	\$1,737
Portfolio Total	\$57,305	\$56,865	1.01	\$439
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 131: PY17 Net TRC Ratios by Program (\$1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$22,078	\$16,136	1.37	\$5,942
Energy Efficient Products	\$2,499	\$3,552	0.70	-\$1,053
Low Income Energy Efficiency	\$1,398	\$3,293	0.42	-\$1,894
Residential Subtotal	\$25,975	\$22,980	1.13	\$2,995
C&I Energy Solutions for Business - Small	\$26,310	\$14,765	1.78	\$11,544
C&I Energy Solutions for Business - Large	\$38,442	\$18,405	2.09	\$20,037
Non-Residential Subtotal	\$64,752	\$33,171	1.95	\$31,581
Portfolio Total	\$90,728	\$56,151	1.62	\$34,576
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 132: PY17 Net TRC Ratios by Program (\$1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$6,395	\$6,253	1.02	\$142
Energy Efficient Products	\$196	\$566	0.35	-\$370
Low Income Energy Efficiency	\$18	\$133	0.14	-\$115
Residential Subtotal	\$6,610	\$6,952	0.95	-\$343
C&I Energy Solutions for Business - Small	\$5,258	\$2,192	2.40	\$3,066
C&I Energy Solutions for Business - Large	\$9,902	\$5,555	1.78	\$4,347
Non-Residential Subtotal	\$15,160	\$7,747	1.96	\$7,413
Portfolio Total	\$21,769	\$14,699	1.48	\$7,070
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 133: PY17 Net TRC Ratios by Program (\$1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$22,540	\$19,121	1.18	\$3,419
Energy Efficient Products	\$2,703	\$4,675	0.58	-\$1,972
Low Income Energy Efficiency	\$2,191	\$2,588	0.85	-\$397
Residential Subtotal	\$27,434	\$26,384	1.04	\$1,050
C&I Energy Solutions for Business - Small	\$17,281	\$7,010	2.47	\$10,272
C&I Energy Solutions for Business - Large	\$26,907	\$17,580	1.53	\$9,328
Non-Residential Subtotal	\$44,189	\$24,590	1.80	\$19,599
Portfolio Total	\$71,622	\$50,973	1.41	\$20,649
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 134, Table 135, Table 136, and Table 137 summarize cost-effectiveness by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Phase IV of Act 129. P4TD costs and benefits are expressed in 2021 dollars regardless of program or reporting year.

Table 134: P4TD Gross TRC Ratios by Program (\$1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$74,261	\$50,898	1.46	\$23,363
Energy Efficient Products	\$22,607	\$28,350	0.80	-\$5,744
Low Income Energy Efficiency	\$11,544	\$12,166	0.95	-\$622
Residential Subtotal	\$108,411	\$91,414	1.19	\$16,997
C&I Energy Solutions for Business - Small	\$81,448	\$44,262	1.84	\$37,186
C&I Energy Solutions for Business - Large	\$88,341	\$81,689	1.08	\$6,652
Non-Residential Subtotal	\$169,789	\$125,951	1.35	\$43,838
Portfolio Total	\$278,201	\$217,365	1.28	\$60,835
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 135: P4TD Gross TRC Ratios by Program (\$1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$65,345	\$38,209	1.71	\$27,136
Energy Efficient Products	\$16,519	\$20,346	0.81	-\$3,827
Low Income Energy Efficiency	\$10,649	\$14,909	0.71	-\$4,260
Residential Subtotal	\$92,512	\$73,464	1.26	\$19,048
C&I Energy Solutions for Business - Small	\$111,145	\$63,085	1.76	\$48,060
C&I Energy Solutions for Business - Large	\$86,186	\$44,891	1.92	\$41,295
Non-Residential Subtotal	\$197,331	\$107,976	1.83	\$89,356
Portfolio Total	\$289,843	\$181,439	1.60	\$108,404
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 136: P4TD Gross TRC Ratios by Program (\$1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$22,501	\$17,841	1.26	\$4,660
Energy Efficient Products	\$5,372	\$5,930	0.91	-\$558
Low Income Energy Efficiency	\$1,718	\$3,634	0.47	-\$1,916
Residential Subtotal	\$29,591	\$27,405	1.08	\$2,186
C&I Energy Solutions for Business - Small	\$21,206	\$12,953	1.64	\$8,253
C&I Energy Solutions for Business - Large	\$31,493	\$22,816	1.38	\$8,676
Non-Residential Subtotal	\$52,698	\$35,769	1.47	\$16,929
Portfolio Total	\$82,289	\$63,174	1.30	\$19,115
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 137: P4TD Gross TRC Ratios by Program (\$1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$66,915	\$50,013	1.34	\$16,902
Energy Efficient Products	\$17,588	\$24,861	0.71	-\$7,273
Low Income Energy Efficiency	\$12,743	\$14,310	0.89	-\$1,567
Residential Subtotal	\$97,246	\$89,184	1.09	\$8,061
C&I Energy Solutions for Business - Small	\$86,933	\$49,386	1.76	\$37,546
C&I Energy Solutions for Business - Large	\$92,341	\$57,329	1.61	\$35,011
Non-Residential Subtotal	\$179,273	\$106,715	1.68	\$72,558
Portfolio Total	\$276,519	\$195,900	1.41	\$80,619
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 138, Table 139, Table 140, and Table 141 present P4TD cost-effectiveness results for Met-Ed, Penelec, Penn Power, and WPP respectively using net verified savings to calculate benefits. Cost and benefits are expressed in 2021 Dollars.

Table 138: P4TD Net TRC Ratios by Program (\$1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$53,188	\$32,645	1.63	\$20,543
Energy Efficient Products	\$11,541	\$17,822	0.65	-\$6,280
Low Income Energy Efficiency	\$11,544	\$12,166	0.95	-\$622
Residential Subtotal	\$76,273	\$62,632	1.22	\$13,641
C&I Energy Solutions for Business - Small	\$56,474	\$33,298	1.70	\$23,176
C&I Energy Solutions for Business - Large	\$55,655	\$55,708	1.00	-\$53
Non-Residential Subtotal	\$112,130	\$89,006	1.26	\$23,124
Portfolio Total	\$188,403	\$151,639	1.24	\$36,764
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 139: P4TD Net TRC Ratios by Program (\$1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$55,490	\$24,577	2.26	\$30,914
Energy Efficient Products	\$9,069	\$13,761	0.66	-\$4,693
Low Income Energy Efficiency	\$10,649	\$14,909	0.71	-\$4,260
Residential Subtotal	\$75,208	\$53,247	1.41	\$21,961
C&I Energy Solutions for Business - Small	\$76,799	\$46,842	1.64	\$29,958
C&I Energy Solutions for Business - Large	\$58,448	\$32,595	1.79	\$25,853
Non-Residential Subtotal	\$135,247	\$79,436	1.70	\$55,811
Portfolio Total	\$210,455	\$132,683	1.59	\$77,772
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 140: P4TD Net TRC Ratios by Program (\$1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$16,534	\$11,772	1.40	\$4,761
Energy Efficient Products	\$2,559	\$3,803	0.67	-\$1,244
Low Income Energy Efficiency	\$1,718	\$3,634	0.47	-\$1,916
Residential Subtotal	\$20,811	\$19,209	1.08	\$1,602
C&I Energy Solutions for Business - Small	\$16,959	\$10,979	1.54	\$5,980
C&I Energy Solutions for Business - Large	\$21,983	\$16,244	1.35	\$5,739
Non-Residential Subtotal	\$38,942	\$27,224	1.43	\$11,719
Portfolio Total	\$59,753	\$46,432	1.29	\$13,320
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

Table 141: P4TD Net TRC Ratios by Program (\$1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Energy Efficient Homes	\$56,906	\$33,895	1.68	\$23,011
Energy Efficient Products	\$9,682	\$16,380	0.59	-\$6,698
Low Income Energy Efficiency	\$12,743	\$14,310	0.89	-\$1,567
Residential Subtotal	\$79,331	\$64,585	1.23	\$14,746
C&I Energy Solutions for Business - Small	\$63,236	\$40,276	1.57	\$22,959
C&I Energy Solutions for Business - Large	\$60,665	\$39,868	1.52	\$20,798
Non-Residential Subtotal	\$123,901	\$80,144	1.55	\$43,757
Portfolio Total	\$203,232	\$144,729	1.40	\$58,503
1 Costs and benefits are expressed as follows: PY13 = 2021, PY14 = 2022, PY15 = 2023, PY16 = 2024, PY17 = 2025				

D.3 HIGH-IMPACT MEASURE NET-TO-GROSS

Findings from net-to-gross research are not used to adjust compliance savings in Pennsylvania. Instead, net-to-gross research provides directional information for program planning purposes. Table 142 and Table 143 present net-to-gross findings HIMs studied thus far in Phase IV¹⁸. All HIMs were evaluated in previous years of Phase IV.

Table 142: High-Impact Measure Net-to-Gross for Met-Ed and Penelec

HIM	Met-Ed			Penelec		
	Free ridership	Spillover	Net to Gross Ratio	Free ridership	Spillover	Net to Gross Ratio
CI Custom	47.2%	4.9%	57.7%	47.2%	4.9%	57.7%
CI Prescriptive	31.0%	1.8%	70.8%	34.9%	0.7%	65.9%
CI EMNC	24.5%	0.7%	76.2%	22.1%	0.6%	78.5%
EE Kits	24.0%	7.1%	83.1%	17.5%	24.1%	106.7%
Res HVAC	50.4%	50.4%	50.4%	45.2%	14.9%	69.7%
Res Appliance Turn-In	38.0%	0.0%	62.0%	40.0%	0.0%	60.0%

Table 143: High-Impact Measure Net-to-Gross for Penn Power and WPP

HIM	Penn Power			West Penn Power		
	Free ridership	Spillover	Net to Gross Ratio	Free ridership	Spillover	Net to Gross Ratio
CI Custom	47.2%	4.9%	57.7%	47.2%	4.9%	57.7%
CI Prescriptive	21.0%	1.1%	80.1%	34.0%	1.4%	67.4%
CI EMNC	23.5%	0.7%	77.3%	23.0%	1.0%	78.1%
EE Kits	22.5%	8.9%	86.4%	13.2%	9.8%	96.6%
Res HVAC	47.4%	2.1%	54.7%	48.8%	3.6%	54.8%
Res Appliance Turn-In	39.0%	0.0%	61.0%	34.0%	0.0%	66.0%

D.4 PROGRAM-LEVEL COMPARISON OF PERFORMANCE TO APPROVED EE&C PLAN

¹⁸ The [Phase IV Evaluation Framework](#) provides guidance to the EDCs to oversample measure categories (technologies) of high importance, called HIMs, to help program planners make decisions concerning those measures. The SWE suggests that for each program year, each EDC identify three to five HIMs for study based on energy impact, level of uncertainty, prospective value, funding, or other parameters. The intent is to prioritize measure-level NTGRs for HIMs, but the EDCs are encouraged to also provide some program-level NTG information – that is, to over-sample HIMs, but they may also include non-HIMs in the research, as appropriate.

Table 144, Table 145, Table 146, and Table 147 present PY17 expenditures, by program, compared to the budget estimates set forth in the EE&C plan for PY17 for Met-Ed, Penelec, Penn Power, and WPP. All the dollars in these tables are presented in 2025 dollars.

Table 144: Comparison of PYTD Expenditures to EE&C Plan (\$1,000) Met-Ed

Program	PY17 Budget from EE&C Plan	PY17 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	\$ 4,650.00	\$ 6,510.11	1.40
Energy Efficient Products Program	\$ 2,678.00	\$ 2,234.24	0.83
Low Income Energy Efficiency Program	\$ 2,963.00	\$ 3,219.29	1.09
C&I Energy Solutions for Business Program - Small	\$ 7,490.00	\$ 4,250.63	0.57
C&I Energy Solutions for Business Program - Large	\$ 7,275.00	\$ 10,763.61	1.48
Total	\$ 25,056.00	\$ 26,977.87	1.08

Table 145: Comparison of PYTD Expenditures to EE&C Plan (\$1,000) Penelec

Program	PY17 Budget from EE&C Plan	PY17 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	\$ 3,740.00	\$ 5,094.51	1.36
Energy Efficient Products Program	\$ 2,392.00	\$ 3,291.53	1.38
Low Income Energy Efficiency Program	\$ 3,254.00	\$ 3,124.99	0.96
C&I Energy Solutions for Business Program - Small	\$ 8,128.00	\$ 7,501.88	0.92
C&I Energy Solutions for Business Program - Large	\$ 5,683.00	\$ 12,377.88	2.18
Total	\$ 23,197.00	\$ 31,390.80	1.35

Table 146: Comparison of PYTD Expenditures to EE&C Plan (\$1,000) Penn Power

Program	PY17 Budget from EE&C Plan	PY17 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	\$ 1,591.00	\$ 1,993.23	1.25
Energy Efficient Products Program	\$ 711.00	\$ 413.64	0.58
Low Income Energy Efficiency Program	\$ 782.00	\$ 102.37	0.13
C&I Energy Solutions for Business Program - Small	\$ 2,074.00	\$ 1,462.64	0.71
C&I Energy Solutions for Business Program - Large	\$ 1,545.00	\$ 2,821.28	1.83
Total	\$ 6,703.00	\$ 6,793.15	1.01

Table 147: Comparison of PYTD Expenditures to EE&C Plan (\$1,000) WPP

Program	PY17 Budget from EE&C Plan	PY17 Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	\$ 4,951.00	\$ 6,959.41	1.41
Energy Efficient Products Program	\$ 2,928.00	\$ 4,213.78	1.44
Low Income Energy Efficiency Program	\$ 3,176.00	\$ 2,435.96	0.77
C&I Energy Solutions for Business Program - Small	\$ 7,089.00	\$ 3,152.70	0.44
C&I Energy Solutions for Business Program - Large	\$ 5,574.00	\$ 8,261.40	1.48
Total	\$ 23,718.00	\$ 25,023.25	1.06

Table 148, Table 149, Table 150, and Table 151 present P4TD expenditures, by program, compared to the budget estimates set forth in the EE&C plan through PY17 for Met-Ed, Penelec, Penn Power, and WPP respectively. All the dollars in these tables are presented in nominal Dollars.

Table 148: Comparison of P4TD Expenditures to EE&C Plan (\$1,000) Met-Ed

Program	Phase IV Budget from EE&C Plan through PY17	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	\$ 23,105.00	\$ 22,535.09	0.98
Energy Efficient Products Program	\$ 13,464.00	\$ 13,444.86	1.00
Low Income Energy Efficiency Program	\$ 15,178.00	\$ 13,291.05	0.88
C&I Energy Solutions for Business Program - Small	\$ 35,973.00	\$ 30,391.77	0.84
C&I Energy Solutions for Business Program - Large	\$ 36,505.00	\$ 29,468.35	0.81
Total	\$ 124,225.00	\$ 109,131.12	0.88

Table 149: Comparison of P4TD Expenditures to EE&C Plan (\$1,000) Penelec

Program	Phase IV Budget from EE&C Plan through PY17	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	\$ 18,599.00	\$ 17,229.38	0.93
Energy Efficient Products Program	\$ 12,040.00	\$ 10,678.61	0.89
Low Income Energy Efficiency Program	\$ 16,367.00	\$ 16,382.00	1.00
C&I Energy Solutions for Business Program - Small	\$ 39,250.00	\$ 39,101.59	1.00
C&I Energy Solutions for Business Program - Large	\$ 28,561.00	\$ 26,585.00	0.93
Total	\$ 114,817.00	\$ 109,976.59	0.96

Table 150: Comparison of P4TD Expenditures to EE&C Plan (\$1,000) Penn Power

Program	Phase IV Budget from EE&C Plan through PY17	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	\$ 7,949.00	\$ 7,878.83	0.99
Energy Efficient Products Program	\$ 3,571.00	\$ 3,272.67	0.92
Low Income Energy Efficiency Program	\$ 4,027.00	\$ 3,942.34	0.98
C&I Energy Solutions for Business Program - Small	\$ 10,063.00	\$ 9,183.26	0.91
C&I Energy Solutions for Business Program - Large	\$ 7,679.00	\$ 7,566.54	0.99
Total	\$ 33,289.00	\$ 31,843.64	0.96

Table 151: Comparison of P4TD Expenditures to EE&C Plan (\$1,000) WPP

Program	Phase IV Budget from EE&C Plan through PY17	P4TD Actual Expenditures	Ratio (Actual/Plan)
Energy Efficient Homes Program	\$ 24,536.00	\$ 23,888.12	0.97
Energy Efficient Products Program	\$ 14,741.00	\$ 13,594.34	0.92
Low Income Energy Efficiency Program	\$ 15,999.00	\$ 15,749.16	0.98
C&I Energy Solutions for Business Program - Small	\$ 34,579.00	\$ 34,566.67	1.00
C&I Energy Solutions for Business Program - Large	\$ 27,901.00	\$ 25,674.44	0.92
Total	\$ 117,756.00	\$ 113,472.73	0.96

Table 152, Table 153, Table 154, and Table 155 compare PYTD verified gross program savings compared to the energy savings projections filed in the EE&C plan for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 152: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Met-Ed

Program	EE&C Plan Projections for PY17	PY17 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	17,077	45,716	2.68
Energy Efficient Products Program	8,978	5,337	0.59
Low Income Energy Efficiency Program	4,979	4,866	0.98
C&I Energy Solutions for Business Program - Small	24,288	21,415	0.88
C&I Energy Solutions for Business Program - Large	38,456	38,162	0.99
Total	93,778	115,496	1.23

Table 153: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Penelec

Program	EE&C Plan Projections for PY17	PY17 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	13,604	32,973	2.42
Energy Efficient Products Program	7,936	7,379	0.93
Low Income Energy Efficiency Program	4,929	3,655	0.74
C&I Energy Solutions for Business Program - Small	30,252	42,589	1.41
C&I Energy Solutions for Business Program - Large	33,650	81,882	2.43
Total	90,371	168,479	1.86

Table 154: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for Penn Power

Program	EE&C Plan Projections for PY17	PY17 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	4,984	15,695	3.15
Energy Efficient Products Program	2,481	506	0.20
Low Income Energy Efficiency Program	1,531	146	0.10
C&I Energy Solutions for Business Program - Small	8,581	8,520	0.99
C&I Energy Solutions for Business Program - Large	8,206	24,024	2.93
Total	25,784	48,891	1.90

Table 155: Comparison of PYTD Actual Program Savings to EE&C Plan Projections for WPP

Program	EE&C Plan Projections for PY17	PY17 VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	17,703	43,779	2.47
Energy Efficient Products Program	10,368	8,652	0.83
Low Income Energy Efficiency Program	5,468	3,761	0.69
C&I Energy Solutions for Business Program - Small	25,940	33,022	1.27
C&I Energy Solutions for Business Program - Large	34,922	73,321	2.10
Total	94,402	162,535	1.72

Table 156, Table 157, Table 158, and Table 159 compare Phase IV verified gross program savings compared to the energy savings projections filed in the EE&C plan for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 156: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for Met-Ed

Program	EE&C Plan through PY17	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	85,876	116,586	1.36
Energy Efficient Products Program	44,891	43,491	0.97
Low Income Energy Efficiency Program	25,807	25,315	0.98
C&I Energy Solutions for Business Program - Small	116,571	109,398	0.94
C&I Energy Solutions for Business Program - Large	191,223	200,617	1.05
Total	464,367	495,408	1.07

Table 157: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for Penelec

Program	EE&C Plan through PY17	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	68,276	89,389	1.31
Energy Efficient Products Program	39,678	31,480	0.79
Low Income Energy Efficiency Program	25,838	25,913	1.00
C&I Energy Solutions for Business Program - Small	146,400	155,964	1.07
C&I Energy Solutions for Business Program - Large	167,194	155,944	0.93
Total	447,386	458,690	1.03

Table 158: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for Penn Power

Program	EE&C Plan through PY17	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	26,502	39,915	1.51
Energy Efficient Products Program	12,406	9,958	0.80
Low Income Energy Efficiency Program	7,831	5,573	0.71
C&I Energy Solutions for Business Program - Small	41,779	33,353	0.80
C&I Energy Solutions for Business Program - Large	40,544	52,113	1.29
Total	129,062	140,913	1.09

Table 159: Comparison of Phase IV Actual Program Savings to EE&C Plan Projections for Phase IV for WPP

Program	EE&C Plan through PY17	VTD Gross MWh Savings	Ratio (Actual/Plan)
Energy Efficient Homes Program	89,017	107,886	1.21
Energy Efficient Products Program	51,838	38,743	0.75
Low Income Energy Efficiency Program	28,456	28,651	1.01
C&I Energy Solutions for Business Program - Small	126,208	143,197	1.13
C&I Energy Solutions for Business Program - Large	173,155	212,065	1.22
Total	468,673	530,541	1.13

Appendix E Evaluation Detail – EE Kits Sub-Initiative

E.1 GROSS IMPACT EVALUATION

The Energy Efficiency Kits (EE Kits) initiative has two sub-initiatives – EE Kits and Low-Income EE Kits. Each sub-initiative has two sub-components: EE Kits and School Education. Both components are administered by AMCG. The EE Kits component distributes kits to customers that submit an online or telephonic request for conservation kits and also provides “new mover” kits to customers who open new accounts. The School Education program component also distributes kits by mail but collaborates with local schools to develop an energy efficiency oriented educational component for children.

E.1.1 Gross Impact Evaluation Methodology

Qualus’ gross impact evaluation methodology was identical for all four Rate Districts and for all kit types, although separate samples and realization rates are developed for each kit type (School Kits, and EE Kits). In the EE Kit subprogram, distinct types of energy conservation kits were sent to customers depending on their hot water fuel source. The kits that are provided to customers with electric water heating included LED lamps, LED night lights, energy saving aerators, a furnace whistle, an energy saving showerhead, and electrical outlet gaskets. The kits that are provided to customers with non-electric water heating excludes the showerhead and aerators. School kits included LED lamps, LED night lights, a furnace whistle, and electrical outlet gaskets. Low-Income kits included advanced power strips instead of electrical outlet gaskets.

In evaluating the gross impact analysis for the energy conservation kits, four items must be determined:

1. The average energy savings and demand reduction for the kit elements that are installed;
2. The number and type of kits mailed to customers during the program year;
3. The installation rate or in-service rate (ISR) for the various kit elements;
4. The delivery rate, or percentage of reported kits sent to customers that were not received by customers, either because of shipping problems, customers moving, or other such scenarios.

The first item has been determined through application of the partially deemed savings protocols in the 2021 TRM. The second item, the total number and type of kits mailed to customers, is determined by reviewing the program tracking and reporting system.

The third item, installation rates, are determined through online and telephone customer verification surveys, except for LED lamps which are given “deemed” installation rates of 0.92 (later multiplied by the kit receipt rate as determined through surveys), consistent with the TRM.

For a particular site in a sample, the installation rate for each kit element takes on a binary value of 1, if the element is installed in accordance with the principles that define that element as an

energy efficiency measure, and 0 otherwise. In particular, faucet aerators and energy saving showerheads are only counted as “installed” if they are installed in a home that has electric water heating.

The final item, the delivery rate is determined through the online and phone survey instrument. Online and phone survey respondents are asked to indicate whether they received the conservation kit that was mailed to them. The final in-service rates are the products of the item-wise in-service rates and the kit delivery rates.

The survey instrument that was used to verify that the shipped energy conservation kits were installed asks a series of questions that determine how many of each item was installed and where each item was installed.

Both telephone and online surveys were conducted in PY17. The two modes yielded compatible results, so each survey response for a given stratum was given equal weight.

The gross realization rates for energy savings and demand reductions were driven primarily by in-service rates for the kit components. The realization rates for EE Kits were similar to those found in past years. The following factors contributed to realization rates:

- Opt-in kits did better than New Mover kits
 - ISRs were higher for Opt-in kits for all non-lighting measures
 - Percent electric water heating for aerators and showerhead in Opt-in kits also trended higher than those in New Mover kits
 - Rate Districts with higher fractions of Opt-in kits had higher realization rates overall
- Low-income kits did better than non-low-income kits mainly due to higher fractions of Opt-in kits.
- Electric kits were the main source of lower realization rates for New Movers due to lower ISRs for showerheads and aerators.

While ISRs can fluctuate from survey to survey, the general trend indicated a systematic shift toward lower ISRs with the New Mover kits. The kits are still quite cost-effective despite the lower in-service rates associated with new mover kits.

E.1.2 Sampling

The low-income kits are treated as a separate sub-initiative and are discussed in Appendix Q. Each kit type was treated as a separate stratum within the sampling initiative. The sample designs for the four Rate Districts are shown in Table 160, Table 161, Table 162, and Table 163.

Table 160: EE Kits Sub-Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	31,169	241	Survey (phone + online)
EE Kits - Standard	23,388	337	
School Education kits	5,869	396	
Program Total	60,426	974	

Table 161: EE Kits Sub-Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	31,484	233	Survey (phone + online)
EE Kits - Standard	29,890	288	
School Education kits	5,842	1,165	
Program Total	67,216	1,686	

Table 162: EE Kits Sub-Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	6,651	118	Survey (phone + online)
EE Kits - Standard	7,260	152	
School Education kits	1,587	115	
Program Total	15,498	385	

Table 163: EE Kits Sub-Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	38,199	293	Survey (phone + online)
EE Kits - Standard	35,155	405	
School Education kits	5,623	572	
Program Total	78,977	1,270	

E.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 164, Table 165, Table 166, and Table 167 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 164: EE Kits Sub-Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	7,271	83%	1.0	9.2%
EE Kits - Standard	3,730	88%	0.5	3.9%
School Education kits	938	122%	0.5	3.5%
Program Total	11,939	87.7%		5.5%

Table 165: EE Kits Sub-Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	7,169	97%	1.0	9.4%
EE Kits - Standard	4,735	93%	0.5	4.2%
School Education kits	929	126%	0.5	1.9%
Program Total	12,832	97.6%		5.4%

Table 166: EE Kits Sub-Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	1,556	80%	1.0	13.1%
EE Kits - Standard	1,188	88%	0.5	5.8%
School Education kits	261	125%	0.5	6.5%
Program Total	3,005	87.3%		6.7%

Table 167: EE Kits Sub-Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	8,996	84%	1.0	8.4%
EE Kits - Standard	5,784	90%	0.5	3.6%
School Education kits	928	132%	0.5	2.9%
Program Total	15,707	89.3%		4.7%

E.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 168, Table 169, Table 170, Table 171 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 168: EE Kits Sub-Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.77	81.2%	1.0	9.2%
EE Kits - Standard	0.41	94.5%	0.5	3.9%
School Education kits	0.104	111.7%	0.5	3.5%
Program Total	1.29	88.0%		5.3%

Table 169: EE Kits Sub-Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.72	94.4%	1.0	9.4%
EE Kits - Standard	0.47	95.8%	0.5	4.2%
School Education kits	0.09	112.9%	0.5	1.9%
Program Total	1.28	96.2%		5.4%

Table 170: EE Kits Sub-Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.16	80.0%	1.0	13.1%
EE Kits - Standard	0.13	92.6%	0.5	5.8%
School Education kits	0.03	106.9%	0.5	6.5%
Program Total	0.33	87.5%		6.6%

Table 171: EE Kits Sub-Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.99	81.8%	1.0	8.4%
EE Kits - Standard	0.70	95.3%	0.5	3.6%
School Education kits	0.11	118.6%	0.5	2.9%
Program Total	1.79	89.3%		4.5%

Note that the overall precision for the EE Kits initiative is the combined precision of the low income and non-low-income components. The combined precisions for each Rate District are shown in Table 172 below.

Table 172: EE Kits Initiative Sampling Precisions

EDC	Relative Precision at 85% C.L., Energy	Relative Precision at 85% C.L., Demand
Met-Ed	4.9%	4.7%
Penelec	5.1%	5.0%
Penn Power	6.7%	6.6%
West Penn Power	4.1%	3.9%

E.2 NET IMPACT EVALUATION

E.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted a net-to-gross study in PY15. The net-to-gross evaluation for the Energy Efficiency Kits measures is based on self-report data from program participants. The following sections provide information related to the net impact evaluation effort.

E.2.2 Sampling

The sample designs for the four Rate Districts are shown Table 173. Note that the process and net impact evaluation survey effort included both low-income and non-low-income customers. The participant counts, sample sizes, and results shown in the following tables corresponds to

the non-low-income component of the kits, which is a part of the Energy Efficient Homes Program.

Table 173: EE Kits Initiative Net-to-Gross Sampling

Rate District	Population Size	Achieved Sample Size (Opt-In)	Achieved Sample Size (New Mover)	Achieved Sample Size (School)	Achieved Sample Size (Total)	Response Rate
Met-Ed	57,375	31	13	24	68	11.6%
Penelec	57,934	30	17	41	88	13.6%
Penn Power	18,185	33	18	3	54	15.4%
WPP	54,744	33	16	26	75	15.2%

E.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 174.

Table 174: EE Kits Initiative Net-to-Gross Results

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	10,475	24.0%	7.1%	83.1%	13.1%
Penelec	12,526	17.5%	24.1%	106.7%	11.5%
Penn Power	2,623	22.5%	8.9%	86.4%	14.7%
WPP	14,028	13.2%	9.8%	96.6%	12.5%

Appendix F Evaluation Detail – Residential Direct Install Initiative

The Residential Direct Install (Res DI) Initiative is implemented by CLEAResult. A participant in this program is defined as a unique address in the program, and multiple projects can be installed at one address.

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

For the initial in-home audit, up to \$450 is allocated to cover the costs of the customer audit fee (\$150) and the rebates for the direct-install measures (capped at \$300). The customer audit fee is paid as a rebate directly to the trade ally by the CSP. The audit fee covers the auditor time, blower door test, home energy education, whole-home analysis, and the home energy report. Additional energy use education and recommendations for further measure installation are also part of the service. After the audit and direct-install measures are completed, the auditor will summarize their recommended measures, inform the customer of available rebates, and provide the customer with a complete list of the audit fee and direct-install measure costs covered by the Comprehensive Audit program. They also provide a FirstEnergy leave-behind flyer that includes information to help the customer with the next steps. If customers are interested in direct-install measures above the \$300 cap or additional testing not covered in the program, auditors can work with the customer to complete the requests.

Solar power was the dominant measure in PY17. The Solar PV Rebate program expanded into a digital gift card incentive as part of the Major Measures rebates that are offered. Additional HVAC and appliance products were also added to the Major Measures offering.

F.1 GROSS IMPACT EVALUATION

F.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Res DI Initiative utilized a stratified sampling plan. The projects are placed into one of three strata based on total reported project impacts.

The program tracking and reporting system is at the measure level and also identifies the rebate application and participant address associated with each measure. In general, there can be

multiple measures per application and even multiple applications per household. An example of the latter scenario is when a household first undergoes an initial audit with direct installation of low-cost measures, but later has major measures installed as identified in the audit report. The subsequent retrofits would be captured in a separate rebate application.

Qualus aggregated impacts from all measures by unique address and then placed each household in one of three strata which correspond to high, medium, and low energy savings in the context of the distribution of reported impacts for the given Rate District. Impact evaluation activities for sampled projects are described below.

F.1.1.1 Weatherization Measures

Engineering calculation reviews were performed on all participants with major measures. Engineering calculations were checked for TRM compliance. The customer's zip code was used to determine EFLHs, HDDs, and CDDs. Reviews also consisted of a document review to verify HVAC equipment and water heating equipment.

Insulation areas, baseline and post-installation insulation R-values were provided in the rebate forms or from accompanying project documentation.

Residential air sealing measures used CFM50_{post} and CFM50_{pre} values found in the project rebate forms.

F.1.1.2 Non-Weatherization Measures

A sample of projects were used to determine measure level in-service rates. Furthermore, a document review when applicable was used to verify water heating. Non-weatherization measures include light bulbs, showerheads, night lights, smart power strips, aerators, pipe wrap insulation smart thermostats, and solar panels. All measures were evaluated according to their respective protocols in the 2021 PA TRM, except solar projects. Qualus evaluated solar power projects according to the interim measure protocol issued by the SWE in PY16. Qualus relied on hourly smart meter data to verify installation and to determine caps on annual energy savings in cases where solar generation exceeded the home's electricity usage. The smart meter data indicated whether electricity was delivered to the customer from the grid or exported by the customer to the grid. The annual net overgeneration amount was calculated as the difference between exported and delivered electricity when exports exceeded deliveries. This overgeneration amount was then subtracted from the annual solar generation, otherwise estimated using the IMP process.

F.1.2 Sampling

Table 175, Table 176, Table 177, and Table 178 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 175: Res DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Solar projects	0.0	1,894	49	
Non-Solar Projects	0.0	611	11	
Program Total		2,505	60	

Table 176: Res DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Solar projects	0.0	1,356	30	
Non-Solar Projects	0.0	539	11	
Program Total		1,895	41	

Table 177: Res DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Solar projects	0.0	532	25	
Non-Solar Projects	0.0	126	14	
Program Total		658	39	

Table 178: Res DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Solar projects	0.0	1,479	47	
Non-Solar Projects	0.0	696	9	
Program Total		2,175	56	

F.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 179, Table 180, Table 181, and Table 182 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 179: Res DI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Solar projects	0.0	22,969	81.2%	0.5	10%
Non-Solar Projects	0.0	467	94.0%	0.5	22%
Program Total		23,436	81.5%		9.9%

Table 180: Res DI Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Solar projects	0.0	16,564	90.7%	0.5	13%
Non-Solar Projects	0.0	260	108.3%	0.5	21%
Program Total		16,824	91.0%		12.8%

Table 181: Res DI Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Solar projects	0.0	6,382	93.1%	0.5	14%
Non-Solar Projects	0.0	50	109.1%	0.5	18%
Program Total		6,432	93.2%		13.9%

Table 182: Res DI Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Solar projects	0.0	18,063	105.5%	0.5	10%
Non-Solar Projects	0.0	420	105.5%	0.5	24%
Program Total		18,483	105.5%		10.1%

F.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 183, Table 184, Table 185, and Table 186 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 183: Res DI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Solar projects	0.0	8.02	80.2%	0.5	10%
Non-Solar Projects	0.0	0.07	70.7%	0.5	0%
Program Total		8.09	80.1%		10.1%

Table 184: Res DI Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Solar projects	0.0	5.95	97.8%	0.5	13%
Non-Solar Projects	0.0	0.04	65.4%	0.5	0%
Program Total		5.99	97.6%		12.9%

Table 185: Res DI Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Solar projects	0.0	2.33	101.4%	0.5	14%
Non-Solar Projects	0.0	0.01	70.3%	0.5	0%
Program Total		2.34	101.3%		14.0%

Table 186: Res DI Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Solar projects	0.0	6.60	105.9%	0.5	10%
Non-Solar Projects	0.0	0.07	87.7%	0.5	0%
Program Total		6.66	105.7%		10.2%

F.2 NET IMPACT EVALUATION

F.2.1 Net Impact Evaluation Methodology

Tetra Tech performed net impact evaluation in PY15 using the approach defined in the Pennsylvania Act 129 Phase IV Statewide Evaluation Framework, which is built around a customer self-report survey. The participant survey includes a series of free-ridership and spillover questions that ask program participants about the actions they would have taken if the program had not been offered. However, for PY17, nearly the entire energy savings, demand reductions, and incremental costs were attributable to solar panel installations. The PY15 program did not include any solar power rebates. Net impact evaluation conducted in PY16 for the C/I Custom Initiative (as discussed in Appendix S.2) indicated that, for commercial customers, solar projects tended to have lower net-to-gross ratios than other projects. This may be explained by the presence of external tax credits for solar power as well as additional financial benefits from Solar Renewable Energy Credits (SRECs). Comparable tax credits and SRECs were also available for residential solar projects. For this reason, the evaluation team judged that the NTG ratios for the Comprehensive Audit program, as determined in PY15, would

overestimate the NTG for the PY17 program. The NTG ratios from the PY16 study for solar power projects commercial solar projects are more applicable to residential solar projects. The following sections describe how the NTG values from commercial solar projects were applied to the PY17 program.

F.2.2 Sampling

This section describes the sampling conducted for commercial and industrial solar projects in PY16, because the commercial solar NTG is applied to the residential solar projects in PY17, in the absence of an up-to-date NTG study for this program component. The previous NTG study for the Residential Direct Install initiative was conducted in PY15.

The population sizes, achieved sample sizes, and response rates are shown in Table 187 below. The results from all four Rate Districts were combined in the commercial and industrial net impact evaluation, which is why the population and sample sizes are identical for each Rate District.

Table 187: Res DI Initiative Net-to-Gross Sampling

Rate District	Population Size	Achieved Sample Size	Response Rate
Met-Ed	97	17	17.5%
Penelec	97	17	17.5%
Penn Power	97	17	17.5%
WPP	97	17	17.5%

F.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 188. While the PY15 program had an average NTG ratio of 93%, driven by the direct-install nature of the program and major measures such as air sealing and attic insulation, the solar projects are expected to have NTG ratios below 50%. However, the lower NTG ratios do not adversely affect cost-effectiveness because the primary Total Resource Cost (TRC) test cost for solar projects is the incremental measure cost, which is reduced in proportion to the NTG ratio. Moreover, the same tax credits and Solar Renewable Energy Credits (SRECs) that contribute to lower attribution of savings to Act 129 rebates are also included as benefits in the TRC test.

Table 188: Res DI Initiative Net-to-Gross Results by Rate District

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	19,094	59.8%	1.1%	41.3%	15.9%
Penelec	15,304	59.8%	1.1%	41.3%	15.9%
Penn Power	5,997	59.8%	1.1%	41.3%	15.9%
WPP	19,497	59.8%	1.1%	41.3%	15.9%

Appendix G Evaluation Detail – Residential New Construction Initiative

The Residential New Construction program incentivizes builders to adopt energy efficient building practices. This includes building envelope improvements, high-efficiency HVAC equipment, duct sealing, and installation of ENERGY STAR® appliances, smart thermostats, and lighting. Participants are defined as each unique dwelling unit (e.g., unique mailing address).

All submitted projects used Ekotrope to generate reported energy and demand impacts.

G.1 GROSS IMPACT EVALUATION

G.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Residential New Construction (Res NC) Initiative involved reviewing the software models submitted with each sampled project, performing verification of model inputs, and re-running modified models through the same software used by program HERS raters. Models were modified based on site inspection information obtained by the implementer (PSD) during their quality control inspections, or Qualus' verification site visits. Additional resources such as aerial maps were also used to verify model inputs such as orientation and number of stories. Modified models were then run against the reference home to obtain ex post energy savings and cooling demand reduction TRM inputs. Ex post cooling demand reductions followed the corresponding TRM algorithm which includes a coincidence factor. Ex post demand reductions for lighting, appliances, and water heaters were obtained from corresponding TRM algorithms. Total ex post demand reductions are the sum of the cooling demand reduction and the lighting, appliances, and water heater demand reductions. Additional algorithm parameters required by the TRM but not required by software inputs were obtained through the on-site verification efforts.

G.1.1.1 On-Site Inspections

Two types of on-site inspections were performed for the impact evaluation effort:

- Diagnostic inspection w/blower door and duct blaster
- Visual inspection without blower door and duct blaster

Diagnostic inspections include the same activity as visual inspections with the addition of blower door and duct blaster testing to verify duct leakage and whole house infiltration rates.

Visual inspection includes the following:

- Building Characteristics
 - Orientation (N, NE, E, SE, etc.)
 - Housing type (SF detached, Townhouse inside unit, Townhouse end unit, etc.)
 - Number of floors on or above grade
 - Conditioned sq. ft.
 - Number of bedrooms

- Window type, size and orientation
 - Ceiling heights
- Envelope
 - Foundation type (slab, conditioned basement, unconditioned basement, etc.)
 - Wall and ceiling insulation R-values
 - Slab and framed floor insulation
 - Rim/band joist insulation
 - Number of exterior doors
- HVAC
 - Make and model
 - SEER2, capacity, and HSPF2
 - For gas furnaces, electric auxiliary energy usage (EAE) as obtained from the AHRI database
 - Smart thermostat is installed
 - Duct location (conditioned space, attic)
 - Type of mechanical ventilation if necessary
- Water heating
 - Type (storage, instantaneous)
 - Fuel (gas, electric resistance, heat pump)
 - Size in gallons
 - Energy factor as obtained from the AHRI database
- Lighting
 - Percent efficient installed interior, exterior, and in the garage. In cases of discrepancies, lighting counts were reported in the notes section of the checklist.
 - Identification of source (incandescent, LED, or CFL)
- Appliances
 - An ENERGY STAR® appliance was installed at the time of inspection
 - kWh/yr for refrigerators and dishwashers
 - Fuel for ranges and cooktops
 - Clothes washer and dryer attributes

G.1.1.2 Engineering Model Reviews

Submitted building models were reviewed as part of the evaluation activities. These reviews included the following activities:

- Baseline specifications are accurate per the TRM
- Model inputs are reasonable and self-consistent
- Models are consistent with actual as-built homes

Each sampled home was reviewed for consistency with actual as-built homes. In cases where submitted models differed from as-built homes, models were modified prior to generating ex post values.

G.1.1.3 TRM Impact Evaluation

Demand impact parameters for cooling equipment, including peak load and EER values, were obtained from software outputs and multiplied by coincidence factors based on zip code according to the TRM algorithm. The TRM requires that demand impacts from lighting and appliances are evaluated with relevant TRM protocols rather than within engineering simulation models since approved software does not produce peak load outputs for end uses other than cooling equipment demand.

G.1.2 Sampling

Table 189, Table 190, Table 191, and Table 192 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively. New Homes and smart thermostats within those homes make up the two qualitative sampling strata.

Table 189: RES NC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	739	24	Model Review / On-Site
Smart Thermostats	217	6	
Program Total	956	30	

Table 190: RES NC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	149	16	Model Review / On-Site
Smart Thermostats	4	4	
Program Total	153	20	

Table 191: RES NC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	669	21	Model Review / On-Site
Smart Thermostats	326	7	
Program Total	995	28	

Table 192: RES NC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
New Homes	1,108	26	Model Review / On-Site
Smart Thermostats	332	8	
Program Total	1,440	34	

G.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 193, Table 194, Table 195, and Table 196 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Gross realization rates for Smart Thermostats varied across Rate Districts mainly due to small sample sizes resulting in higher and lower square footage per ton than ex ante assumptions.

Table 193: RES NC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	2,624	100.8%	0.3	7.8%
Smart Thermostats	55	123.4%	0.5	29.0%
Program Total	2,679	101.3%		7.6%

Table 194: RES NC Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	433	100.7%	0.4	14.4%
Smart Thermostats	1	83.1%	0.5	0.0%
Program Total	434	100.7%		14.4%

Table 195: RES NC Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	1,896	103.3%	0.2	6.8%
Smart Thermostats	59	114.4%	0.5	26.9%
Program Total	1,955	103.6%		6.7%

Table 196: Res DI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	3,492	100.7%	0.5	13.0%
Smart Thermostats	64	113.6%	0.5	25.1%
Program Total	3,556	100.9%		12.7%

G.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 197, Table 198, Table 199, and Table 200 for Met-Ed, Penelec, Penn Power, and WPP respectively. Gross realization rates for demand savings were primarily driven by differences in methodology. Application of the TRM's coincidence factor to the peak design load results in a lower kW value than the average kW in July at 6 PM, which is the basis for reported demand reductions.

Table 197: RES NC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	0.62	108.7%	0.5	14.2%
Smart Thermostats	0.02	111.0%	0.5	29.0%
Program Total	0.64	108.8%		13.8%

Table 198: RES NC Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	0.10	90.8%	0.3	11.7%
Smart Thermostats	0.00	79.6%	0.5	0.0%
Program Total	0.10	90.8%		11.7%

Table 199: RES NC Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	0.50	95.0%	0.4	11.3%
Smart Thermostats	0.02	135.3%	0.5	26.9%
Program Total	0.52	96.3%		10.8%

Table 200: RES NC Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
New Homes	0.80	111.7%	0.4	10.4%
Smart Thermostats	0.02	107.0%	0.5	25.1%
Program Total	0.82	111.6%		10.1%

G.2 NET IMPACT EVALUATION

G.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted a net impact evaluation in PY14 by tailoring the common approach defined in the Pennsylvania Act 129 Phase IV Statewide Evaluation Framework to the New Homes program design. A series of free-ridership and spillover questions included in the builder interviews ask participating builders about the actions they would have taken if the program had not been offered and whether various program aspects influenced their actions. A total of 14

builders were interviewed from the 34 total builders that participated in the program across the four PA Company's. Builder responses resulted in a free ridership rate of 28 percent for PY14 (similar to the 27% measured in PY10). The net-to-gross research did not identify any participant spillover. Due to the homogeneity of the program approach across the four PA Rate Districts, and the relatively small number of builders, the same NTG ratio is applied to all four Rate District's programs.

G.2.2 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 201.

Table 201: Res NC Initiative Net-to-Gross Results by Rate District

Rate District	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	2,714	28.0%	0.0%	72.0%	14.5%
Penelec	437	28.0%	0.0%	72.0%	14.5%
Penn Power	2,026	28.0%	0.0%	72.0%	14.5%
WPP	3,589	28.0%	0.0%	72.0%	14.5%

Appendix H Evaluation Detail – Residential Multifamily Direct Install Initiative

The Residential Multifamily Direct Install (Res MF) Initiative is implemented by CLEAResult. A participant in this program is defined as a unique address in the program, and multiple projects can be installed at one address.

This program consists of brief energy audits performed by CLEAResult along with energy efficiency measures directly installed in customers' dwelling units. The audit is used to identify low-cost energy savings opportunities, with associated energy savings measures directly installed in the unit during the audit. Low-cost measures installed in PY17 included light bulbs, nightlights, smart power strips, efficient showerheads, and low-flow aerators.

H.1 GROSS IMPACT EVALUATION

H.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Res MF Initiative utilized a stratified sampling plan. Most projects are placed into one sampling stratum, with an additional stratum reserved for high-impact projects.

The program tracking and reporting system is at the measure level, and also identifies the rebate application and participant address associated with each measure. Qualrus aggregated all measures by unique address and then placed each household in one of the two strata: high-impact projects with reported energy savings above 2,000 kWh, and all other projects.

Due to the low participation and impacts in this initiative in Phase IV, desk reviews were the most appropriate evaluation activity. Qualrus evaluators compared audit reports and invoices to program tracking and reporting data to reconcile quantities of installed measures. The evaluators also independently calculated impacts for all measures according to their respective protocols in the 2021 PA TRM.

H.1.2 Sampling

Table 202, Table 203, Table 204, and Table 205 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 202: Res MF Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High-Impact	2,000	0	0	Inspection of QA/QC verification forms, desk reviews
All Other	na	134	23	
Program Total		134	23	

Table 203: Res MF Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High-Impact	2,000	0	0	Inspection of QA/QC verification forms, desk reviews
All Other	na	175	27	
Program Total		175	27	

Table 204: Res MF Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High-Impact	2,000	0	0	Inspection of QA/QC verification forms, desk reviews
All Other	na	9	7	
Program Total		9	7	

Table 205: Res MF Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High-Impact	2,000	0	0	Inspection of QA/QC verification forms, desk reviews
All Other	na	274	29	
Program Total		274	29	

H.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 206, Table 207, Table 208, and Table 209 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 206: Res MF Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0	0.0%	0.5	0%
All Other	na	46	100.1%	0.5	14%
Program Total		46	100.1%		13.7%

Table 207: Res MF Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0	0.0%	0.5	0%
All Other	na	88	98.3%	0.5	13%
Program Total		88	98.3%		12.7%

Table 208: Res MF Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0	0.0%	0.5	0%
All Other	na	3	106.2%	0.5	13%
Program Total		3	106.2%		12.8%

Table 209: Res MF Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0	0.0%	0.5	0%
All Other	na	63	98.3%	0.5	13%
Program Total		63	98.3%		12.6%

H.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 210, Table 211, Table 212, and Table 213 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 210: Res MF Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0.00	0.0%	0.5	0%
All Other	na	0.01	76.7%	0.5	14%
Program Total		0.01	76.7%		13.7%

Table 211: Res MF Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0.00	0.0%	0.5	0%
All Other	na	0.01	82.3%	0.5	13%
Program Total		0.01	82.3%		12.7%

Table 212: Res MF Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0.00	0.0%	0.5	0%
All Other	na	0.00	78.3%	0.5	13%
Program Total		0.00	78.3%		12.8%

Table 213: Res MF Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High-Impact	2,000	0.00	0.0%	0.5	0%
All Other	na	0.01	78.4%	0.5	13%
Program Total		0.01	78.4%		12.6%

H.2 NET IMPACT EVALUATION

H.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted a net impact evaluation for the CI MF initiative in PY15. The NTG evaluation relies on the survey of building owners/managers, who can report on behalf of multiple buildings because they are the decision-makers for what services and energy-saving upgrades can be provided to tenants or in common areas. Survey questions to estimate free-ridership and spillover and analysis algorithms follow the standardized self-report methodology described in the evaluation framework. Due to the small population size and a limited number of respondents, NTG ratios are estimated across the Multifamily subprograms (combining the residential and C&I components) and across Rate Districts. The population sizes, achieved sample sizes, and response rates from the study are shown in Table 214 below.

Table 214: Res MF Initiative Net-to-Gross Sampling

Rate District	Population Size	Achieved Sample Size	Response Rate
All Rate Districts Combined	46	14	30.4%

H.2.2 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 215.

Table 215: Res MF Initiative Net-to-Gross Results by EDC

Rate District	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	46	0.6%	0.0%	99.5%	12.8%
Penelec	86	0.6%	0.0%	99.5%	12.8%
Penn Power	3	0.6%	0.0%	99.5%	12.8%
WPP	62	0.6%	0.0%	99.5%	12.8%

Appendix I Evaluation Detail – Residential Online Audit Initiative

Online Audit is a component of the Behavioral subprogram—a subprogram administered as part of both the Energy Efficient Homes and Low-Income Energy Efficiency programs. The Online Audit component provides residential customers with a web-based platform that provides: (1) visualizations of a customer’s energy use, (2) tips on ways customers can save energy, and (3) promoting other programs in FirstEnergy’s residential energy efficiency portfolio. The administration of this component is divided between standard residential customers, as part of the Energy Efficient Homes Program, or Low-Income customers, as part of the Low-Income Energy Efficiency Program. Online Audits are administered as a customer opt-in program, meaning that customers can freely enroll in the program at any time.

I.1 GROSS IMPACT EVALUATION

I.1.1.1 Data Gathering

Data used to evaluate this program component include:

- Hourly residential AMI data, which is regularly received by Qualus from FirstEnergy via an automated transfer,
- An extract of FirstEnergy’s T&R system, which is regularly delivered to Qualus via a monthly transfer,
- Global Historical Climatology Network (GHCN) weather data obtained via the National Oceanic and Atmospheric Administration (NOAA) website, and
- An additional extract of missing tracking data for Met-Ed.

I.1.1.2 Data Preparation

Qualus prepared AMI data for evaluation using the following method:

- Residential AMI data was filtered by cohort by the treatment and control group account numbers.
- AMI data included actual reads and estimated reads. Rather than interpolating estimated AMI data, estimated AMI data and any calendar day containing estimated AMI data was removed from the data set on a per-customer basis.
- The total daily kWh per customer was taken for each customer for each day by summing across the kWh for each calendar day.
- An outlier filter of +/- 300 kWh per day was applied to the data set.

The nearest GHCN hourly weather station was mapped to each customer zip code using Haversine distance on the latitude longitude of the zip code and the GHCN hourly weather station. Stations with fewer than 70% missingness were included in the final weather data

set. Missing hourly observations were interpolated using inverse distance matching on the five nearest weather stations.

I.1.1.3 Billing Analysis

Analysis Population

As noted in the PY16 evaluation, concerns were raised by the SWE on the statistical power of PY16's evaluation and its capacity to show statistically robust savings at the 85% confidence level after calculating cluster robust standard errors. I.e., repeated measurements from a given customer over time exhibit a level of autocorrelation. Thus, it is best practice to correct for the autocorrelation of observations when calculating the standard errors of a resulting regression analysis by calculating cluster robust standard errors. Despite showing relatively stable year-over-year savings from PY14 to PY16, Qualus failed to correct for this autocorrelation in its resulting analysis. Consequently, once cluster robust standard errors were calculated for PY16, the resulting savings were no longer significant at the 85% confidence level.

One way to increase the potential for finding statistically significant savings is to increase the number of participants included in the analysis. However, Online Audits is a customer opt-in program with fluctuating participation from year to year. Thus, rather than relying on a single year's participant group as the basis for analysis for PY17, Qualus used all participants from PY14 through PY17 as the analysis population of interest. PY13 was excluded from the analysis population due to the potential superposition of COVID-19 impacts on AMI data. To ensure a minimum of six months of post-exposure data, Qualus limited the analysis to customers with participation dates prior to January 1, 2027.

Additionally, to ensure enough participants in the regression, Qualus aggregated customers across the four Rate Districts by rate type. I.e., standard residential customers across all four Rate Districts were included in a single regression and low-income customers across all four utilities were included in another regression.

Post-treatment data for all customers included in the analysis was limited to one year after the treatment date.

Propensity Score Matching

The Phase IV Online Audit subprogram functions as an opt-in program, meaning that customers enroll in the program at their own discretion rather than being enrolled in the program automatically. Thus, a control group is not defined prior to participation. To develop a comparison group, Qualus leveraged the population of residential AMI data and performed a nearest neighbor match to develop a comparison group. To ensure customers were matched to appropriate comparison groups, matching occurred on a per-customer sector by Rate District basis. I.e., treatment customers for the standard residential group for Met-Ed were matched to comparison customers from the standard residential Met-ed population, etc. Standard and Low-Income populations for the comparison group were defined using enrollment in Health & Human Services Programs as defined by FirstEnergy's Customer Information System, low-income designation in Oracle's corresponding in the HERs program, and participation in other low-income subprograms.

Additionally, customers were segmented by treatment month for matching to reduce the amount of distance between the matching period and the treatment date. Segments were matched serially and sequentially from the most recent treatment month to the earliest treatment month. Non-participants selected in each segment were not eligible to be selected in a subsequent segment, ensuring that non-participants could only be represented in the comparison group once.

In previous program years, Qualus relied on five pre-treatment variables representing customers' average annual consumption and average consumption in each of the four seasons for matching. A visual inspection of a match generated using these variables showed substantial differences between the participant and comparison groups. Thus, Qualus modified the matching algorithm for PY17 to use seven pre-treatment variables: a pre-treatment annual variable (average daily kWh across the 12-month period), a pre-winter variable (average daily kWh for December through March), a pre-summer variable (average daily kWh for June through September), the average consumption for the last 30 days prior to the treatment month, the standard deviation in daily consumption for the last 30 days prior to the treatment month, the slope between the average consumption between the two months prior to the treatment month, and the average summer peak kW (2 p.m. to 6 p.m. on non-holiday weekdays from June through August). Additionally, customer zip codes were used to look up approximate latitude and longitude for each customer address. Due to concerns with overlap with the HER sub-program, a categorical variable was also generated indicating HER treatment status and HER cohort.

The seven consumption variables and two geolocation variables were included in the nearest neighbor match algorithm while HER cohort was specified as an exact matching variable. The nearest neighbor match used "greedy" matching without replacement, meaning that the algorithm matched treatment group customers serially and sequentially. A 1:1 treatment to comparison group ratio was used for matching. Qualus reviewed a MANOVA on the nine quantitative variables, the standard mean difference of the nine quantitative variables, and a visualization of the 365-day pre-period for the treatment and comparison group to determine a good match. The match was considered good if the standard mean differences did not exceed a value of 0.1, the visual representation did not show any obvious differences between the two groups, and the parametric t-tests from the MANOVA showed good agreement for all variables.

Regression Model

Because the Online Audit component relies on a non-RCT design, Qualus' method for evaluation draws from "Chapter 8: Whole-Building Retrofit with Consumption Data Analysis Evaluation Protocol" of Uniform Methods Project (UMP) (Agnew & Goldberg, 2017). The UMP protocol for whole building retrofit provides guidance for performing pooled billing analysis using a matched comparison group. The regression model recommended by the UMP is a form of the LFER model found in the Behavioral section of the Phase IV Evaluation Framework. Qualus used a form of this regression model to evaluate savings for the Online Audits component.

Degree day bases were optimized for each customer by testing a range of potential CDD bases (65-80 degrees Fahrenheit) and HDD bases (50-65 degrees Fahrenheit) at all potential whole-

number combinations rounded to the nearest multiple of 5 and selecting the pair that provides the highest R-squared value when regressing against each customer's monthly billing data.

Although Qualus used a comparison group that should theoretically match the treatment group on pre-treatment characteristics, Qualus opted to include weather terms in the Online Audit analysis to better control for potential variability between the treatment and control group. Additionally, although HERs cohort assignment was included as an exact matching variable, Qualus opted to include an additional Boolean variable for post-treatment HERs as an additional independent variable to ensure variability associated with HERs was well-controlled.

The model is specified in the equation below:

$$\begin{aligned} kWh_{i,d} = & \beta_i + \beta_{post} * post_{i,d} + \beta_{cdd} * CDD_{i,d} + \beta_{hdd} * HDD_{i,d} + \beta_{post,cdd} * post_{i,d} * CDD_{i,d} + \\ & \beta_{post,hdd} * post_{i,d} * HDD_{i,d} + \beta_{treat,cdd} * treat_i * CDD_{i,d} + \beta_{treat,hdd} * treat_i * HDD_{i,d} + \beta_{her_post} * her_post_i + \tau_{post,treat} \\ & * post_{i,d} * treat_i + \tau_{post,treat,cdd} * post_{i,d} * treat * CDD_{i,d} + \tau_{post,treat,hdd} * post_{i,d} * treat * HDD_{i,d} + \varepsilon_{imy} \end{aligned}$$

Equation 4: Formula specifying the Online Audits regression model

The variables above are defined in Table 216 below.

Table 216: Definition of variables in the Online Audit regression model

Variable	Definition
$kWh_{i,d}$	Customer i's daily electric usage on day d.
β_i	The intercept term for customer i, or the "fixed effect" term.
β_{post}	The coefficient for the main effect of "post."
β_{cdd}	The coefficient of the main effect of CDD.
β_{hdd}	The coefficient of the main effect of HDD.
$\beta_{post,cdd}$	The coefficient of the interactive effect of CDD and post.
$\beta_{post,hdd}$	The coefficient of the interactive effect of HDD and post.
$\beta_{treat,cdd}$	The coefficient of the interactive effect of CDD and treat.
$\beta_{treat,hdd}$	The coefficient of the interactive effect of HDD and treat.
β_{her_post}	The coefficient for the effect of her-treatment x post-treatment.
$post_{i,d}$	An indicator variable that equals one during the post-period for customer i.
$CDD_{i,d}$	Customer i's CDD on day d.
$HDD_{i,d}$	Customer i's HDD on day d.
$treat_i$	An indicator variable that equals 1 for customers in the treatment group and 0 for customers in the comparison group.
her_post_i	An indicator variable that equals 1 for HER-treatment customers in the post-treatment start period for HER.
$\tau_{post,treat}$	The estimated treatment effect in kWh per day; the main parameter of interest. Estimated separately for each month and year
$\tau_{post,treat,cdd}$	The estimated treatment effect in kWh per CDD.
$\tau_{post,treat,hdd}$	The estimated treatment effect in kWh per HDD.
ε_{imy}	The error term.

I.1.1.4 Dual Participation Analysis

The following sub-section provides a formal description of Qualus' Dual Participation Analysis for Online Audits. On average, Qualus found an annual impact of Dual Participation of approximately 28 kWh per customer.

Participants in both the treatment and comparison groups participate in other FirstEnergy energy efficiency programs. Furthermore, the Online Audits measure may cause treatment group participants to seek out other programs and measures offered in the FirstEnergy efficiency portfolio to a greater extent than the control group. To the extent that the treatment group participates in other FirstEnergy programs at a rate above and beyond that of the comparison group, those incremental savings were reflected in the gross energy savings calculated using the method above. However, savings for these items will also have been attributed to their respective programs and subprograms. Qualus corrected for dual participation that occurred after treatment began to the extent that the treatment group participated at a higher rate than the comparison group.

It is important to note that dual participation with the HER component was controlled prior to the regression analysis by matching HER treatment status and cohort and including a post-treatment term for HER in the regression model.

Adjustment for Downstream Measures

For downstream measures, Qualus conducted a review of the tracking and reporting system for each experimental cohort to identify EE program participation that occurred from the treatment start date onwards. The following steps detail the process of correcting for these measures:

1. For each customer, the tracking and reporting data set was reviewed for any measures installed within one year after the treatment start date.
2. For measures installed prior to PY17, verified savings were used. For measures installed during PY17, reported savings were used due to EM&V for those programs occurring simultaneously with the Online Audits evaluation.
3. For each measure for each customer, the first-year incremental savings were pro-rated based on the measure installation date relative to the treatment start date. I.e., if a measure was installed two months after the treatment start date, savings were only counted for the remaining 10 months.
4. The savings for all measures were then summed by customer.
5. The savings by customer were then summed by treatment/comparison group by Rate District and standard residential/LI.

Adjustment for Upstream Measures

The Phase IV Evaluation Framework recommends adjustment for upstream measures based on years of exposure to upstream lighting programs. Because the Company did not administer an upstream lighting program in Phase IV, an upstream adjustment did not occur.

I.1.1.5 Gross Energy Savings Calculation

The regression model provides a series of regression coefficients for the treatment term and treatment by weather terms. A negative coefficient represents savings that can be attributed to the treatment effect. Multiplying the inverse of the coefficient by the number of days, the number of participants, and for weather-interacted terms, the average daily CDD or HDD, provides the total kWh per component. Summing the savings for three components corresponding to the program year provides the savings attributable to the program year prior to adjusting for dual participation in other programs. Equation 2 demonstrates the algorithm for calculating verified savings for the model prior to correcting for dual participation in other energy efficiency programs.

$$kWh\ savings = n \times \{(\tau_{base} \times days_y) + (\tau_{cdd} \times CDD_y) + (\tau_{hdd} \times HDD_y) - Dual\ Participation/yr\}$$

Equation 5: kWh savings calculation

The variables in the above equation are defined in Table 111 below.

Table 217: Definition of variables for kWh savings calculation

Variable	Definition
τ_{base}	The regression coefficient of the treatment effect that represents savings that are not weather-related.
τ_{cdd}	The estimated treatment effect in kWh per CDD.
τ_{hdd}	The estimated treatment effect in kWh per HDD.
CDD_y	The total annual CDD in year y.
HDD_y	The total annual HDD for customer X.
n	The total number of participants in the program year of interest.
y	The program year of interest

Although a regression was performed across Rate Districts, the regression coefficients were applied to weather variables for each Rate District independently, resulting in Rate District-specific savings values. Additionally, dual participation adjustments were made by Rate District and rate class.

I.1.1.6 Gross Demand Savings Calculation

Because the Online Audits program allows customers to have a floating start date at any point between the beginning and end of the program year, directly measuring gross demand savings is not a feasible task for this program. Therefore, Qualus generated an ETDF using residential load profiles corresponding to the treatment group for the 12-month pre-treatment period.

I.1.2 Results for Energy and Demand

Table 218 below shows the number of participants, reported energy savings, and verified energy savings for each Rate District and cohort. The last two columns of the table show the gross realization rates and relative precisions. The nomenclature in the table includes a prefix to denote the Rate District, a suffix of “-LI” for low-income groups, and a number that identifies

waves of participants sequentially. The verified values below include dual participation adjustments. Table 219 shows the reported and verified demand reductions for the program.

Table 218: Res Online Audit Initiative Energy Gross Realization Rates

Rate District	Experimental Cohort	Participants	PYRTD (MWh)	PYVTD (MWh)	Energy Realization Rate	Relative Precision at 85% CL
Met-Ed	ME-1	4,646	604	959	158.79%	17.11%
Met-Ed	Total for EEH Program	4,646	604	959	158.79%	17.11%
Met-Ed	ME-1-LI	472	61	116	189.25%	49.43%
Met-Ed	Total for LI Program	472	61	116	189.25%	49.43%
Penelec	PN-1	4,214	548	871	159.06%	17.77%
Penelec	Total for EEH Program	4,214	548	871	159.06%	17.77%
Penelec	PN-1-LI	958	125	281	225.46%	43.64%
Penelec	Total for LI Program	958	125	281	225.46%	43.64%
Penn Power	PP-1	1,673	217	365	167.87%	16.41%
Penn Power	Total for EEH Program	1,673	217	365	167.87%	16.41%
Penn Power	PP-1-LI	167	22	44	201.00%	47.42%
Penn Power	Total for LI Program	167	22	44	201.00%	47.42%
WPP	WP-1	5,407	703	1,112	158.13%	17.22%
WPP	Total for EEH Program	5,407	703	1,112	158.13%	17.22%
WPP	WP-1-LI	661	86	170	197.52%	47.48%
WPP	Total for LI Program	661	86	170	197.52%	47.48%

Table 219: Res Online Audit Initiative Demand Gross Realization Rates¹⁹

Rate District	Experimental Cohort	PYRTD MW/yr	PYVTD MW/yr	Demand Realization Rate
Met-Ed	ME-1	0.07	0.17	258.77%
Met-Ed	Total for EEH Program	0.07	0.17	258.77%
Met-Ed	ME-1-LI	0.01	0.02	276.98%
Met-Ed	Total for LI Program	0.01	0.02	276.98%
Penelec	PN-1	0.06	0.14	231.56%
Penelec	Total for EEH Program	0.06	0.14	231.56%
Penelec	PN-1-LI	0.01	0.04	306.40%
Penelec	Total for LI Program	0.01	0.04	306.40%
Penn Power	PP-1	0.02	0.07	278.43%
Penn Power	Total for EEH Program	0.02	0.07	278.43%
Penn Power	PP-1-LI	0.00	0.01	301.86%
Penn Power	Total for LI Program	0.00	0.01	301.86%
WPP	WP-1	0.08	0.19	252.68%
WPP	Total for EEH Program	0.08	0.19	252.68%
WPP	WP-1-LI	0.01	0.03	290.55%
WPP	Total for LI Program	0.01	0.03	290.55%

I.2 NET IMPACT EVALUATION

I.2.1 Net Impact Evaluation Methodology

The net-to-gross ratios are 100% because the gross impact evaluation methodology measures net impacts.

¹⁹ The program implementer did not measure or report demand reductions for Online Audits. Qualus has set the reported demand reduction to 0.013 kW per home (a rate of one kW per 10 MWh) to avoid divide-by-zero errors in reporting calculations.

Appendix J Evaluation Detail – Residential Appliance Recycling Sub-Initiative

J.1 GROSS IMPACT EVALUATION

The Appliance Recycling (ATI, for Appliance Turn-In) Initiative has three sub-initiatives: Appliance Recycling, Low-Income Appliance Recycling and Nonresidential Appliance Recycling.

There are five distinct measures offered by the program: refrigerator recycling, freezer recycling, room air conditioner (RAC) recycling, dehumidifier recycling, and mini refrigerator recycling.

J.1.1 Gross Impact Evaluation Methodology

Qualus' gross impact evaluation methodology was identical for all four Rate Districts. A TRM-based calculation was performed using population averages for parameter values required by the TRM algorithms. The TRM parameter values were taken from project-specific data in the tracking and reporting system when applicable, from TRM defaults, and from customer verification surveys.

For refrigerators and freezers, measure attributes that participants would readily recall were determined from participant surveys, and the average parameter values were applied to all measures. Apart from measure verification, these attributes include the part-use factor, the location in the home where the appliance was used, and for refrigerators, whether the appliance was a primary or secondary unit.

Technical attributes of the appliances, such as the age, capacity, and configuration, as collected by the implementer, were taken from program tracking and reporting data. The TRM default value was used for RAC efficiency. Table 220 lists the data sources for gross impact calculation algorithms.

Table 220: Data Sources for the ATI Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
Refrigerator, Freezer	Appliance Age	Tracking and Reporting System
Refrigerator, Freezer	Pre-1990	Tracking and Reporting System
Refrigerator, Freezer	Appliance Size / Capacity	Tracking and Reporting System
Refrigerator, Freezer	Configuration/Type	Tracking and Reporting System
Refrigerator	Primary Usage	Participant Surveys
Refrigerator, Freezer	Part Use Factor	Participant Surveys
Refrigerator, Freezer	In Unconditioned Space?	Participant Surveys
Refrigerator, Freezer	CDD and HDD	TRM - Zip Code Lookup
RAC	Capacity	Tracking and Reporting System
RAC	EER	TRM Default
RAC	RAC EFLH	TRM - Zip Code Lookup
RAC	CF	TRM - Zip Code Lookup
Dehumidifier	Capacity	Tracking and Reporting System
Dehumidifier	Region (to determine kWh)	TRM - Zip Code Lookup
All Measures	Verification Rate	Participant Surveys

The gross realization rates for energy savings were driven primarily by part-use factors for refrigerators and freezers as determined through verification surveys, and by the unit energy consumptions for refrigerators and freezers, as determined through measure attributes recorded in the tracking and reporting system.

J.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four Rate Districts are shown in Table 221, Table 222, Table 223, and Table 224. The population sizes and sample sizes represent individual appliances rather than individual customers. Survey samples were drawn randomly for each stratum and administered by email and telephone over the course of the program. Sample sizes reflect valid survey responses.

Table 221: ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	2,173	100	Participant Surveys
Freezers	450	38	
RACs	2,164	104	
Dehumidifiers	327	31	
Mini Friges	113	6	
Program Total	5,227	279	

Table 222: ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	1,862	115	Participant Surveys
Freezers	361	39	
RACs	1,718	115	
Dehumidifiers	306	31	
Mini Friges	80	8	
Program Total	4,327	308	

Table 223: ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	0	0	Participant Surveys
Freezers	0	0	
RACs	0	0	
Dehumidifiers	0	0	
Mini Friges	0	0	
Program Total	0	0	

Table 224: ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	2,101	102	Participant Surveys
Freezers	439	52	
RACs	1,454	109	
Dehumidifiers	261	41	
Mini Friges	111	10	
Program Total	4,366	314	

J.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 225, Table 226, Table 227, and Table 228 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 225: ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	1,989	102.0%	0.5	7.0%
Freezers	266	117.6%	0.5	11.2%
RACs	275	105.3%	0.5	6.9%
Dehumidifiers	187	143.9%	0.5	12.3%
Mini Friges	28	117.7%	0.5	28.6%
Program Total	2,745	106.8%		5.2%

Table 226: ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	1,713	92.3%	0.5	6.5%
Freezers	234	85.2%	0.5	10.9%
RACs	172	134.1%	0.5	6.5%
Dehumidifiers	160	134.8%	0.5	12.3%
Mini Friges	20	117.7%	0.5	24.1%
Program Total	2,299	97.9%		4.9%

Table 227: ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0	100.0%	0.5	0.0%
Freezers	0	100.0%	0.5	0.0%
RACs	0	100.0%	0.5	0.0%
Dehumidifiers	0	100.0%	0.5	0.0%
Mini Friges	0	100.0%	0.5	0.0%
Program Total	0	100.0%		0.0%

Table 228: ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	1,948	88.5%	0.5	7.0%
Freezers	281	97.3%	0.5	9.4%
RACs	163	130.8%	0.5	6.6%
Dehumidifiers	136	143.8%	0.5	10.3%
Mini Friges	27	117.7%	0.5	21.7%
Program Total	2,554	95.4%		5.1%

J.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 229, Table 230, Table 231, and Table 232 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 229: ATI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.35	101.9%	0.5	7.0%
Freezers	0.05	117.6%	0.5	11.2%
RACs	0.56	107.8%	0.5	6.9%
Dehumidifiers	0.04	146.2%	0.5	12.3%
Mini Friges	0.00	169.8%	0.5	28.6%
Program Total	1.00	108.0%		4.6%

Table 230: ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.30	92.3%	0.5	6.5%
Freezers	0.04	85.3%	0.5	10.9%
RACs	0.43	126.1%	0.5	6.5%
Dehumidifiers	0.04	137.9%	0.5	12.3%
Mini Friges	0.00	169.8%	0.5	24.1%
Program Total	0.82	112.2%		4.4%

Table 231: ATI Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.00	100.0%	0.5	0.0%
Freezers	0.00	100.0%	0.5	0.0%
RACs	0.00	100.0%	0.5	0.0%
Dehumidifiers	0.00	100.0%	0.5	0.0%
Mini Friges	0.00	100.0%	0.5	0.0%
Program Total	0.00	100.0%		0.0%

Table 232: ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.34	88.5%	0.5	7.0%
Freezers	0.05	97.2%	0.5	9.4%
RACs	0.39	129.6%	0.5	6.6%
Dehumidifiers	0.03	144.1%	0.5	10.3%
Mini Friges	0.00	169.8%	0.5	21.7%
Program Total	0.83	111.3%		4.4%

Note that the overall precision for the ATI initiative is the combined precision of the low income, non-low-income, and nonresidential components. The combined precisions for each Rate District are shown in Table 233 below.

Table 233: ATI Initiative Sampling Precisions

Rate District	Relative Precision at 85% C.L., Energy	Relative Precision at 85% C.L., Demand
Met-Ed	6.9%	6.3%
Penelec	6.6%	6.1%
Penn Power	0.0%	0.0%
West Penn Power	6.9%	6.2%

J.2 NET IMPACT EVALUATION

J.2.1 Net Impact Evaluation Methodology

The Qualus team conducted net impact evaluation for the Appliance Recycling initiative in PY13. The net-to-gross evaluation for the Appliance Recycling program followed the participant self-report methodology outlined in the PA Evaluation Framework. Net-to-gross was estimated for the program for each Rate District.

The participant self-report methodology was implemented following the common approach outlined in Appendix B of the Phase IV evaluation framework. Tetra Tech added a question to identify customers who would have kept the recycled unit at least a year longer, since program results represent first-year annual savings. This clarifies that customers who respond they would have removed the unit, but at some point in the future, are really more appropriately characterized as keeping the unit for at least the program year in question. Individual free-ridership rates from the participant survey were weighted to adjust for sampling differences, non-response, and claimed energy savings to calculate overall estimates.

The Appliance Recycling program is not designed to promote spillover since it does not push customers to implement energy efficiency projects outside of FirstEnergy's programs. Because the participant survey is already lengthy, containing both gross and net impact questions, the evaluation team did not collect spillover information from customers. Moreover, because the Company offers incentives for efficient new refrigerators and freezers, it is possible that the most likely spillover may overlap with gross impacts for the Efficient Products program and lead to undesired double-counting of net impacts.

J.2.2 Sampling

The sample designs from study for the four Rate Districts are shown in Table 234, Table 235, Table 236, and Table 237 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 234: ATI Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	3,464	100	379	20.3%
Program Total	3,464	100	379	20.3%

Table 235: ATI Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	2,320	100	288	21.8%
Program Total	2,320	100	288	21.8%

Table 236: ATI Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	751	100	115	22.2%
Program Total	751	100	115	22.2%

Table 237: ATI Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Target Sample Size	Achieved Sample Size	Response Rate
All	2,656	100	354	22.7%
Program Total	2,656	100	354	22.7%

J.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 238, Table 239, Table 240, and Table 241 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 238: ATI Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	2,932	38.0%	0.0%	62.0%	7.4%
Program Total	2,932	38.0%	0.0%	62.0%	7.4%

Table 239: ATI Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	2,250	40.0%	0.0%	60.0%	8.5%
Program Total	2,250	40.0%	0.0%	60.0%	8.5%

Table 240: ATI Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	0	39.0%	0.0%	61.0%	13.4%
Program Total	0	39.0%	0.0%	61.0%	13.4%

Table 241: ATI Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	2,437	34.0%	0.0%	66.0%	7.7%
Program Total	2,437	34.0%	0.0%	66.0%	7.7%

Appendix K Evaluation Detail – Residential Upstream Electronics Initiative

The Company did not offer this program component in PY17.

Appendix L Evaluation Detail – Residential HVAC Initiative

The Residential HVAC initiative provides rebates to customers who purchase high efficiency HVAC equipment, Tune-Up an existing HVAC system, or install a new smart thermostat, bathroom fan, or circulating pump.

Participants are defined as each separate measure rebated. Thus, the rebate application, rather than the customer, is the sampling unit for gross impact evaluation.

L.1 GROSS IMPACT EVALUATION

L.1.1 Gross Impact Evaluation Methodology

Each component of gross impact evaluation is described below. The gross impact evaluation included customer surveys for verification purposes, coupled with documentation reviews to support detailed TRM calculations for sampled projects. The desk review process is described below.

Table 242 lists the data sources for gross impact calculation algorithms.

Table 242: Data Sources for the Res HVAC Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
All HVAC Equipment	AHRI or Model # (to get other TRM parameters)	Invoice Inspections and Tracking Data
All HVAC Equipment	Heating Capacity	AHRI database reference
All HVAC Equipment	Cooling Capacity	AHRI database reference
HVAC Maintenance	Heating Capacity	Invoice Inspections
HVAC Maintenance	Cooling Capacity	Invoice Inspections
All	SEER/EER/HSPF/COP	AHRI database reference
Minisplits	EFLH	ZIP lookup and survey for room type
Minisplits	Baseline Type	Customer Surveys
Bathroom Fans	HOU and CF	IMP defaults
Smart Thermostats	Install Type	Application Review
Smart Thermostats	Thermostat Type	Application Review
Smart Thermostats	Heating System Type	Application Review
Smart Thermostats	Cooling System Type	Application Review
Smart Thermostats	Baseline Thermostat Type	Application Review

L.1.1.1 Determination of Verification Rate

Qualus conducted verification surveys on a random sample of customers selected from the tracking and reporting data. All contacted customers verified that they have purchased and installed the stated HVAC measures. The verification rates are used to inform measure-level realization rates.

L.1.1.2 Invoice and Application Review

Qualus obtained invoices and applications from Franklin Energy Services. For each application, Qualus verified that the manufacturer name and model number in the tracking and reporting system matches those on the invoice and rebate application. In general, all sampled measures

were matched to qualifying product lists. Qualus independently retrieved the attributes necessary for TRM and IMP calculations from various supporting databases which were compiled for this purpose. These include the AHRI database and manufacturer websites.

L.1.1.3 Calculation Review using TRM algorithm and parameters

For HVAC measures with partially deemed TRM (or IMP) protocols, the T&R system reported impacts with one savings scenario rather than with specific scenarios that occur in measure implementation. For example, values from planning assumptions for capacity and efficiency are used rather than HVAC system-specific values. In general, the per-unit savings reported by the ICSP are rather conservative (the assumed average efficiency levels or capacities are lower than actual average values). For all reviewed records, Qualus used project-specific attributes to calculate “On-TRM” impacts.

The average per-unit gross verified impact for a given measure is the product of the measure-specific verification rate as determined from customer surveys, and the average calculated impacts as described above.

The following provide additional details into the calculation review procedure:

CACs and ASHPs

Central HVAC systems were looked up on the AHRI database to determine individual measure attributes for use in the TRM algorithms. These attributes include heating and cooling capacities, and seasonal efficiency ratios (SEER2 and HSPF2). EFLHs and CFs were taken from the TRM based on the reported zip code or zip code obtained through participant surveys if the reported zip code was overridden by the respondent. Baseline efficiencies were taken as TRM defaults aligned with the installation scenarios included in the tracking system.

GSHPs

Ground-source heat pump make and model numbers, or AHRI certificate numbers, are cross-referenced on the AHRI database to determine equipment parameters for use in the TRM algorithm. EFLHs and CFs were determined through zip code lookups as provided in the T&R data or with zip codes from survey data if overridden by respondents. Other TRM default values used include GSHPDF, GSER, GSOP, and GSPK. Baseline efficiencies were taken as TRM defaults for a replace on burnout scenario with an ASHP as the baseline system.

For GSHP units larger than 65 kBtuh, the commercial algorithm in section 3.2.3 of the TRM was used to calculate impacts. Here the baseline efficiencies were taken from TRM table 3-38. In these cases, the replace on burnout scenario assumes kWh_{pump} and kW_{pump} for the baseline ASHP are zero.

Mini-Splits

Ductless mini-splits (ACs and heat pumps) were also looked up on AHRI similar to the other HVAC system types, and CFs were determined with zip code lookups, but several additional steps were taken to determine gross impacts. EFLHs were determined through the TRM classification of “primary zone” or “secondary zone”. Participant survey responses were used to determine the TRM classification based on which room the systems were installed in as rebate

applications do not include this information. The baseline system type was determined from participant surveys. Several response fields were considered to determine the baseline including whether the mini-split installation supplemented an existing HVAC system. In cases where there was no existing heating or cooling, or the respondent did not know what type of existing system they had, the baseline was taken to be an ASHP. Baseline efficiencies were taken from TRM tables 2-8 and 2-12 according to the type of baseline system.

Thermostats

Smart thermostats were evaluated according to the protocol in section 2.2.11 of the 2021 PA TRM. Qualus evaluators reviewed invoices and application materials to determine the heating and cooling system types, the installation scenario described in the TRM, and baseline thermostats.

Furnace Fans

High-efficiency furnace fan energy savings relied on the deemed values in the TRM. EFLHs and CFs were taken from the TRM based on the reported zip code or zip code obtained through participant surveys if the reported zip code was overridden by the respondent. Qualus used the results of participant surveys to determine the verification rate and the fraction with central cooling. For homes without central cooling, the kWh_{cool} term in the TRM algorithm was taken to be zero.

HVAC Maintenance

Default TRM parameters were used for HVAC Tune-Up calculations. Heating and cooling capacities were determined from the rebate application for sampled units. For tune-ups performed on AC units, the kWh_{heat} term in the TRM algorithm was taken to be zero.

Bathroom Fans

Qualus used the IMP for bathroom fans with hours of use and CF for intermittent operation. Fan flow rates and efficacies were obtained from ENERGY STAR® based on reported model numbers.

Circulation Pumps

Qualus used TRM Section 3.3.5 to calculate impacts for ECM circulation pumps, but with residential heating EFLH.

PTACs and PTHPs

There were no PTACs or PTHPs reported.

L.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four Rate Districts are shown in Table 243, Table 244, Table 245, and Table 246.

Table 243: Res HVAC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	339	19	8
ASHP	267	20	19
Smart Thermostat	299	3	18
GSHP	41	1	3
CAC	406	42	22
Furnace Fan	349	26	19
Tune-Up	41	3	7
Circulating Pump	3	0	0
Bathroom Fan	27	1	3
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	1,772	115	99

Table 244: Res HVAC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	523	38	107
ASHP	71	6	6
Smart Thermostat	93	0	13
GSHP	7	1	1
CAC	55	5	8
Furnace Fan	174	11	20
Tune-Up	88	10	10
Circulating Pump	0	0	0
Bathroom Fan	36	3	3
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	1,047	74	168

Table 245: Res HVAC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	34	8	6
ASHP	51	3	12
Smart Thermostat	65	0	15
GSHP	1	0	0
CAC	62	7	12
Furnace Fan	208	7	27
Tune-Up	37	3	7
Circulating Pump	0	0	0
Bathroom Fan	8	1	4
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	466	29	83

Table 246: Res HVAC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Minisplit	424	19	121
ASHP	296	20	19
Smart Thermostat	177	1	19
GSHP	32	0	4
CAC	161	21	10
Furnace Fan	701	37	20
Tune-Up	729	58	23
Circulating Pump	6	0	0
Bathroom Fan	242	1	18
ASHP wDHW	0	0	0
Quality Install	0	0	0
PTAC	0	0	0
PTHP	0	0	0
Program Total	2,768	157	234

L.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 247, Table 248, Table 249, and Table 250 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 247: Res HVAC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	373	155.1%	0.5	25.2%
ASHP	293	102.1%	0.5	15.9%
Smart Thermostat	180	115.3%	0.5	16.5%
GSHP	81	78.5%	0.5	40.0%
CAC	143	89.3%	0.5	14.9%
Furnace Fan	67	97.8%	0.5	16.1%
Tune-Up	5	117.8%	0.5	24.8%
Circulating Pump	1	100.0%	0.5	100.0%
Bathroom Fan	1	72.3%	0.5	39.2%
ASHP wDHW	0	100.0%	0.5	100.0%
Quality Install	0	100.0%	0.5	100.0%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	1,143	118.0%		11.9%

Table 248: Res HVAC Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	739	104.0%	0.5	6.2%
ASHP	92	116.1%	0.5	28.1%
Smart Thermostat	51	71.9%	0.5	18.5%
GSHP	14	171.3%	0.5	66.7%
CAC	15	90.3%	0.5	23.5%
Furnace Fan	31	89.8%	0.5	15.1%
Tune-Up	9	114.0%	0.5	21.4%
Circulating Pump	0	100.0%	0.5	100.0%
Bathroom Fan	1	50.8%	0.5	39.8%
ASHP wDHW	0	100.0%	0.5	100.0%
Quality Install	0	100.0%	0.5	100.0%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	953	103.8%		6.0%

Table 249: Res HVAC Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	35	276.8%	0.5	26.7%
ASHP	42	107.6%	0.5	18.2%
Smart Thermostat	42	87.6%	0.5	16.3%
GSHP	2	100.0%	0.5	100.0%
CAC	20	90.2%	0.5	18.7%
Furnace Fan	37	95.6%	0.5	12.9%
Tune-Up	3	112.7%	0.5	24.5%
Circulating Pump	0	100.0%	0.5	100.0%
Bathroom Fan	0	99.5%	0.5	25.5%
ASHP wDHW	0	100.0%	0.5	100.0%
Quality Install	0	100.0%	0.5	100.0%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	182	130.8%		11.9%

Table 250: Res HVAC Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	638	102.3%	0.5	5.5%
ASHP	343	107.6%	0.5	16.0%
Smart Thermostat	105	97.5%	0.5	15.6%
GSHP	64	150.8%	0.5	33.7%
CAC	43	90.3%	0.5	22.0%
Furnace Fan	130	93.1%	0.5	15.9%
Tune-Up	74	101.4%	0.5	14.8%
Circulating Pump	1	100.0%	0.5	100.0%
Bathroom Fan	6	133.8%	0.5	16.3%
ASHP wDHW	0	100.0%	0.5	100.0%
Quality Install	0	100.0%	0.5	100.0%
PTAC	0	100.0%	0.5	100.0%
PTHP	0	100.0%	0.5	100.0%
Program Total	1,404	104.3%		5.6%

L.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 251, Table 252, Table 253, and Table 254 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 251: Res HVAC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.03	272.7%	0.5	25.2%
ASHP	0.02	116.7%	0.5	15.9%
Smart Thermostat	0.02	99.7%	0.5	16.5%
GSHP	0.02	74.8%	0.5	40.0%
CAC	0.07	104.6%	0.5	14.9%
Furnace Fan	0.02	100.2%	0.5	16.1%
Tune-Up	0.00	113.6%	0.5	24.8%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	69.7%	0.5	39.2%
ASHP wDHW	0.00	100.0%	0.5	100.0%
Quality Install	0.00	100.0%	0.5	100.0%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	100.0%
Program Total	0.18	129.1%		10.5%

Table 252: Res HVAC Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.05	109.6%	0.5	6.2%
ASHP	0.00	97.8%	0.5	28.1%
Smart Thermostat	0.01	98.4%	0.5	18.5%
GSHP	0.00	178.1%	0.5	66.7%
CAC	0.01	105.1%	0.5	23.5%
Furnace Fan	0.01	80.7%	0.5	15.1%
Tune-Up	0.00	121.7%	0.5	21.4%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	56.0%	0.5	39.8%
ASHP wDHW	0.00	100.0%	0.5	100.0%
Quality Install	0.00	100.0%	0.5	100.0%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	100.0%
Program Total	0.08	108.3%		6.2%

Table 253: Res HVAC Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.00	612.5%	0.5	26.7%
ASHP	0.00	103.6%	0.5	18.2%
Smart Thermostat	0.00	98.5%	0.5	16.3%
GSHP	0.00	100.0%	0.5	100.0%
CAC	0.01	105.2%	0.5	18.7%
Furnace Fan	0.01	97.3%	0.5	12.9%
Tune-Up	0.00	103.4%	0.5	24.5%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	100.3%	0.5	25.5%
ASHP wDHW	0.00	100.0%	0.5	100.0%
Quality Install	0.00	100.0%	0.5	100.0%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	100.0%
Program Total	0.03	139.8%		10.4%

Table 254: Res HVAC Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Minisplit	0.05	101.8%	0.5	5.5%
ASHP	0.02	108.7%	0.5	16.0%
Smart Thermostat	0.01	99.1%	0.5	15.6%
GSHP	0.02	143.4%	0.5	33.7%
CAC	0.02	105.3%	0.5	22.0%
Furnace Fan	0.03	99.6%	0.5	15.9%
Tune-Up	0.04	99.5%	0.5	14.8%
Circulating Pump	0.00	100.0%	0.5	100.0%
Bathroom Fan	0.00	158.7%	0.5	16.3%
ASHP wDHW	0.00	100.0%	0.5	100.0%
Quality Install	0.00	100.0%	0.5	100.0%
PTAC	0.00	100.0%	0.5	100.0%
PTHP	0.00	100.0%	0.5	100.0%
Program Total	0.20	105.3%		6.4%

L.2 NET IMPACT EVALUATION

L.2.1 Net Impact Evaluation Methodology

Tetra Tech performed the NTG analysis in PY15 using the approach defined in the Pennsylvania Act 129 Phase IV Statewide Evaluation Framework, which is built around a customer self-report survey. The participant survey included a series of free-ridership and spillover questions that asked program participants about the actions they would have taken if the program had not been offered. This section breaks down the survey results into discussions of free-ridership, spillover, and the overall NTG results.

L.2.2 Sampling

Tetra Tech sampled randomly from all participants on record in the Company's tracking and reporting systems between Q4 of PY14 and Q2 of PY15. The sample designs for the four Rate Districts are shown in Table 255, Table 256, Table 257, and Table 258 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 255: Res HVAC Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,952	65	21.7%
Program Total	2,952	65	21.7%

Table 256: Res HVAC Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,155	73	26.1%
Program Total	2,155	73	26.1%

Table 257: Res HVAC Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,935	71	25.1%
Program Total	1,935	71	25.1%

Table 258: Res HVAC Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	4,320	73	24.3%
Program Total	4,320	73	24.3%

L.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 259, Table 260, Table 261, and Table 262 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 259: Res HVAC Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	1,349	50.0%	0.6%	50.6%	13.4%
Program Total	1,349	50.0%	0.6%	50.6%	13.4%

Table 260: Res HVAC Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	989	45.2%	14.9%	69.7%	12.6%
Program Total	989	45.2%	14.9%	69.7%	12.6%

Table 261: Res HVAC Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	238	47.4%	2.1%	54.7%	12.6%
Program Total	238	47.4%	2.1%	54.7%	12.6%

Table 262: Res HVAC Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	1,464	48.8%	3.6%	54.8%	12.6%
Program Total	1,464	48.8%	3.6%	54.8%	12.6%

Appendix M Evaluation Detail – Residential Appliances and LI Residential Appliances Initiative

Residential Appliances and LI Appliances are combined into a single initiative in Qualus' PY17 evaluation plan. While the program process is the same between the two, the measures and rebate levels differ. Incentives for the low-income component are increased by \$25 per appliance, while there are no specific income-qualified incentives for heat-pump and solar water heaters, variable speed pool-pumps or ceiling fans.

Participants are defined as each separate appliance rebated. Thus, the rebate application, rather than the customer, is the sampling unit for gross impact evaluation.

M.1 GROSS IMPACT EVALUATION

M.1.1 Gross Impact Evaluation Methodology

Each component of gross impact is described below.

M.1.1.1 Verification Surveys

Qualus performed telephone and online surveys on a random sample of customers selected from the tracking and reporting data. All contacted customers verified that they have purchased and installed the stated appliances. The verification rates are used to inform measure-level realization rates.

M.1.1.2 Invoice and Application Review

Qualus obtained invoices and applications from the ICSP, Franklin Energy Services. For each application, Qualus verified that the manufacturer name and model number in the tracking and reporting system matches those on the invoice and rebate application. In general, all sampled appliances were matched to the qualifying ENERGY STAR® product lists. Qualus independently retrieved the attributes necessary for TRM calculations from the ENERGY STAR® database. In certain cases, the make or model numbers were entered in with minor typographic errors or with missing or inserted dashes, spaces, or other delimiting characters. In such cases, manual correction of the make or model numbers results in positive identification of the involved equipment in the supporting databases.

M.1.1.3 Saving Calculations with TRM Algorithms and Parameters

For measures with partially deemed TRM (or IMP) protocols, the T&R system reported impacts with one savings scenario rather than with specific scenarios that occur in measure implementation. For example, values from planning assumptions for capacity and efficiency are used rather than rebate-specific values. For all reviewed records, Qualus used project-specific attributes to calculate "On-TRM" impacts.

The average per-unit gross verified impact for a given measure is the product of the measure-specific verification rate (as determined from customer surveys or retailer invoice details) and the average calculated impacts as described above.

There were no ceiling fans reported in PY17.

Table 263 lists the data sources for gross impact calculation algorithms.

Table 263: Data Sources for the Res Appliances Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
All Measures	Verification Rate	Participant Surveys
All Measures	Capacity	Energy Star Database - Model Lookup
All Measures	ETDF	TRM Default
Clothes Washer	Configuration	Energy Star Database
Clothes Washer	IMEF_base	Federal Standard - Configuration Lookup
Clothes Washer	Cycles per year	TRM Default
Clothes Washer	CW_base / CW_ee	TRM Default
Clothes Washer	DHW_base / DHW_ee	TRM Default
Clothes Washer	%ElectricDHW	Participant Surveys
Clothes Washer	Dryer_base / Dryer_ee	TRM Default
Clothes Washer	%ElectricDryer	Participant Surveys
Clothes Washer	%dry/wash	TRM Default
Clothes Washer	time per cycle / CF	TRM Default
Clothes Dryer	Fuel / Configuration	Energy Star Database
Clothes Dryer	CEF_base	Federal Standard - Configuration Lookup
Clothes Dryer	Wash Cycles per year	TRM Default
Clothes Dryer	%dry/wash	TRM Default
Clothes Dryer	Load_avg	TRM - Configuration Lookup
Clothes Dryer	time per cycle /CF	TRM Default
Refrigerator/Freezer	Product Class	Energy Star Database
Refrigerator/Freezer	Adjusted Volume	Energy Star Database
Dehumidifier	HOU / CF	TRM Default
Dehumidifier	L/kWh_base / L/kWh_ee	TRM - Capacity Lookup
Air Purifier	Annual Consumption	TRM Default
Air Purifier	HOU / CF	TRM Default
Dishwasher	Annual Consumption	TRM Default
Dishwasher	Water Heater Fuel	Application / TRM Default
Pool Pump	HOU / Volume	TRM Default
Pool Pump	Energy Factor	Energy Star Database
Room Air Conditioner	HOU / CF	TRM - Zip Code Lookup
HPWH	EF_ee	Energy Star Database
HPWH	F_derate	TRM Default
Smart Thermostat	EFLH Heat/Cool	Customer Zip Code
Smart Thermostat	Previous Thermostat	Application / Participant Surveys
Smart Thermostat	HVAC Equipment Type	Application / Participant Surveys

The gross realization rates for energy savings were driven primarily by differences between project-specific TRM calculations for sampled projects and the reported energy savings in the tracking and reporting system. Verification rates were not a major driver of realization rates for

most measures, but the evaluation team noted lower in-service rates for smart thermostats and advanced power strips rebated through the Online Marketplace program component. Although causality cannot be definitively established, the evaluation team observed that higher incentive levels were associated with increased participation but lower in-service rates for these measures. The lower in-service rates may reflect participants purchasing products before they are prepared to install them.

M.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four Rate Districts are shown in Table 264, Table 265, Table 266, and Table 267.

Table 264: Res Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	36	3	4
Ceiling Fan	0	0	0
Clothes Dryer	289	21	21
Clothes Washer	403	15	30
Dehumidifier	134	15	9
Dishwasher	353	17	18
Freezer	52	4	3
Heat Pump Water Heater	124	9	7
Mini Refrigerator	0	0	0
Advanced Power Strip	0	0	0
Refrigerator	624	44	24
Room Air Conditioner	68	5	13
Smart Thermostat	314	16	23
Low-Income Total	114	12	22
Non Low-Income Total	2,283	137	130
Program Total	2,397	149	152

Table 265: Res Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	16	2	2
Ceiling Fan	0	0	0
Clothes Dryer	198	8	74
Clothes Washer	337	13	108
Dehumidifier	103	13	4
Dishwasher	400	19	126
Freezer	68	3	20
Heat Pump Water Heater	25	1	3
Mini Refrigerator	0	0	0
Advanced Power Strip	6,913	136	0
Refrigerator	712	38	213
Room Air Conditioner	45	3	6
Smart Thermostat	7,578	145	9
Low-Income Total	127	13	16
Non Low-Income Total	16,268	368	549
Program Total	16,395	381	565

Table 266: Res Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	23	0	4
Ceiling Fan	0	0	0
Clothes Dryer	69	5	13
Clothes Washer	117	7	20
Dehumidifier	32	3	4
Dishwasher	137	5	22
Freezer	12	2	0
Heat Pump Water Heater	13	2	3
Mini Refrigerator	0	0	0
Advanced Power Strip	0	0	0
Refrigerator	215	14	17
Room Air Conditioner	5	0	2
Smart Thermostat	118	8	19
Low-Income Total	0	0	0
Non Low-Income Total	741	46	104
Program Total	741	46	104

Table 267: Res Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Air Purifier	17	3	2
Ceiling Fan	0	0	0
Clothes Dryer	399	13	13
Clothes Washer	595	19	19
Dehumidifier	149	17	7
Dishwasher	567	27	14
Freezer	57	5	4
Heat Pump Water Heater	95	8	8
Mini Refrigerator	0	0	0
Advanced Power Strip	8,036	230	0
Refrigerator	911	58	22
Room Air Conditioner	40	5	3
Smart Thermostat	8,828	243	9
Low-Income Total	137	15	14
Non Low-Income Total	19,557	613	87
Program Total	19,694	628	101

M.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 268, Table 269, Table 270, and Table 271 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 268: Res Appliances Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	5	243.7%	0.5	33.9%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	8	158.2%	0.5	15.1%
Clothes Washer	63	113.2%	0.5	12.6%
Dehumidifier	16	98.2%	0.5	17.5%
Dishwasher	17	100.0%	0.5	16.5%
Freezer	2	148.5%	0.5	34.6%
Heat Pump Water Heater	174	115.6%	0.5	23.1%
Mini Refrigerator	0	0.0%	0.5	100.0%
Advanced Power Strip	0	0.0%	0.5	100.0%
Refrigerator	36	104.9%	0.5	10.5%
Room Air Conditioner	4	100.0%	0.5	18.0%
Smart Thermostat	119	72.0%	0.5	14.5%
Low-Income Total	12	103.7%		10.7%
Non Low-Income Total	433	103.7%		10.7%
Program Total	445	103.7%		10.7%

Table 269: Res Appliances Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	2	226.8%	0.5	47.6%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	5	195.0%	0.5	6.6%
Clothes Washer	50	107.7%	0.5	5.7%
Dehumidifier	12	117.3%	0.5	18.7%
Dishwasher	17	108.3%	0.5	5.3%
Freezer	2	152.9%	0.5	13.5%
Heat Pump Water Heater	36	113.1%	0.5	39.0%
Mini Refrigerator	0	0.0%	0.5	100.0%
Advanced Power Strip	614	67.3%	0.5	6.1%
Refrigerator	40	96.6%	0.5	4.1%
Room Air Conditioner	2	100.0%	0.5	27.4%
Smart Thermostat	2,027	59.7%	0.5	5.9%
Low-Income Total	11	64.5%		4.3%
Non Low-Income Total	2,796	64.5%		4.3%
Program Total	2,807	64.5%		4.3%

Table 270: Res Appliances Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	2	202.7%	0.5	32.7%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	2	182.9%	0.5	18.0%
Clothes Washer	18	105.3%	0.5	14.7%
Dehumidifier	4	106.7%	0.5	33.7%
Dishwasher	6	100.0%	0.5	14.1%
Freezer	0	100.0%	0.5	46.5%
Heat Pump Water Heater	14	112.6%	0.5	36.5%
Mini Refrigerator	0	0.0%	0.5	100.0%
Advanced Power Strip	0	0.0%	0.5	100.0%
Refrigerator	12	99.4%	0.5	16.8%
Room Air Conditioner	0	100.0%	0.5	39.4%
Smart Thermostat	43	73.9%	0.5	15.1%
Low-Income Total	0	95.8%		8.8%
Non Low-Income Total	103	95.8%		8.8%
Program Total	103	95.8%		8.8%

Table 271: Res Appliances Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	2	264.2%	0.5	37.7%
Ceiling Fan	0	0.0%	0.5	100.0%
Clothes Dryer	11	107.4%	0.5	19.6%
Clothes Washer	94	120.1%	0.5	16.3%
Dehumidifier	18	109.6%	0.5	16.4%
Dishwasher	29	100.0%	0.5	13.5%
Freezer	2	150.0%	0.5	30.8%
Heat Pump Water Heater	116	114.5%	0.5	24.4%
Mini Refrigerator	0	0.0%	0.5	100.0%
Advanced Power Strip	714	75.2%	0.5	4.7%
Refrigerator	49	101.8%	0.5	9.1%
Room Air Conditioner	2	100.0%	0.5	30.1%
Smart Thermostat	2,860	38.9%	0.3	2.7%
Low-Income Total	13	51.7%		2.7%
Non Low-Income Total	3,884	51.7%		2.7%
Program Total	3,897	51.7%		2.7%

M.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 272, Table 273, Table 274, and Table 275 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 272: Res Appliances Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	0.00	244.1%	0.5	33.9%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	160.3%	0.5	15.1%
Clothes Washer	0.01	113.2%	0.5	12.6%
Dehumidifier	0.00	98.0%	0.5	17.5%
Dishwasher	0.00	100.0%	0.5	16.5%
Freezer	0.00	149.3%	0.5	34.6%
Heat Pump Water Heater	0.02	115.6%	0.5	23.1%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Advanced Power Strip	0.00	0.0%	0.5	100.0%
Refrigerator	0.01	104.9%	0.5	10.5%
Room Air Conditioner	0.01	100.0%	0.5	18.0%
Smart Thermostat	0.01	88.7%	0.5	14.5%
Low-Income Total	0.00	106.4%		7.8%
Non Low-Income Total	0.06	106.4%		7.8%
Program Total	0.06	106.4%		7.8%

Table 273: Res Appliances Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	0.00	227.2%	0.5	47.6%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	197.4%	0.5	6.6%
Clothes Washer	0.01	107.7%	0.5	5.7%
Dehumidifier	0.00	116.9%	0.5	18.7%
Dishwasher	0.00	108.3%	0.5	5.3%
Freezer	0.00	153.8%	0.5	13.5%
Heat Pump Water Heater	0.00	113.1%	0.5	39.0%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Advanced Power Strip	0.07	61.0%	0.5	6.1%
Refrigerator	0.01	96.6%	0.5	4.1%
Room Air Conditioner	0.00	100.0%	0.5	27.4%
Smart Thermostat	0.18	50.0%	0.5	5.9%
Low-Income Total	0.00	58.7%		3.9%
Non Low-Income Total	0.27	58.7%		3.9%
Program Total	0.27	58.7%		3.9%

Table 274: Res Appliances Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	0.00	203.0%	0.5	32.7%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	163.4%	0.5	18.0%
Clothes Washer	0.00	105.3%	0.5	14.7%
Dehumidifier	0.00	106.6%	0.5	33.7%
Dishwasher	0.00	100.0%	0.5	14.1%
Freezer	0.00	100.0%	0.5	46.5%
Heat Pump Water Heater	0.00	112.6%	0.5	36.5%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Advanced Power Strip	0.00	0.0%	0.5	100.0%
Refrigerator	0.00	99.4%	0.5	16.8%
Room Air Conditioner	0.00	100.0%	0.5	39.4%
Smart Thermostat	0.01	63.7%	0.5	15.1%
Low-Income Total	0.00	91.3%		7.9%
Non Low-Income Total	0.01	91.3%		7.9%
Program Total	0.01	91.3%		7.9%

Table 275: Res Appliances Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Air Purifier	0.00	264.8%	0.5	37.7%
Ceiling Fan	0.00	0.0%	0.5	100.0%
Clothes Dryer	0.00	108.7%	0.5	19.6%
Clothes Washer	0.01	120.1%	0.5	16.3%
Dehumidifier	0.00	109.5%	0.5	16.4%
Dishwasher	0.00	100.0%	0.5	13.5%
Freezer	0.00	150.9%	0.5	30.8%
Heat Pump Water Heater	0.01	114.5%	0.5	24.4%
Mini Refrigerator	0.00	0.0%	0.5	100.0%
Advanced Power Strip	0.08	68.0%	0.5	4.7%
Refrigerator	0.01	101.8%	0.5	9.1%
Room Air Conditioner	0.00	100.0%	0.5	30.1%
Smart Thermostat	0.34	40.4%	0.5	4.6%
Low-Income Total	0.00	51.9%		3.3%
Non Low-Income Total	0.47	51.9%		3.3%
Program Total	0.47	51.9%		3.3%

M.2 NET IMPACT EVALUATION

M.2.1 Net Impact Evaluation Methodology

Tetra Tech conducted net impact evaluation for this initiative in PY14. The net-to-gross evaluation for the downstream Appliances measures was based on self-report data from program participants. This followed the self-report methodologies for free-ridership and spillover from the PA Evaluation Framework. Participants were randomly sampled since the savings for these sub-programs are relatively small and do not qualify for the higher level of rigor of high-impact measures. Individual free-ridership and spillover rates from the participant survey were weighted to adjust for sampling differences, non-response, and claimed energy savings to calculate overall estimates.

Overall NTG ratios were comparable to those found in the Phase III evaluation. An NTG ratio of 100% is used for reporting net impacts and for cost effectiveness testing for the Low-Income Appliances Initiative.

M.2.2 Sampling

Tetra Tech sampled randomly from all PY14 participants on record at the time of the survey launch (Q3 of PY14) in the Company's tracking and reporting systems. The sample designs for the four Rate Districts are shown in Table 276, Table 277, Table 278, and Table 279 for Met-Ed, Penelec, Penn Power, and WPP. The achieved sample sizes and response rates in the table below are from the PY14 net impact evaluation effort.

Table 276: Res Appliances Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,752	69	25.0%
Program Total	2,752	69	25.0%

Table 277: Res Appliances Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,709	71	25.5%
Program Total	1,709	71	25.5%

Table 278: Res Appliances Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	899	74	26.4%
Program Total	899	74	26.4%

Table 279: Res Appliances Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,970	72	25.7%
Program Total	2,970	72	25.7%

M.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 280, Table 281, Table 282, and Table 283 for Met-Ed, Penelec, Penn Power, and WPP. The spillover percentages for PY15 and later are higher than the spillover percentages initially reported in PY14 due to the discovery and correction of a calculation error in the PY14 spillover analysis. As averaged for the four Rate Districts, the spillover is now 5.3% instead of 2.7%.

Table 280: Res Appliances Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	449	42.4%	10.3%	67.9%	13.0%
Program Total	449	42.4%	10.3%	67.9%	13.0%

Table 281: Res Appliances Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	1,803	52.2%	1.5%	49.4%	12.8%
Program Total	1,803	52.2%	1.5%	49.4%	12.8%

Table 282: Res Appliances Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	98	49.8%	2.0%	52.3%	12.6%
Program Total	98	49.8%	2.0%	52.3%	12.6%

Table 283: Res Appliances Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	2,009	50.0%	2.2%	52.2%	12.7%
Program Total	2,009	50.0%	2.2%	52.2%	12.7%

Appendix N Evaluation Detail – Residential Midstream Appliances Initiative

In this initiative, rebates are paid to retailers for point-of-sale discounts on the purchase price for dehumidifiers, heat pump water heaters, ceiling fans, air purifiers, room air conditioners, and smart thermostats at participating stores. Residential customers do not file rebate applications; instead, retailers discount the appliances and invoice for rebates with point-of-sale data files as supporting documentation.

Some measures are offered in both the downstream and midstream offerings. Double-dipping is not allowed by the program, meaning that customers who purchase program measures at participating retail stores for the midstream program are not eligible to submit a mail-in rebate. For income-qualified customers, the downstream offering already has increased rebates available. If an income-qualified customer were to purchase an eligible appliance through the midstream offering, they could apply for an additional rebate, referred to as an 'enhanced rebate.' The ICSP, Franklin Energy has processes to ensure only eligible customers receive a rebate.

Participants are defined as each separate appliance rebated. Additional rebates provided to LI customers are not included in the participation counts. Thus, the rebate application, rather than the customer, is the sampling unit for gross impact evaluation.

N.1 GROSS IMPACT EVALUATION

N.1.1 Gross Impact Evaluation Methodology

Each component of gross impact is described below.

N.1.1.1 Invoice and Application Review

For midstream appliances, Qualus obtained retailer invoices with supporting documentation containing details of the rebated appliance models. Each model on the invoices was matched to the ENERGY STAR® database to obtain measure attributes. A census of the reported models was researched in this way.

N.1.1.2 Saving Calculations with TRM Algorithms and Parameters

For all reviewed records, Qualus used model-specific attributes to calculate “On-TRM” impacts.

The average per-unit gross verified impact for a given measure is the product of the measure-specific verification rate (as determined from retailer invoice details) and the average calculated impacts as described above. The gross realization rates for energy savings were driven primarily by the reported energy savings in the tracking and reporting system. The reported impacts are based on market-average efficiency and capacity attributes while the verified impacts are calculated with model-specific attributes as derived from the ENERGY STAR® database.

N.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four Rate Districts are shown in Table 284, Table 285, Table 286, and Table 287.

Table 284: Res Midstream Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	3,228	3,228
Heat Pump Water Heater	1	1
Ceiling Fan	0	0
Air Purifier	201	201
Room Air Conditioner	86	86
Smart Thermostat	606	606
Program Total	4,122	4,122

Table 285: Res Midstream Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	10,201	10,201
Heat Pump Water Heater	122	122
Ceiling Fan	0	0
Air Purifier	665	665
Room Air Conditioner	837	837
Smart Thermostat	3,793	3,793
Program Total	15,618	15,618

Table 286: Res Midstream Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	1,394	1,394
Heat Pump Water Heater	0	0
Ceiling Fan	0	0
Air Purifier	45	45
Room Air Conditioner	0	0
Smart Thermostat	0	0
Program Total	1,439	1,439

Table 287: Res Midstream Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Desk Review)
Dehumidifier	10,812	10,812
Heat Pump Water Heater	152	152
Ceiling Fan	0	0
Air Purifier	733	733
Room Air Conditioner	751	751
Smart Thermostat	4,600	4,600
Program Total	17,048	17,048

N.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 288, Table 289, Table 290, and Table 291 for Met-Ed, Penelec, Penn Power, and WPP respectively. In general, gross realization rates were slightly higher than 100%, driven by high realization rates for air purifiers and heat pump water heaters.

Table 288: Res Midstream Appliances Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	385.1	95.2%	0.5	0.0%
Heat Pump Water Heater	1.9	118.6%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	30.0	159.6%	0.5	0.0%
Room Air Conditioner	5.3	100.0%	0.5	0.0%
Smart Thermostat	185.1	100.0%	0.5	0.0%
Program Total	607	100.0%		0.0%

Table 289: Res Midstream Appliances Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	1,217.0	95.1%	0.5	0.0%
Heat Pump Water Heater	213.6	114.2%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	91.4	152.0%	0.5	0.0%
Room Air Conditioner	18.1	81.9%	0.5	0.0%
Smart Thermostat	781.7	100.0%	0.5	0.0%
Program Total	2,322	100.7%		0.0%

Table 290: Res Midstream Appliances Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	166.3	95.3%	0.5	0.0%
Heat Pump Water Heater	0.0	100.0%	0.5	100.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	6.9	158.2%	0.5	0.0%
Room Air Conditioner	0.0	100.0%	0.5	100.0%
Smart Thermostat	0.0	100.0%	0.5	100.0%
Program Total	173	97.8%		0.0%

Table 291: Res Midstream Appliances Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	1,289.9	95.0%	0.5	0.0%
Heat Pump Water Heater	253.5	114.3%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	92.0	153.6%	0.5	0.0%
Room Air Conditioner	20.6	80.0%	0.5	0.0%
Smart Thermostat	1,068.8	100.0%	0.5	0.0%
Program Total	2,725	100.6%		0.0%

N.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 292, Table 293, Table 294, and Table 295 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 292: Res Midstream Appliances Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	0.1	95.2%	0.5	0.0%
Heat Pump Water Heater	0.0	118.6%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	0.0	159.8%	0.5	0.0%
Room Air Conditioner	0.0	100.0%	0.5	0.0%
Smart Thermostat	0.0	100.0%	0.5	0.0%
Program Total	0.14	98.0%		0.0%

Table 293: Res Midstream Appliances Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	0.3	95.1%	0.5	0.0%
Heat Pump Water Heater	0.0	114.2%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	0.0	152.3%	0.5	0.0%
Room Air Conditioner	0.0	81.5%	0.5	0.0%
Smart Thermostat	0.1	100.0%	0.5	0.0%
Program Total	0.52	97.0%		0.0%

Table 294: Res Midstream Appliances Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	0.0	95.3%	0.5	0.0%
Heat Pump Water Heater	0.0	100.0%	0.5	100.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	0.0	158.4%	0.5	0.0%
Room Air Conditioner	0.0	100.0%	0.5	100.0%
Smart Thermostat	0.0	100.0%	0.5	100.0%
Program Total	0.05	96.5%		0.0%

Table 295: Res Midstream Appliances Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Dehumidifier	0.4	95.0%	0.5	0.0%
Heat Pump Water Heater	0.0	114.3%	0.5	0.0%
Ceiling Fan	0.0	100.0%	0.5	100.0%
Air Purifier	0.0	153.8%	0.5	0.0%
Room Air Conditioner	0.0	79.9%	0.5	0.0%
Smart Thermostat	0.1	100.0%	0.5	0.0%
Program Total	0.58	96.9%		0.0%

N.2 NET IMPACT EVALUATION

N.2.1 Net Impact Evaluation Methodology

A net impact evaluation was not conducted for midstream appliances in PY17. Net impact evaluation results from downstream appliances are used as a proxy, with the modification that spillover was not included for the midstream program. The midstream and downstream program components offer identical rebate amounts per appliance and efficiency grade. The net-to-gross evaluation for the downstream Appliances measures was based on self-report data from program participants. The following sections provide information related to the downstream net impact evaluation effort that informs the initiative's NTG values for PY17.

N.2.2 Sampling

The sampling scheme for the downstream appliance initiative, which informed NTG for the midstream appliances, is summarized below. Tetra Tech sampled randomly from all participants on record in the Company's tracking and reporting systems in early PY14 Q3. The sample designs for the four Rate Districts are shown in Table 296. The achieved sample sizes and response rates in the table below are from the PY14 net impact evaluation effort.

Table 296: Res Appliances Initiative Net-to-Gross Sampling

Rate District	Stratum	Population Size	Achieved Sample Size	Response Rate
Met-Ed	All Rebates	2,752	69	25.0%
Met-Ed Total		2,752	69	25.0%
Penelec	All Rebates	1,709	71	25.5%
Penelec Total		1,709	71	25.5%
Penn Power	All Rebates	899	74	26.4%
Penn Power Total		899	74	26.4%
WPP	All Rebates	2,970	72	25.7%
WPP Total		2,970	72	25.7%

N.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 297.

Table 297: Res Appliances Initiative Net-to-Gross Results

EDC	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	607	42.4%	0.0%	57.6%	13.0%
Penelec	2,337	52.2%	0.0%	47.8%	12.8%
Penn Power	169	49.8%	0.0%	50.2%	12.6%
WPP	2,741	50.0%	0.0%	50.0%	12.7%

Appendix O Evaluation Detail – Low-Income Residential Appliance Recycling Sub-Initiative

O.1 GROSS IMPACT EVALUATION

Gross impact evaluation for the Low-Income Appliance Recycling (LI ATI) Sub-Initiative included customer verification surveys and TRM calculations of measure-level impacts. There are five distinct measures offered by the program: refrigerator recycling, freezer recycling, room AC (RAC) recycling, mini-fridge recycling, and dehumidifier recycling.

O.1.1 Gross Impact Evaluation Methodology

Qualus' gross impact evaluation methodology was identical for all four Rate Districts. A TRM-based calculation was performed for each entry in the tracking and reporting system. The parameter values from the TRM (or for dehumidifiers, IMP) algorithms were taken from project-specific data from the tracking and reporting system when applicable, from TRM defaults, or from customer verification surveys. For refrigerators and freezers, measure attributes that participants would readily recall were determined from participant surveys, and the average parameter values were applied to all measures. Apart from measure verification, these attributes include the part-use factor, the location in the home where the appliance was used, and for refrigerators, whether the appliance was a primary or secondary unit. Technical attributes of the appliances, such as the age, capacity, and configuration, as collected by CLEAResult, were taken from program tracking and reporting data. TRM or IMP default parameters were used for room air conditioners (RACs) and dehumidifiers. Table 298 lists the data sources for gross impact calculation algorithms.

Table 298: Data Sources for the LI ATI Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
Refrigerator, Freezer	Appliance Age	Tracking and Reporting System
Refrigerator, Freezer	Pre-1990	Tracking and Reporting System
Refrigerator, Freezer	Appliance Size / Capacity	Tracking and Reporting System
Refrigerator, Freezer	Configuration/Type	Tracking and Reporting System
Refrigerator	Primary Usage	Participant Surveys
Refrigerator, Freezer	Part Use Factor	Participant Surveys
Refrigerator, Freezer	In Unconditioned Space?	Participant Surveys
Refrigerator, Freezer	CDD and HDD	TRM - Zip Code Lookup
RAC	Capacity	Tracking and Reporting System
RAC	EER	TRM Default
RAC	RAC EFLH	TRM - Zip Code Lookup
RAC	CF	TRM - Zip Code Lookup
Dehumidifier	Capacity	Tracking and Reporting System
Dehumidifier	Region (to determine kWh)	TRM - Zip Code Lookup
All Measures	Verification Rate	Participant Surveys

The gross realization rates for energy savings were driven primarily by part-use factors for refrigerators and freezers as determined through verification surveys, and by the unit energy consumptions for refrigerators and freezers, as determined through measure attributes recorded in the tracking and reporting system.

O.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four Rate Districts are shown in Table 299, Table 300, Table 301, and Table 302. The population sizes and sample sizes represent individual appliances rather than individual customers. Most surveys were conducted online, with telephone surveys employed to meet sample quotas if only a few more sample points were needed. Note that the overall precision for the ATI initiative is the combined precision of the low income, non-low-income, and nonresidential components. The combined precisions for each Rate District are shown in Table 233 in Appendix J.

Table 299: LI ATI Sub-Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	91	10	Participant Surveys
Freezers	11	1	
RACs	123	9	
Dehumidifiers	15	5	
Mini Friges	7	0	
Program Total	247	25	

Table 300: LI ATI Sub-Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	101	12	Participant Surveys
Freezers	23	2	
RACs	125	11	
Dehumidifiers	16	0	
Mini Friges	5	0	
Program Total	270	25	

Table 301: LI ATI Sub-Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	0	0	Participant Surveys
Freezers	0	0	
RACs	0	0	
Dehumidifiers	0	0	
Mini Friges	0	0	
Program Total	0	0	

Table 302: LI ATI Sub-Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	120	7	Participant Surveys
Freezers	10	0	
RACs	113	6	
Dehumidifiers	18	0	
Mini Friges	3	2	
Program Total	264	15	

O.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 303, Table 304, Table 305, and Table 306 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 303: LI ATI Sub-Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	83	95.0%	0.5	21.5%
Freezers	7	83.3%	0.5	68.6%
RACs	12	141.3%	0.5	23.1%
Dehumidifiers	10	115.9%	0.5	26.3%
Mini Friges	2	100.0%	0.5	0.0%
Program Total	114	101.1%		15.8%

Table 304: LI ATI Sub-Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	93	101.5%	0.5	19.5%
Freezers	15	72.6%	0.5	48.6%
RACs	13	138.4%	0.5	20.7%
Dehumidifiers	8	128.2%	0.5	0.0%
Mini Friges	1	100.0%	0.5	0.0%
Program Total	130	103.4%		14.5%

Table 305: LI ATI Sub-Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0	100.0%	0.5	0.0%
Freezers	0	100.0%	0.5	0.0%
RACs	0	100.0%	0.5	0.0%
Dehumidifiers	0	100.0%	0.5	0.0%
Mini Friges	0	100.0%	0.5	0.0%
Program Total	0	100.0%		0.0%

Table 306: LI ATI Sub-Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	111	105.0%	0.5	26.4%
Freezers	6	72.9%	0.5	0.0%
RACs	11	149.3%	0.5	28.6%
Dehumidifiers	6	232.0%	0.5	0.0%
Mini Friges	1	117.7%	0.5	29.4%
Program Total	136	112.9%		20.4%

O.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 307, Table 308, Table 309, and Table 310 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 307: LI ATI Sub-Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.01	95.0%	0.5	21.5%
Freezers	0.00	83.3%	0.5	68.6%
RACs	0.02	142.3%	0.5	23.1%
Dehumidifiers	0.00	115.8%	0.5	26.3%
Mini Friges	0.00	144.3%	0.5	0.0%
Program Total	0.04	123.0%		16.3%

Table 308: LI ATI Sub-Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.02	101.5%	0.5	19.5%
Freezers	0.00	72.6%	0.5	48.6%
RACs	0.03	127.5%	0.5	20.7%
Dehumidifiers	0.00	140.5%	0.5	0.0%
Mini Friges	0.00	144.3%	0.5	0.0%
Program Total	0.05	117.2%		14.5%

Table 309: LI ATI Sub-Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.00	100.0%	0.5	0.0%
Freezers	0.00	100.0%	0.5	0.0%
RACs	0.00	100.0%	0.5	0.0%
Dehumidifiers	0.00	100.0%	0.5	0.0%
Mini Friges	0.00	100.0%	0.5	0.0%
Program Total	0.00	100.0%		0.0%

Table 310: LI ATI Sub-Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.02	105.0%	0.5	26.4%
Freezers	0.00	72.9%	0.5	0.0%
RACs	0.03	143.9%	0.5	28.6%
Dehumidifiers	0.00	218.5%	0.5	0.0%
Mini Friges	0.00	169.8%	0.5	29.4%
Program Total	0.05	129.6%		19.5%

O.2 NET IMPACT EVALUATION

O.2.1 Net Impact Evaluation Methodology

As with other programs that target income-qualified participants, an NTG ratio of 100% is used for calculation of portfolio-level net verified impacts and for net-level TRC calculations.

Appendix P Evaluation Detail – Residential Low-Income Direct Install Initiative

The Low-Income direct install initiative is comprised of three subprograms: WARM – Plus, WARM – Extra Measure, and WARM Multifamily. Each subprogram is implemented by FirstEnergy. Each sub program offers similar measures to its participants.

Participants are defined as the number of unique project numbers in the program. Participants can receive numerous measures installed over the course of the program year. Participants must have a gross household income at or below 150% of the 2023 Federal Income Poverty Guideline (FPIG).

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

P.1 GROSS IMPACT EVALUATION

P.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the LI DI Initiative involved using TRM calculations for measures installed throughout the program. Unique measure calculations were performed in accordance with the 2021 PA TRM for each measure type. The impact evaluation process is described below.

P.1.1.1 Determination of In-Service Rates

In-service rates are calculated by using QA/QC forms created by a third-party inspector. Inspectors verified measure installations during a site visit after the project was completed. The verified installed quantities were compared to reported quantities to develop the in-service rates.

In a previous program year, Qualus performed ride along site visits with three different QA/QC contractors to ensure that the contractors were performing the QA/QC visit properly. It was found that the QA/QC contractors were indeed looking for the right measures and measure quantities. Qualus verified the same quantity of measures as the QA/QC contractors. Qualus continues to rely on QA/QC contractors' inspections to determine in-service rates for measures.

In-service rates were used in all savings calculations except air sealing and attic insulation measures.

P.1.1.2 TRM Calculations

For lighting measures, efficient and baseline lamp wattages are stated in the reported data and supporting documents. The hours of use are assumed to be the TRM defaults of 3 or 2.5 hours, depending on the proportion of lamps in a household that are retrofitted. TRM defaults were used for other portions of the calculation.

TRM defaults were used for the LED Nights Lights.

For refrigerator and freezer measures, each installation was assigned a category number using model numbers provided in supporting documentation. If the name and description fields contradicted each other, the description field was used because the description column is more accurate and detailed. The appliance age-based variables of the savings calculations for recycling come from supporting documentation if available, or from the appliance recycling program otherwise. Input values for other variables come from the determined category number of the appliance. All appliances were assumed to be primary appliances and are installed within conditioned space.

For domestic hot water measures, first the water heater type was verified. The housing type identified in the customer tracking data is used in showerhead and aerator measure savings calculations. The heat pump water heater measure calculation uses the efficient energy factor rating and volume stated in the customer tracking data or found in the supporting documentation. TRM defaults are assumed when specific values are not known or found.

Project audit forms were used to determine heating and cooling equipment types for accounts which received attic insulation. Once the heating and cooling equipment type was verified, the attic insulation savings calculation was completed. Insulation area, R_{base} , R_{ee} were provided in the project documentation. The HDDs, CDDs, and $EFLH_{cool}$ were found using the zip code lookup table to the projects reference city.

Residential air sealing measures used $CFM50_{post}$ and $CFM50_{pre}$ values found in the project audit forms. The heating equipment type was found in the customer tracking data and the cooling equipment type was in project audit forms.

The default savings values were used for the smart strip plug outlets. The equip name or description columns were used to find the quantity of the plugs on the smart strips. Projects which have multiple smart strips installed were assigned the savings values for the “Unspecified use or multiple purchased” smart strips. The description column indicates if the smart strip was installed on an entertainment center. Descriptions which included phrases such as “TV”, “Living room”, or “entertain” were considered entertainment center installations.

P.1.2 Sampling

The sampling strategy for gross impact evaluation is summarized in Table 311, Table 312, Table 313, and Table 314 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 311: LI DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1.4	144	12	TRM Analysis + On-Site Verification
Medium Savings	0.8	585	14	
Low Savings	0.0	962	7	
Program Total		1,691	33	

Table 312: LI DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1.3	190	6	TRM Analysis + On-Site Verification
Medium Savings	0.7	690	19	
Low Savings	0.0	800	8	
Program Total		1,680	33	

Table 313: LI DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	na	0	0	TRM Analysis + On-Site Verification
Medium Savings	na	0	0	
Low Savings	na	0	0	
Program Total		0	0	

Table 314: LI DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1.6	78	6	TRM Analysis + On-Site Verification
Medium Savings	0.9	254	8	
Low Savings	0.0	669	13	
Program Total		1,001	27	

P.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 315, Table 316, Table 317, and Table 318 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 315: LI DI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.4	298	98.6%	0.5	20%
Medium Savings	0.8	590	102.6%	0.5	19%
Low Savings	0.0	360	88.9%	0.5	27%
Program Total		1,248	97.7%		12.8%

Table 316: LI DI Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.3	365	103.2%	0.5	29%
Medium Savings	0.7	740	105.1%	0.5	16%
Low Savings	0.0	378	103.5%	0.5	25%
Program Total		1,484	104.2%		12.6%

Table 317: LI DI Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	na	0	0.0%	0.5	0%
Medium Savings	na	0	0.0%	0.5	0%
Low Savings	na	0	0.0%	0.5	0%
Program Total		0	0.0%		0.0%

Table 318: LI DI Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.6	167	102.0%	0.5	28%
Medium Savings	0.9	302	109.9%	0.5	25%
Low Savings	0.0	426	100.2%	0.5	20%
Program Total		895	103.8%		13.8%

P.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 319, Table 320, Table 321, and Table 322 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 319: LI DI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.4	0.04	99.9%	0.5	20%
Medium Savings	0.8	0.08	105.2%	0.5	19%
Low Savings	0.0	0.04	89.9%	0.5	27%
Program Total		0.16	99.8%		12.8%

Table 320: LI DI Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.3	0.05	103.5%	0.5	29%
Medium Savings	0.7	0.10	106.2%	0.5	16%
Low Savings	0.0	0.05	103.5%	0.5	25%
Program Total		0.20	104.9%		12.5%

Table 321: LI DI Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	na	0.00	0.0%	0.5	0%
Medium Savings	na	0.00	0.0%	0.5	0%
Low Savings	na	0.00	0.0%	0.5	0%
Program Total		0.00	0.0%		0.0%

Table 322: LI DI Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1.6	0.02	102.8%	0.5	28%
Medium Savings	0.9	0.04	111.9%	0.5	25%
Low Savings	0.0	0.07	102.1%	0.5	20%
Program Total		0.13	105.4%		13.8%

P.2 NET IMPACT EVALUATION

P.2.1 Net Impact Evaluation Methodology

An independent net impact evaluation was not conducted for this initiative.

Appendix Q Evaluation Detail – LI EE Kits Sub-Initiative

Q.1 GROSS IMPACT EVALUATION

The Low-Income EE Kits initiative has two sub-components: Low-income EE Kits and the Low-Income School Education program, both administered by AMCG. Both program components are similar to their non-income-qualified counterparts described in Appendix E. Other than minor differences in kit contents, the low-income EE Kit program components differ from the general EE Kit program components in the way customers are targeted and enrolled. The Low-Income EE Kit program targets customers that are income qualified in the Company's customer information systems databases. The Low-Income Schools program targets schools in low-income areas.

Q.1.1 Gross Impact Evaluation Methodology

Qualus' gross impact evaluation methodology was identical to the process described for EE Kits in Appendix E. The gross realization rates and underlying in-service rates were generally higher for the Low-Income EE kits. ISRs for showerheads, aerators, and night lights are appreciably higher for the low-income subgroup.

Q.1.2 Sampling

Each kit type was treated as a separate stratum within the sampling initiative. The sample designs for the four Rate Districts are shown in Table 323, Table 324, Table 325, and Table 326. Note that the overall precision for the EE Kits initiative is the combined precision of the low income and non-low-income components. The combined precisions for each Rate District are shown in Table 172 in Appendix E.

Table 323: LI EE Kits Sub-Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	3,915	100	Survey (phone + online)
LI EE Kits - Standard	2,244	60	
LI School Education Kits	571	23	
Program Total	6,730	183	

Table 324: LI EE Kits Sub-Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	851	37	Survey (phone + online)
LI EE Kits - Standard	1,333	30	
LI School Education Kits	1,739	240	
Program Total	3,923	307	

Table 325: LI EE Kits Sub-Initiative Gross Impact Sample Design for Penn Power

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

Table 326: LI EE Kits Sub-Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	3,848	121	Survey (phone + online)
LI EE Kits - Standard	2,775	116	
LI School Education Kits	2,900	230	
Program Total	9,523	467	

Q.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 327, Table 328, Table 329, and Table 330 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 327: LI EE Kits Sub-Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	1,053	101.4%	1.0	14%
LI EE Kits - Standard	478	85.9%	0.5	9%
LI School Education Kits	126	105.2%	0.5	15%
Program Total	1,658	97.2%	1.00	9.8%

Table 328: LI EE Kits Sub-Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	226	135.2%	1.0	23%
LI EE Kits - Standard	288	102.2%	0.5	13%
LI School Education Kits	391	98.1%	0.5	4%
Program Total	905	108.7%	1.00	8.4%

Table 329: LI EE Kits Sub-Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0	0.0%	1.0	0%
LI EE Kits - Standard	0	0.0%	0.5	0%
LI School Education Kits	0	0.0%	0.5	0%
Program Total	0	100.0%	1.00	0.0%

Table 330: LI EE Kits Sub-Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	1,042	112.3%	1.0	13%
LI EE Kits - Standard	605	92.1%	0.5	7%
LI School Education Kits	660	106.7%	0.5	5%
Program Total	2,307	105.4%	1.00	6.5%

Q.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 331, Table 332, Table 333, and Table 334 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 331: LI EE Kits Sub-Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.11	107.2%	1.0	14%
LI EE Kits - Standard	0.05	91.0%	0.5	9%
LI School Education Kits	0.01	92.7%	0.5	15%
Program Total	0.18	101.2%	1.00	9.7%

Table 332: LI EE Kits Sub-Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.02	150.0%	1.0	23%
LI EE Kits - Standard	0.03	110.4%	0.5	13%
LI School Education Kits	0.04	97.0%	0.5	4%
Program Total	0.09	114.4%	1.00	8.6%

Table 333: LI EE Kits Sub-Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.00	0.0%	1.0	0%
LI EE Kits - Standard	0.00	0.0%	0.5	0%
LI School Education Kits	0.00	0.0%	0.5	0%
Program Total	0.00	100.0%	1.00	0.0%

Table 334: LI EE Kits Sub-Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.11	117.6%	1.0	13%
LI EE Kits - Standard	0.07	95.4%	0.5	7%
LI School Education Kits	0.08	104.8%	0.5	5%
Program Total	0.267	107.7%	1.00	6.4%

Q.2 NET IMPACT EVALUATION

A net impact evaluation was not conducted for the LI EE Kits Initiative.

Appendix R Evaluation Detail – Commercial and Industrial Prescriptive Initiative

R.1 GROSS IMPACT EVALUATION

The Commercial and Industrial Prescriptive (C&I Prescriptive) initiative is administered by Franklin Energy Services and includes four components: Downstream lighting, midstream lighting, downstream non-lighting, and midstream non-lighting.

Gross impact evaluation for C&I Prescriptive Initiative involved stratified sampling, on-site verifications, and project-specific data collection and calculations. For the lighting sub-initiatives, evaluation activities also include TRM Appendix C calculations with primary data collection for lighting hours of use for medium savings and high savings projects, and application of TRM deemed hours of operation for low savings projects.

R.1.1 Gross Impact Evaluation Methodology

As a first step, projects are categorized into one of the four components described above. Projects are clearly defined by subprogram names, which simplifies the process. The evaluation method for each component is described below.

R.1.1.1 Downstream Lighting

As a first step, projects are placed into one of three sampling strata as described in the next section. Each sampled lighting project first undergoes a desk review. The desk review includes reconciliation of invoices, fixture specification sheets (cut sheets), and re-calculating reported savings using TRM algorithms and/or ex-ante assumptions and identifying key parameters to be researched in the M&V plan. One aspect of the desk review is to transfer the calculation data into the PA TRM's Appendix C calculator. Although the Company's implementation vendor processes rebates with an independent calculator that mirrors the TRM's Appendix C calculations (augmented with worksheets to suit rebate application purposes), the transferring of the data to Qualus' version of Appendix C is an evaluation step to ensure that all verified impacts for lighting projects are derived using the 2021 TRM's Appendix C.

Evaluation of all but the simplest of projects requires a site-specific M&V plan (SSMVP). The first step in the M&V planning process is to check that the project is sufficiently documented. For example, contractors working on large projects often have detailed, space-by-space inventories of the baseline and new lighting fixtures. If such detailed information is found to be lacking, Qualus analysts will contact the applicant or the contractor directly, or through a request to the ICSP, and ask if such documentation is available.

The desk review and M&V plan inform the data acquisition activities needed to evaluate the sampled project. Evaluation activities can include calculation reviews, reconciliation of the Appendix C calculator with invoices and equipment specification sheets, determination of hours of use through interviews or logging, and on-site verification.

In cases where projects have limited scope and complexity, the desk review process may indicate that an on-site visit would not add sufficient value to the evaluation effort. In such cases, a verification interview may suffice to reduce uncertainty regarding the project. Where loggers are used, data analysis is finalized following their retrieval. Billing analysis is a viable option for certain projects, and in some cases the verified results are determined wholly or partially by billing analysis.

R.1.1.1 Midstream Lighting

Once a project has been sampled, evaluation activities are similar to those described for downstream lighting projects. The business name and address where the lighting equipment will be installed is recorded for each project, so surveys and site inspections are possible, similar to the downstream component. While most midstream lighting projects tend to be much smaller in scope than downstream projects, there were several very large midstream projects in PY17. While the evaluation team does not have an “above-threshold” process, where large projects are evaluated prior to rebate approval, for midstream lighting, the evaluators sampled two of two projects with expected savings over 2,000 MWh, and five of eleven projects with expected savings above 750 MWh.

R.1.1.2 Downstream Non-Lighting

As with lighting projects, each sampled prescriptive project undergoes a desk review prior to M&V activities. The desk review includes a full documentation review and if needed, additional topical research. Some projects may require M&V plans and additional verification activities, but most projects can be evaluated through documentation review. The prescriptive non-lighting projects (both downstream and midstream) accounted for less than 1% of nonresidential impacts in PY17. Due to the low evaluation risk posed by these projects, desk reviews were identified as the most appropriate impact evaluation activity.

R.1.1.3 Midstream Non-Lighting

Once a project has been sampled, evaluation activities are similar to those described for downstream non-lighting projects.

Figure 7 shows the fraction of verified energy savings, as averaged over the four PA Rate Districts, by primary evaluation activities.

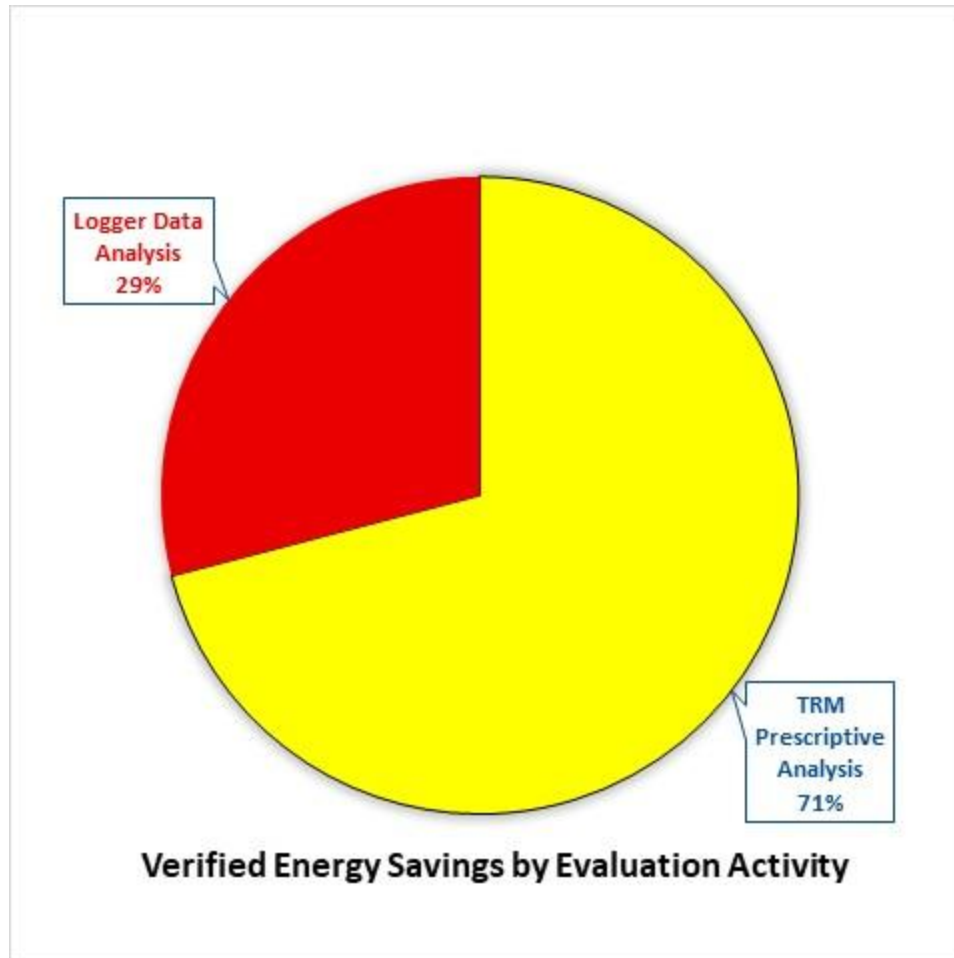


Figure 7: Fraction of verified energy savings by evaluation activity.

As a final step in the evaluation process, Qualus analysts determine the incremental material and labor costs. In estimating the material and labor costs, preference is given first to invoices, then to the SWE incremental cost database, and then to the cost values from the CA DEER database, then to the costs used in the EDCs' EE&C plans. Incremental costs for downstream lighting projects are evaluated under the "early replacement" scenario unless the project is a new construction or remodeling project. Incremental costs for midstream projects are evaluated under the "replace on burnout" scenario.

R.1.2 Sampling

In PY17, both midstream and downstream lighting components had the volume and heterogeneity to motivate savings-based stratification. Downstream lighting projects were placed into three strata. The first stratum or "certainty" stratum consists of projects that are expected to result in energy savings in excess of 750 MWh. All of these projects are sampled for evaluation, and nearly all of them are evaluated prior to rebate approval. Therefore, the gross realization rate for the certainty stratum is essentially 100% by design, although reported impacts may at times be lower than the 750 MWh threshold, as the threshold is on ex ante

MWh, while ex post MWh are reported for these projects. The remaining projects are placed into two sampling strata according to their reported energy impacts. The sample design is not optimized for efficiency in the sense of achieving the desired precision with the absolute minimum number of sample points. Rather, the sample is designed to facilitate specific evaluation protocols that are based on energy savings thresholds. For example, projects in the certainty stratum are evaluated with the highest level of rigor in advance of rebate approval to ensure that customers' incentives are determined from verified energy savings. The smallest projects, those with expected impacts under 120 MWh, are placed in a separate stratum. For these projects, hours of use may be determined by logging, customer interviews, or application of deemed hours in the PA TRM depending on the level of uncertainty in lighting schedules and how closely the business schedule aligns with the archetypal building types in the TRM. Midstream lighting had five sampling strata in PY17, corresponding to projects with expected impacts above or below 25 MWh, 120 MWh, 750 MWh, as well as projects above 2,000 MWh (of which there were two in PY17). In addition to lighting, there is one stratum for downstream non-lighting, and one for midstream non-lighting. The sample designs for the four Rate Districts are shown in Table 335, Table 336, Table 337, and Table 338.

Table 335: CI Prescriptive Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	3	3	Desk Review, On-Site Verification
Downstream Lighting-2	120	17	11	
Downstream Lighting-1	0	53	4	
Downstream Nonlighting	0	36	5	
Midstream Lighting-1	0	299	4	
Midstream Lighting-2	25	27	6	
Midstream Lighting-3	120	3	2	
Midstream Lighting-4	750	0	0	
Midstream Lighting-5	2000	0	0	
Midstream Nonlighting	0	0	0	
Program Total	n/a	438	35	

Table 336: CI Prescriptive Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	6	6	Desk Review, On-Site Verification
Downstream Lighting-2	120	18	6	
Downstream Lighting-1	0	123	1	
Downstream Nonlighting	0	14	2	
Midstream Lighting-1	0	1,371	8	
Midstream Lighting-2	25	426	12	
Midstream Lighting-3	120	105	15	
Midstream Lighting-4	750	11	5	
Midstream Lighting-5	2000	2	2	
Midstream Nonlighting	0	1	1	
Program Total	n/a	2,077	58	

Table 337: CI Prescriptive Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	3	3	Desk Review, On-Site Verification
Downstream Lighting-2	120	2	2	
Downstream Lighting-1	0	18	3	
Downstream Nonlighting	0	1	1	
Midstream Lighting-1	0	265	5	
Midstream Lighting-2	25	84	14	
Midstream Lighting-3	120	6	6	
Midstream Lighting-4	750	0	0	
Midstream Lighting-5	2000	0	0	
Midstream Nonlighting	0	0	0	
Program Total	n/a	379	34	

Table 338: CI Prescriptive Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Downstream Lighting-C	750	8	8	Desk Review, On-Site Verification
Downstream Lighting-2	120	19	5	
Downstream Lighting-1	0	61	2	
Downstream Nonlighting	0	5	3	
Midstream Lighting-1	0	636	3	
Midstream Lighting-2	25	195	11	
Midstream Lighting-3	120	58	10	
Midstream Lighting-4	750	0	0	
Midstream Lighting-5	2000	0	0	
Midstream Nonlighting	0	1	1	
Program Total	n/a	983	43	

R.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 339, Table 340, Table 341, and Table 342 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 8 plots the verified energy savings against the reported energy savings for all evaluated prescriptive projects for the program year. The figure includes data points from all four Rate Districts and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficients of variation determined through the variability of realization rates. Most strata had CVs at or below 0.3, as prescriptive projects tend to have homogeneous realization rates. However, the Midstream Lighting-3 and Midstream Lighting-4 strata were found to have more variance between reported and verified impacts, and the CVs were 0.7 and 1.3 respectively. This can be seen in Figure 8, where several projects above 750 MWh in expected savings had very low realization rates, primarily due to lower as-found baseline wattage than assumed baseline wattage.

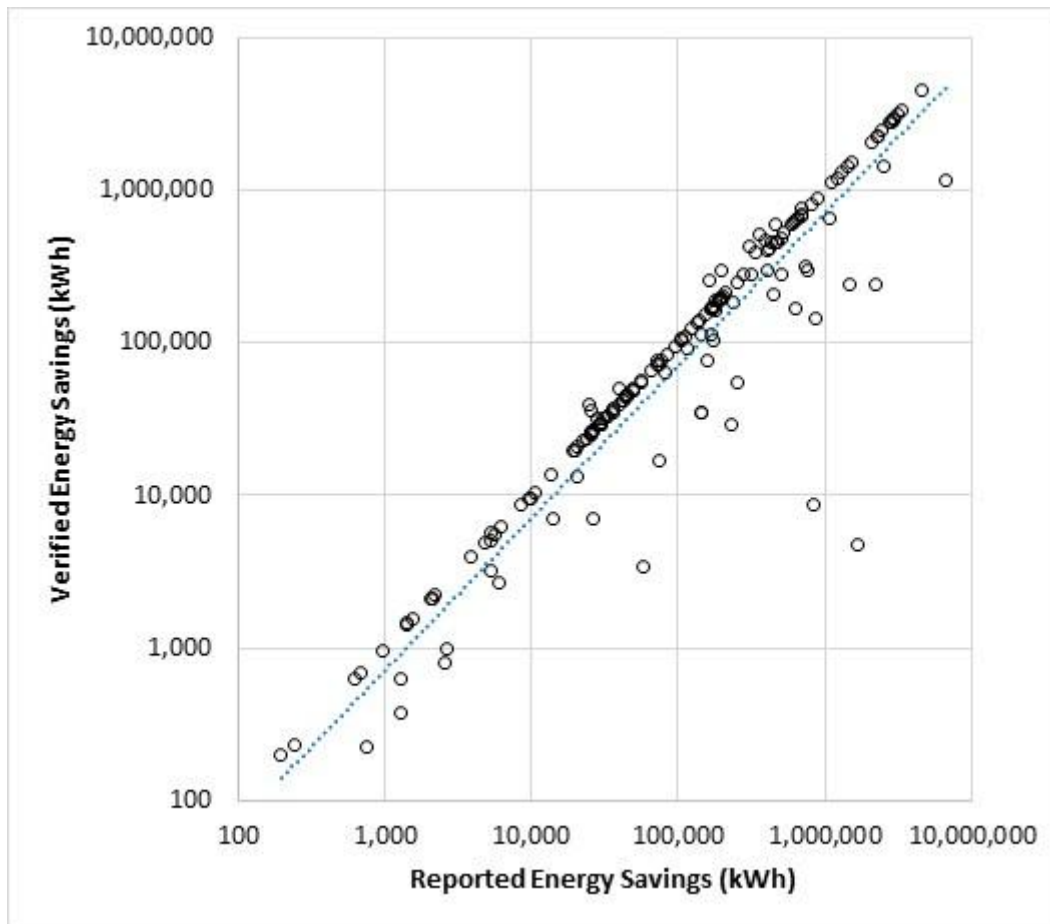


Figure 8: Verified vs. Reported Energy Savings for Sampled Prescriptive Projects.

Table 339: CI Prescriptive Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	6,099	100.0%	0.3	0%
Downstream Lighting-2	120	6,079	104.1%	0.3	6%
Downstream Lighting-1	0	1,790	100.4%	0.3	17%
Downstream Nonlighting	0	573	99.7%	0.3	15%
Midstream Lighting-1	0	1,278	60.6%	0.3	18%
Midstream Lighting-2	25	1,323	79.4%	0.3	13%
Midstream Lighting-3	120	587	48.9%	0.7	42%
Midstream Lighting-4	750	0	100.0%	1.3	0%
Midstream Lighting-5	2000	0	100.0%	0.3	0%
Midstream Nonlighting	0	0	100.0%	0.3	0%
Program Total	n/a	17,729	95.4%		3.4%

Table 340: CI Prescriptive Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	8,800	100.0%	0.3	0%
Downstream Lighting-2	120	5,853	72.9%	0.3	12%
Downstream Lighting-1	0	1,822	98.5%	0.3	36%
Downstream Nonlighting	0	57	145.4%	0.3	24%
Midstream Lighting-1	0	8,377	94.0%	0.3	13%
Midstream Lighting-2	25	21,553	101.9%	0.3	10%
Midstream Lighting-3	120	26,787	68.3%	0.7	25%
Midstream Lighting-4	750	13,049	17.8%	1.3	63%
Midstream Lighting-5	2000	8,868	15.7%	0.3	0%
Midstream Nonlighting	0	1	100.0%	0.3	0%
Program Total	n/a	95,168	70.2%		8.1%

Table 341: CI Prescriptive Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	6,935	100.0%	0.3	0%
Downstream Lighting-2	120	832	80.8%	0.3	0%
Downstream Lighting-1	0	361	100.3%	0.3	19%
Downstream Nonlighting	0	3	31.4%	0.3	0%
Midstream Lighting-1	0	1,902	83.4%	0.3	16%
Midstream Lighting-2	25	4,094	94.0%	0.3	9%
Midstream Lighting-3	120	2,202	88.6%	0.7	0%
Midstream Lighting-4	750	0	100.0%	1.3	0%
Midstream Lighting-5	2000	0	100.0%	0.3	0%
Midstream Nonlighting	0	0	100.0%	0.3	0%
Program Total	n/a	16,329	94.0%		2.8%

Table 342: CI Prescriptive Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	18,844	100.0%	0.3	0%
Downstream Lighting-2	120	7,326	99.1%	0.3	14%
Downstream Lighting-1	0	2,037	99.5%	0.3	25%
Downstream Nonlighting	0	30	100.4%	0.3	13%
Midstream Lighting-1	0	3,831	98.8%	0.3	21%
Midstream Lighting-2	25	10,688	88.9%	0.3	11%
Midstream Lighting-3	120	17,434	77.7%	0.7	30%
Midstream Lighting-4	750	0	100.0%	1.3	0%
Midstream Lighting-5	2000	0	100.0%	0.3	0%
Midstream Nonlighting	0	9	100.0%	0.3	0%
Program Total	n/a	60,198	91.4%		8.0%

R.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 343, Table 344, Table 345, and Table 346 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 343: CI Prescriptive Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	0.86	100.0%	0.3	0%
Downstream Lighting-2	120	1.08	96.7%	0.3	6%
Downstream Lighting-1	0	0.26	89.3%	0.3	17%
Downstream Nonlighting	0	0.05	97.2%	0.3	15%
Midstream Lighting-1	0	0.32	48.9%	0.3	18%
Midstream Lighting-2	25	0.33	72.2%	0.3	13%
Midstream Lighting-2	120	0.33	72.2%	0.7	42%
Midstream Lighting-2	750	0.33	72.2%	1.3	0%
Midstream Lighting-2	2000	0.33	72.2%	0.3	0%
Midstream Nonlighting	0	0.00	100.0%	0.3	0%
Program Total	n/a	3.89	84.7%		4.1%

Table 344: CI Prescriptive Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	1.13	100.0%	0.3	0%
Downstream Lighting-2	120	1.06	49.1%	0.3	12%
Downstream Lighting-1	0	0.43	98.5%	0.3	36%
Downstream Nonlighting	0	0.01	192.9%	0.3	24%
Midstream Lighting-1	0	1.89	92.0%	0.3	13%
Midstream Lighting-2	25	5.13	99.6%	0.3	10%
Midstream Lighting-3	120	5.12	68.7%	0.7	25%
Midstream Lighting-4	750	1.92	28.9%	1.3	63%
Midstream Lighting-5	2000	1.28	16.3%	0.3	0%
Midstream Nonlighting	0	0.00	100.0%	0.3	0%
Program Total	n/a	17.98	73.6%		8.4%

Table 345: CI Prescriptive Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	0.87	100.0%	0.3	0%
Downstream Lighting-2	120	0.15	88.0%	0.3	0%
Downstream Lighting-1	0	0.08	99.9%	0.3	19%
Downstream Nonlighting	0	0.00	4.9%	0.3	0%
Midstream Lighting-1	0	0.49	90.4%	0.3	16%
Midstream Lighting-2	25	1.18	81.3%	0.3	9%
Midstream Lighting-3	120	0.55	75.2%	0.7	0%
Midstream Lighting-4	750	0.00	100.0%	1.3	0%
Midstream Lighting-5	2000	0.00	100.0%	0.3	0%
Midstream Nonlighting	0	0.00	100.0%	0.3	0%
Program Total	n/a	3.32	87.3%		3.8%

Table 346: CI Prescriptive Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Downstream Lighting-C	750	2.12	100.0%	0.3	0%
Downstream Lighting-2	120	1.11	96.5%	0.3	14%
Downstream Lighting-1	0	0.38	91.7%	0.3	25%
Downstream Nonlighting	0	0.00	86.9%	0.3	13%
Midstream Lighting-1	0	0.91	97.8%	0.3	21%
Midstream Lighting-2	25	2.92	57.8%	0.3	11%
Midstream Lighting-3	120	4.63	60.1%	0.7	30%
Midstream Lighting-4	750	0.00	100.0%	1.3	0%
Midstream Lighting-5	2000	0.00	100.0%	0.3	0%
Midstream Nonlighting	0	0.00	100.0%	0.3	0%
Program Total	n/a	12.08	73.7%		10.0%

R.2 NET IMPACT EVALUATION

R.2.1 Net Impact Evaluation Methodology

In PY14, Tetra Tech assessed free-ridership through participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. The customer free-ridership portion captures two components: (1) intention to carry out the energy-efficient project without program funds, and (2) influence of the program in the decision to carry out the energy-efficient project. Customer-identified influential vendors were asked a series of questions assessing the program's influence on their recommendations to the customer(s) who identified them as being influential in their decision-making process to support the free-ridership assessment. Like the customer self-report methodology, an influence component score was calculated for each influential vendor specific to each project. If the vendor's influence score is greater than the customer's score from the participant survey, the vendor score replaced the customer score in the self-report free-ridership scoring algorithm, under the rationale that the vendor's recommendation was a program-attributable factor because the vendor, in turn, was influenced by the program.

In addition to free-ridership, the NTG evaluation also assessed both participant spillover and nonparticipant spillover. Participant spillover was assessed through participant customer self-reports. We excluded like-spillover for the Midstream program component as this equipment was likely received at a discounted price and therefore benefited from FirstEnergy's buydown. The evaluation team felt that these midstream customers were likely to get the equipment from the same vendor as their original purchase; therefore, the savings would be double counted if it was reported as spillover. Nonparticipant spillover was estimated from vendor self-report surveys at the program component level (i.e., Custom and EMNC). According to the Pennsylvania Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates. Individual free-ridership and spillover rates from the customer and vendor surveys were weighted to adjust for proportional sampling differences, non-response, and claimed energy savings to calculate overall estimates.

The following sections provide information related to the net impact evaluation effort that informs the initiative's NTG values for PY15.

R.2.2 Sampling

The sample designs for the four Rate Districts are shown in Table 347, Table 348, Table 349, and Table 350 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 347: CI Prescriptive Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Downstream Prescriptive	161	41	25%
Midstream Prescriptive	64	16	25%
Program Total	225	57	25.3%

Table 348: CI Prescriptive Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Downstream Prescriptive	200	70	35%
Midstream Prescriptive	162	39	24%
Program Total	362	109	30.1%

Table 349: CI Prescriptive Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Downstream Prescriptive	91	35	38%
Midstream Prescriptive	8	1	13%
Program Total	99	36	36.4%

Table 350: CI Prescriptive Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Downstream Prescriptive	272	97	36%
Midstream Prescriptive	93	20	22%
Program Total	365	117	32.1%

R.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 351, Table 352, Table 353, and Table 354 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 351: CI Prescriptive Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	14,227	29.1%	2.1%	73.0%	9.7%
Downstream Nonlighting	572	29.1%	2.1%	73.0%	9.7%
Midstream Lighting	2,113	44.2%	0.0%	55.8%	15.6%
Midstream Nonlighting	0	44.2%	0.0%	55.8%	15.6%
Program Total	16,911	31.0%	1.8%	70.8%	8.4%

Table 352: CI Prescriptive Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	14,860	37.3%	3.3%	66.0%	6.9%
Downstream Nonlighting	83	37.3%	3.3%	66.0%	6.9%
Midstream Lighting	51,864	34.2%	0.0%	65.8%	10.0%
Midstream Nonlighting	1	34.2%	0.0%	65.8%	10.0%
Program Total	66,808	34.9%	0.7%	65.9%	1.5%

Table 353: CI Prescriptive Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	7,969	17.4%	2.1%	84.8%	9.5%
Downstream Nonlighting	1	17.4%	2.1%	84.8%	9.5%
Midstream Lighting	7,387	25.0%	0.0%	75.0%	67.3%
Midstream Nonlighting	0	25.0%	0.0%	75.0%	67.3%
Program Total	15,357	21.0%	1.1%	80.1%	5.2%

Table 354: CI Prescriptive Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Downstream Lighting	28,135	42.8%	2.7%	59.9%	5.9%
Downstream Nonlighting	30	42.8%	2.7%	59.9%	5.9%
Midstream Lighting	26,827	24.7%	0.0%	75.3%	14.3%
Midstream Nonlighting	9	24.7%	0.0%	75.3%	14.3%
Program Total	55,000	34.0%	1.4%	67.4%	2.7%

Appendix S Evaluation Detail – Commercial and Industrial Custom Initiative

S.1 GROSS IMPACT EVALUATION

Gross impact evaluation for the Commercial and Industrial Custom (C&I Custom) Initiative involved stratified sampling, on-site verifications, and project-specific data collection and calculations.

S.1.1 Gross Impact Evaluation Methodology

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

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

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

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

General Process Improvements: For general process improvements, the evaluation determines the change in the energy usage intensity associated with the creation or maintenance of one production unit. Production data are typically provided by the applicant upon Qualus' request. Energy usage is measured either through power monitoring, energy management system trending, or billing analysis.

Solar Power Projects: Qualus divided solar power projects into "small" and "large" categories. Small projects (under 150 MWh) were evaluated with the C&I Photovoltaic IMP issued by SWE in PY17. For larger projects, Qualus attempted to collect site-specific generation data to calibrate System Advisor Model (SAM) models and only relied on the IMP if site-specific data were not available. All projects had annual generation impacts capped at the given facility's annual energy usage (or, if applicable, the combined usage of any facilities that were virtually net metered). However, peak load reductions were not capped as Qualus' interpretation of the IMP is that the modules may feed into the power grid to meet the needs of other customers at times when generation exceeds the given facility's electricity demand.

General Space and Process Cooling Improvements: Data acquisition for such projects involves the determination of independent variables that predict the cooling load (units produced, degree-days, etc.) along with utility bills, EMS trending data, or sub-metering. The data analysis may involve regressions or energy simulation models.

In some cases, the desk review process may indicate that an on-site visit would not add sufficient value to the evaluation effort. For example, billing analysis or trending data analysis is a viable option for certain projects. Figure 9 shows the fraction of verified energy savings, as averaged over the four PA Rate Districts, by primary evaluation activities.

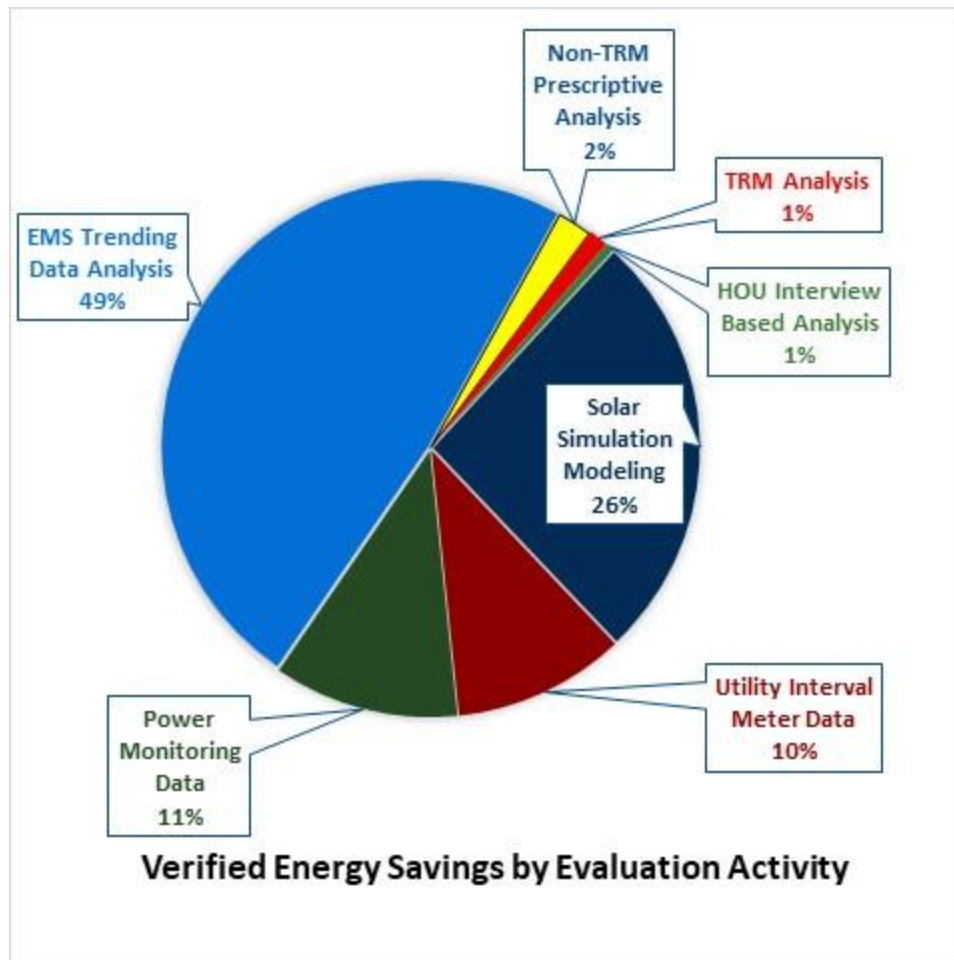


Figure 9: Fraction of verified energy savings by evaluation activity.

As a final step in custom project analysis, Qualus analysts determine the incremental material and labor costs. In estimating the material and labor costs, preference is given first to invoices, then to the SWE incremental cost database, and then to the cost values from the CA DEER database, then to the costs used in the EDCs' EE&C plans.

S.1.2 Sampling

Projects are placed into three strata. The first stratum or "certainty" stratum consists of projects that are expected to result in energy savings in excess of 500 MWh. All of these projects are sampled for evaluation, and nearly all of them are evaluated prior to rebate approval. Therefore, the gross realization rate for the certainty stratum is essentially 100% by design, although reported impacts may at times be lower than the 500 MWh threshold, as the threshold is on ex ante MWh, while ex post MWh are reported for these projects. The remaining projects are placed into one of two sampling strata: one for projects with expected savings above 75 MWh, and one for smaller projects. The sample designs for the four Rate Districts are shown in Table 355, Table 356, Table 357, and Table 358.

Table 355: CI Custom Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	3	3	Desk Review, On-Site Verification, Metering
Custom-2	75	19	8	
Custom-1	0	31	6	
Program Total	n/a	53	17	

Table 356: CI Custom Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	6	6	Desk Review, On-Site Verification, Metering
Custom-2	75	33	11	
Custom-1	0	46	6	
Program Total	n/a	85	23	

Table 357: CI Custom Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	2	2	Desk Review, On-Site Verification, Metering
Custom-2	75	8	4	
Custom-1	0	8	3	
Program Total	n/a	18	9	

Table 358: CI Custom Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-C	500	5	5	Desk Review, On-Site Verification, Metering
Custom-2	75	25	4	
Custom-1	0	29	2	
Program Total	n/a	59	11	

S.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 359, Table 360, Table 361, and Table 362 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 10 plots the verified energy savings against the reported energy savings for all evaluated custom projects for the program year. The figure includes data points from all four Rate Districts and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficient of variation of 0.4, as determined from the observed realization rate variability in each stratum.

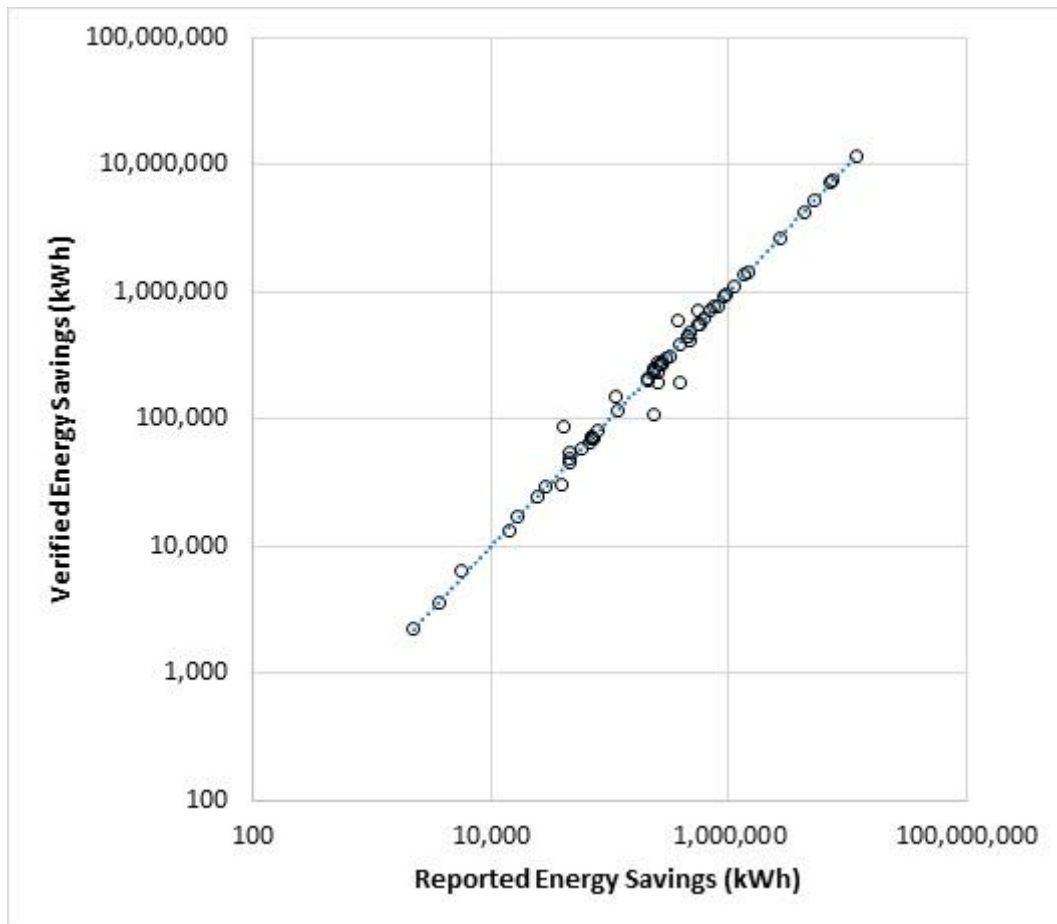


Figure 10: Verified vs. Reported Energy Savings for Sampled Custom Projects.

Table 359: CI Custom Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	2,570	100.0%	0.4	0%
Custom-2	75	6,174	99.8%	0.4	15%
Custom-1	0	700	119.9%	0.4	21%
Program Total	n/a	9,445	101.4%		10.1%

Table 360: CI Custom Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	3,759	100.0%	0.4	0%
Custom-2	75	8,244	88.3%	0.4	14%
Custom-1	0	1,608	100.6%	0.4	22%
Program Total	n/a	13,611	93.0%		8.6%

Table 361: CI Custom Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	10,199	100.0%	0.4	0%
Custom-2	75	3,175	116.5%	0.4	20%
Custom-1	0	185	101.1%	0.4	26%
Program Total	n/a	13,559	103.9%		5.4%

Table 362: CI Custom Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	29,145	100.0%	0.4	0%
Custom-2	75	6,778	104.4%	0.4	26%
Custom-1	0	877	102.6%	0.4	39%
Program Total	n/a	36,801	100.9%		5.1%

S.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 363, Table 364, Table 365, and Table 366 for Met-Ed, Penelec, Penn Power, and WPP respectively. Realization rates were slightly higher than 100% primarily due to an error in the designation of peak demand window for solar projects. The initial peak demand window was based on standard time instead of daylight savings time. The SWE noted this error in their advanced review of Qualus's analyses, and Qualus revised the verified impacts. This increased verified demand impacts relative to reported demand impacts.

Table 363: CI Custom Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	0.36	100.0%	0.4	0%
Custom-2	75	2.11	103.3%	0.4	15%
Custom-1	0	0.24	84.8%	0.4	21%
Program Total	n/a	2.71	101.2%		12.4%

Table 364: CI Custom Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	0.44	100.0%	0.4	0%
Custom-2	75	2.69	97.0%	0.4	14%
Custom-1	0	0.57	94.6%	0.4	22%
Program Total	n/a	3.70	97.0%		10.8%

Table 365: CI Custom Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	1.50	100.0%	0.4	0%
Custom-2	75	1.16	109.2%	0.4	20%
Custom-1	0	0.07	105.7%	0.4	26%
Program Total	n/a	2.73	104.0%		9.1%

Table 366: CI Custom Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-C	500	3.32	100.0%	0.4	0%
Custom-2	75	2.25	103.3%	0.4	26%
Custom-1	0	0.29	105.8%	0.4	39%
Program Total	n/a	5.86	101.5%		10.5%

S.2 NET IMPACT EVALUATION

S.2.1 Net Impact Evaluation Methodology

In PY16, Tetra Tech assessed free-ridership through participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. The customer free-ridership portion captures two components: (1) intention to carry out the energy-efficient project without program funds, and (2) influence of the program in the decision to carry out the energy-efficient project. Customer-identified influential vendors were asked a series of questions assessing the program's influence on their recommendations to the customer(s) who identified them as being influential in their decision-making process to support the free-ridership assessment. Like the customer self-report methodology, an influence component score was calculated for each influential vendor specific to each project. If the vendor's influence score is greater than the customer's score from the participant survey, the vendor score replaced the customer score in the self-report free-ridership scoring algorithm, under the rationale that the vendor's recommendation was a program-attributable factor because the vendor, in turn, was influenced by the program.

In addition to free-ridership, the NTG evaluation also assessed both participant spillover and nonparticipant spillover. Participant spillover was assessed through participant customer self-reports. Nonparticipant spillover was estimated from vendor self-report surveys at the program component level (i.e., Custom and EMNC). According to the Pennsylvania Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates. Individual free-ridership and spillover rates from the customer and vendor surveys were weighted to adjust for proportional sampling differences, non-response, and claimed energy savings to calculate overall estimates.

The following sections provide information related to the net impact evaluation effort that informs the initiative's NTG values for PY17.

S.2.2 Sampling

The sample designs for the four Rate Districts are shown in Table 367, Table 368, Table 369, and Table 370 for Met-Ed, Penelec, Penn Power, and WPP respectively. Tetra Tech attempted outreach to the census of participants but it was not possible to achieve the desired quotas due to high refusal rates and high rates of partial survey completions. It was particularly difficult to reach and garner participation of Large C/I participants, although those that installed solar panels had higher response rates. Results from all four Rate Districts were combined as a remediation measure for the low response rates.

Table 367: CI Custom Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom Non-Solar	105	7	7%
Custom Solar	97	17	18%
Program Total	202	24	12%

Table 368: CI Custom Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom Non-Solar	105	7	7%
Custom Solar	97	17	18%
Program Total	202	24	12%

Table 369: CI Custom Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom Non-Solar	105	7	7%
Custom Solar	97	17	18%
Program Total	202	24	12%

Table 370: CI Custom Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom Non-Solar	105	7	7%
Custom Solar	97	17	18%
Program Total	202	24	12%

S.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 371, Table 372, Table 373, and Table 374 for Met-Ed, Penelec, Penn Power, and WPP respectively. Solar power projects had lower NTGs than non-solar custom projects. This may be due to multiple sources of incentives, such as tax credits and accelerated depreciation, that are available for this measure.

Table 371: CI Custom Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom Non-Solar	3,686	47.2%	4.9%	57.7%	26.3%
Custom Solar	5,887	59.8%	1.1%	41.3%	15.9%
Program Total	9,573	55.0%	2.6%	47.6%	14.9%

Table 372: CI Custom Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom Non-Solar	6,666	47.2%	4.9%	57.7%	26.3%
Custom Solar	5,989	59.8%	1.1%	41.3%	15.9%
Program Total	12,655	53.2%	3.1%	49.9%	17.2%

Table 373: CI Custom Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom Non-Solar	12,359	47.2%	4.9%	57.7%	26.3%
Custom Solar	1,724	59.8%	1.1%	41.3%	15.9%
Program Total	14,083	48.8%	4.5%	55.7%	23.9%

Table 374: CI Custom Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom Non-Solar	32,577	47.2%	4.9%	57.7%	26.3%
Custom Solar	4,544	59.8%	1.1%	41.3%	15.9%
Program Total	37,121	48.8%	4.5%	55.7%	23.9%

Appendix T Evaluation Detail – Commercial and Industrial Energy Management and New Construction Initiative

T.1 GROSS IMPACT EVALUATION

The Commercial and Industrial Energy Management and New Construction (CI EMNC) initiative has six subcomponents:

- The *Building Tune-Ups* subprogram is a direct-install effort targeting small and medium-sized businesses.
- The *Custom Building Improvements* (CBI) subprogram provides incentives for envelope and equipment upgrades in existing buildings.
- The *Building Operations Certification* (BOC) subprogram provides incentives for qualified personnel to obtain BOC through a certified training program related to the efficient design, operations, and maintenance of buildings.
- The *Retro-Commissioning* (RCx) subprogram for existing buildings includes traditional and retro-commissioning projects.
- The *Virtual-Commissioning* (VCx) subprogram for existing buildings includes virtual commissioning projects.
- The *New Construction* subprogram provides design assistance, energy calculations, and incentives for efficient new construction methods and equipment.

All six subprograms had completed rebate applications in PY17.

T.1.1 Gross Impact Evaluation Methodology

Projects within the Building Tune-Ups sub-initiative are stratified into three strata, and projects within the CBI sub-initiative into two strata, according to savings. All other sub-initiatives each have one sampling stratum. Projects above 500 MWh are placed in a certainty stratum (labeled EMNC-C in tables below) and are evaluated in advance of rebate approval. Projects are sampled randomly from the population of projects for impact evaluation, with activities for each sub-initiative described below.

T.1.1.1 Building Tune-Up

Each sampled building tune-up project first undergoes a desk review. The desk review includes reconciliation of invoices with fixture or equipment specification sheets (cut sheets) and re-calculating reported savings using TRM algorithms and/or ex-ante assumptions and identifying key parameters to be researched in the M&V plan. The Building Tune-Up program is new for Phase IV. Qualus opted for on-site inspections of most sampled projects.

T.1.1.2 Commercial New Construction

Gross Impact Evaluation Activities

Qualus sampled each project for evaluation and reviewed all documents and calculations. The program ICSP, Willdan, has built a process to promote and rebate new construction projects in a uniform manner. The process uses Willdan's Net Energy Optimizer (NEO) building simulation tool to develop baseline, design, and as-built simulation models. The NEO tool is a web-based front-end for the DOE2 simulation engine. Willdan has developed additional features to NEO to facilitate modeling efficiency measures such as machine room-less elevators and efficient food-service equipment. Willdan staff develop the baseline model as well as several design options that feature various energy efficiency measures and design changes. Once the participant selects the desired efficiency features and completes building construction, Willdan staff perform either an on-site or virtual inspection, and gather data to develop the final as-built simulation model. Project documentation includes a final verification report which lists all efficiency measures and provides itemized energy savings for each measure. Qualus also requested and received access to online NEO models and DOE2 input and output files, including 8760 hourly energy simulation outputs for all sampled projects and for several projects that are in various phases of construction. If the project includes significant energy savings from lighting, Willdan provides an itemized lighting calculation.

Qualus reviewed the baseline and as-built simulation models and performed parallel calculations using TRM algorithms for sampled measures within each project. Energy savings for measures that have prescriptive counterparts in the TRM are consistent with TRM calculations, within reasonable tolerances associated with the NEO calculation representing one specific instance or application of a measure, and the TRM representing a typical application of a measure within a market segment. The NEO framework assigns baseline lighting power densities (LPDs) in a manner similar to the TRM's Appendix C lighting calculator. This appears to be a hybrid application of whole-building and space-by-space strategies. For new construction projects that are generally not dominated by savings from the lighting end-use, this is a reasonable and consistent approach. Based on the review findings, the evaluation approach is to use the simulation output unless significant variances are found for certain measures, in which case Qualus would modify the energy and demand impacts with extrinsic calculations.

As a final step, Qualus analysts determine the incremental material and labor costs. In estimating the material and labor costs, preference is given first to invoices, then to the SWE incremental cost database, and then to the cost values from the CA DEER database, then to the costs used in the EDCs' EE&C plans.

T.1.1.3 Custom Building Improvements

Building Improvement projects are varied in nature. As a result, calculation methods used for evaluation ranged from application of engineering algorithms for wall insulation and high-speed doors, to engineering models and whole building interval meter data analysis.

T.1.1.1 Retro-Commissioning and Virtual-Commissioning

Both traditional retro-commissioning and virtual commissioning projects typically involved adjustment of setpoints and operation schedules, Virtual commissioning projects were evaluated through analysis of whole-building interval meter data, while retro-commissioning projects were evaluated through the combination of engineering analysis and customer interviews.

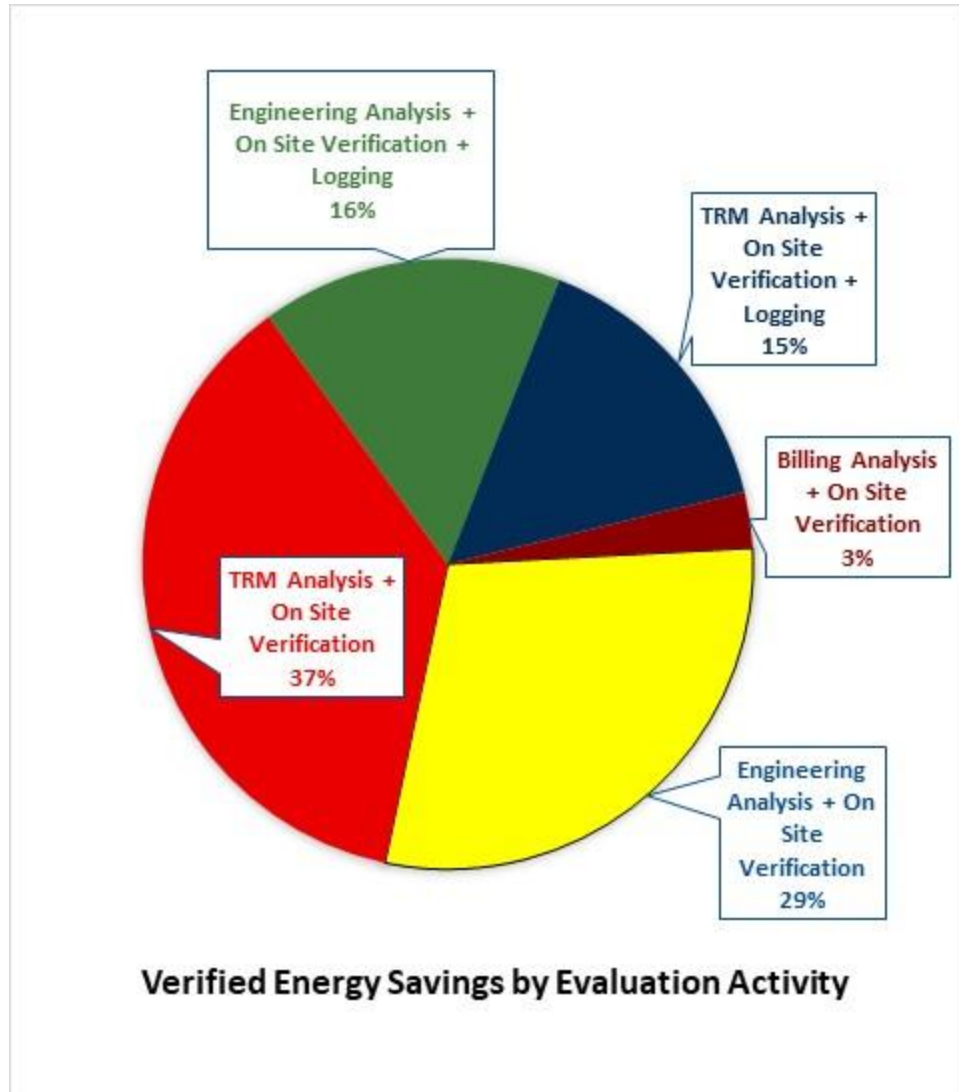
T.1.1.2 Building Operator Certification

Evaluation activities for the Building Operator Certification program component consisted of calculation reviews, verification of training completion through surveys and interviews, and verifying the building energy usage history through utility billing data. Qualus calculated verified impacts with the updated version of the interim measure protocol for the measure, dated November of 2023.

T.1.1.3 Evaluation Activities Summary

Figure 11 shows the fraction of verified energy savings, as averaged over the four PA Rate Districts, by primary evaluation activities.

Figure 11: Fraction of verified energy savings by evaluation activity.



T.1.2 Sampling

The sample designs for the four EDCs are shown in Table 375, Table 376, Table 377, and Table 378.

Table 375: CI Lighting Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-1	0	123	7	Desk Review; On-Site Verification
Building Tune-Ups-2	50	37	7	
Building Tune-Ups-3	250	0	0	
CBI-1	0	72	11	
CBI-2	200	15	4	
BOC-1	0	5	2	
RCX-1	0	0	0	
VCX-1	0	12	6	
CNC-1	0	17	5	
EMNC-C	500	9	9	
Program Total	n/a	290	51	

Table 376: CI EMNC Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-1	0	146	3	Desk Review; On-Site Verification
Building Tune-Ups-2	50	29	6	
Building Tune-Ups-3	250	1	1	
CBI-1	0	80	11	
CBI-2	200	18	9	
BOC-1	0	17	2	
RCX-1	0	2	1	
VCX-1	0	2	2	
CNC-1	0	4	2	
EMNC-C	500	10	10	
Program Total	n/a	309	47	

Table 377: CI EMNC Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-1	0	7	3	Desk Review; On-Site Verification
Building Tune-Ups-2	50	4	4	
Building Tune-Ups-3	250	0	0	
CBI-1	0	13	11	
CBI-2	200	2	2	
BOC-1	0	5	3	
RCX-1	0	1	1	
VCX-1	0	0	0	
CNC-1	0	1	1	
EMNC-C	500	1	1	
Program Total	n/a	34	26	

Table 378: CI EMNC Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Building Tune-Ups-1	0	34	2	Desk Review; On-Site Verification
Building Tune-Ups-2	50	20	8	
Building Tune-Ups-3	250	3	3	
CBI-1	0	35	12	
CBI-2	200	7	2	
BOC-1	0	9	1	
RCX-1	0	4	2	
VCX-1	0	0	0	
CNC-1	0	3	1	
EMNC-C	500	4	4	
Program Total	n/a	119	35	

T.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 379, Table 380, Table 381, and Table 382 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 12 plots the verified energy savings against the reported energy savings for all evaluated EMNC projects for the program year. The figure includes data points from all four Rate Districts and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficient of variation of 0.5, but the actual error ratios are variable stratum by stratum, but overall tend to be somewhat lower than 0.4.

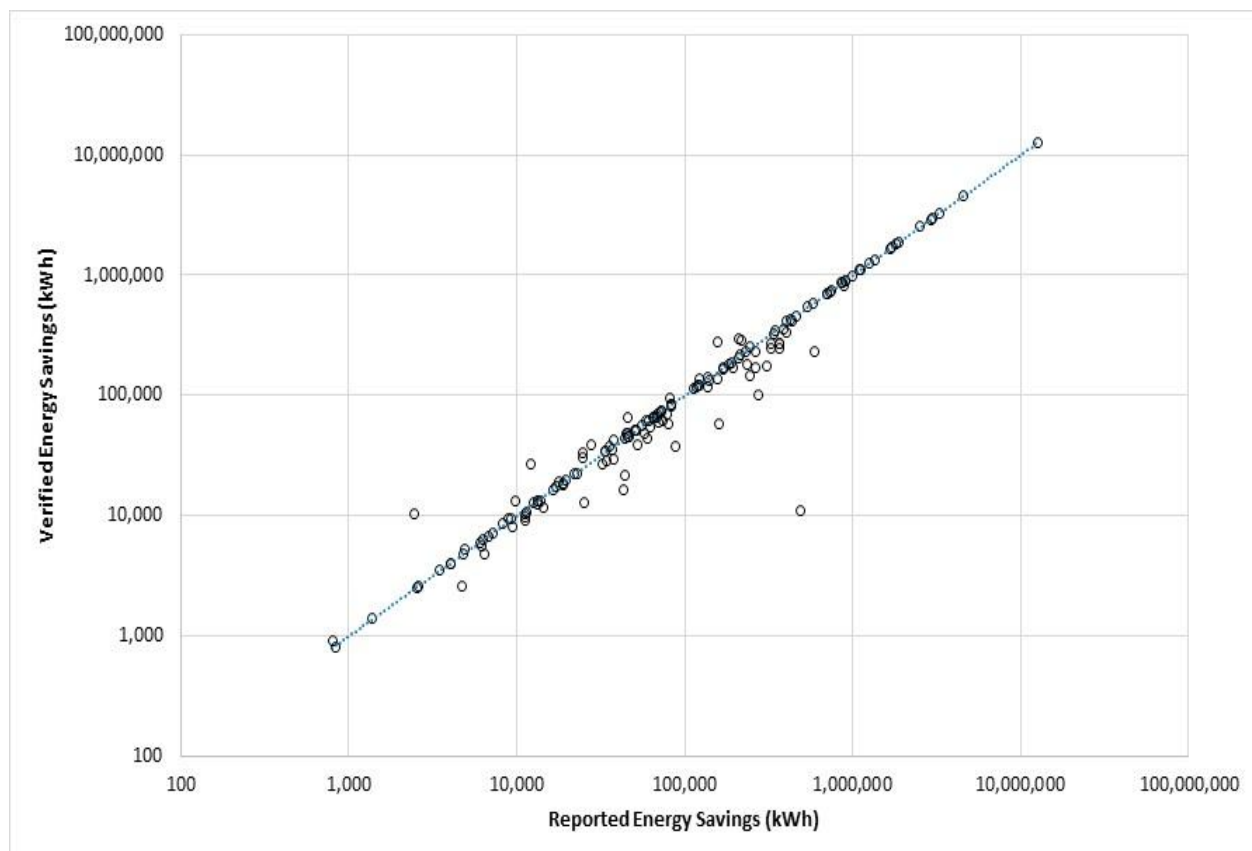


Figure 12: Verified vs. Reported Energy Savings for Sampled EMNC Projects.

Table 379: CI EMNC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-1	0	1,902	98.4%	0.4	21%
Building Tune-Ups-2	50	3,213	102.5%	0.4	20%
Building Tune-Ups-3	250	0	100.0%	0.4	0%
CBI-1	0	3,669	93.3%	0.6	24%
CBI-2	200	4,925	84.4%	0.5	31%
BOC-1	0	4,233	99.8%	0.4	32%
RCX-1	0	0	100.0%	0.4	0%
VCX-1	0	769	107.8%	0.4	17%
CNC-1	0	2,291	104.1%	0.4	22%
EMNC-C	500	12,365	100.0%	0.4	0%
Program Total	n/a	33,368	97.6%		6.8%

Table 380: CI EMNC Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-1	0	2,220	62.6%	0.4	33%
Building Tune-Ups-2	50	3,760	78.6%	0.4	21%
Building Tune-Ups-3	250	323	84.3%	0.4	0%
CBI-1	0	5,200	137.4%	0.6	24%
CBI-2	200	6,770	76.4%	0.5	17%
BOC-1	0	2,417	100.0%	0.4	38%
RCX-1	0	89	136.1%	0.4	41%
VCX-1	0	248	91.7%	0.4	0%
CNC-1	0	460	67.2%	0.4	29%
EMNC-C	500	25,009	99.8%	0.4	0%
Program Total	n/a	46,497	96.7%		5.1%

Table 381: CI EMNC Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-1	0	92	98.1%	0.4	25%
Building Tune-Ups-2	50	435	83.6%	0.4	0%
Building Tune-Ups-3	250	0	100.0%	0.4	0%
CBI-1	0	747	72.2%	0.6	10%
CBI-2	200	915	52.1%	0.5	0%
BOC-1	0	195	100.6%	0.4	21%
RCX-1	0	6	74.2%	0.4	0%
VCX-1	0	0	100.0%	0.4	0%
CNC-1	0	114	99.2%	0.4	0%
EMNC-C	500	1,246	100.0%	0.4	0%
Program Total	n/a	3,750	80.8%		2.4%

Table 382: CI EMNC Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-1	0	533	96.1%	0.4	40%
Building Tune-Ups-2	50	2,071	100.8%	0.4	16%
Building Tune-Ups-3	250	996	77.9%	0.4	0%
CBI-1	0	1,480	96.0%	0.6	20%
CBI-2	200	2,558	49.6%	0.5	43%
BOC-1	0	312	105.4%	0.4	54%
RCX-1	0	116	127.3%	0.4	29%
VCX-1	0	0	100.0%	0.4	0%
CNC-1	0	133	108.1%	0.4	47%
EMNC-C	500	7,421	100.0%	0.4	0%
Program Total	n/a	15,620	90.3%		5.3%

T.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 383, Table 384, Table 385, and Table 386 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 383: CI EMNC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-1	0	0.37	103.5%	0.4	21%
Building Tune-Ups-2	50	0.50	109.4%	0.4	20%
Building Tune-Ups-3	250	0.00	100.0%	0.4	0%
CBI-1	0	0.66	94.9%	0.6	24%
CBI-2	200	0.75	83.9%	0.5	31%
BOC-1	0	0.69	99.8%	0.4	32%
RCX-1	0	0.00	100.0%	0.4	0%
VCX-1	0	0.30	119.9%	0.4	17%
CNC-1	0	0.41	119.3%	0.4	22%
EMNC-C	500	2.07	100.0%	0.4	0%
Program Total	n/a	5.75	100.7%		6.5%

Table 384: CI EMNC Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-1	0	0.40	73.3%	0.4	33%
Building Tune-Ups-2	50	0.81	53.6%	0.4	21%
Building Tune-Ups-3	250	0.08	43.6%	0.4	0%
CBI-1	0	1.14	47.9%	0.6	24%
CBI-2	200	1.40	69.7%	0.5	17%
BOC-1	0	0.49	100.0%	0.4	38%
RCX-1	0	0.00	100.0%	0.4	41%
VCX-1	0	0.05	63.5%	0.4	0%
CNC-1	0	0.10	47.7%	0.4	29%
EMNC-C	500	3.41	99.8%	0.4	0%
Program Total	n/a	7.87	79.4%		5.0%

Table 385: CI EMNC Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-1	0	0.02	103.5%	0.4	25%
Building Tune-Ups-2	50	0.08	84.2%	0.4	0%
Building Tune-Ups-3	250	0.00	100.0%	0.4	0%
CBI-1	0	0.24	40.5%	0.6	10%
CBI-2	200	0.22	42.0%	0.5	0%
BOC-1	0	0.06	100.6%	0.4	21%
RCX-1	0	0.00	121.9%	0.4	0%
VCX-1	0	0.00	100.0%	0.4	0%
CNC-1	0	0.01	109.5%	0.4	0%
EMNC-C	500	0.17	100.0%	0.4	0%
Program Total	n/a	0.81	64.7%		3.1%

Table 386: CI EMNC Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Building Tune-Ups-1	0	0.12	93.7%	0.4	40%
Building Tune-Ups-2	50	0.32	105.0%	0.4	16%
Building Tune-Ups-3	250	0.10	108.7%	0.4	0%
CBI-1	0	0.37	91.1%	0.6	20%
CBI-2	200	0.44	100.4%	0.5	43%
BOC-1	0	0.05	105.4%	0.4	54%
RCX-1	0	0.02	138.9%	0.4	29%
VCX-1	0	0.00	100.0%	0.4	0%
CNC-1	0	0.03	89.4%	0.4	47%
EMNC-C	500	1.37	100.0%	0.4	0%
Program Total	n/a	2.83	99.8%		7.7%

T.2 NET IMPACT EVALUATION

T.2.1 Net Impact Evaluation Methodology

In PY16, Tetra Tech assessed free-ridership through participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. The customer free-ridership portion captures two components: (1) intention to carry out the energy-efficient project without program funds, and (2) influence of the program in the decision to carry out the energy-efficient project. Customer-identified influential vendors were asked a series of questions assessing the program's influence on their recommendations to the customer(s) who identified them as being influential in their decision-making process to support the free-ridership assessment. Like the customer self-report methodology, an influence component score was calculated for each influential vendor specific to each project. If the vendor's influence score is greater than the customer's score from the participant survey, the vendor score replaced the customer score in the self-report free-ridership scoring algorithm, under the rationale that the vendor's recommendation was a program-attributable factor because the vendor, in turn, was influenced by the program.

In addition to free-ridership, the NTG evaluation also assessed both participant spillover and nonparticipant spillover. Participant spillover was assessed through participant customer self-reports. Nonparticipant spillover was estimated from vendor self-report surveys at the program component level (i.e., Custom and EMNC). According to the Pennsylvania Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates. Individual free-ridership and spillover rates from the customer and vendor surveys were weighted to adjust for proportional sampling differences, non-response, and claimed energy savings to calculate overall estimates.

The following sections provide information related to the net impact evaluation effort that informs the initiative's NTG values for PY17.

T.2.2 Sampling

The PY16 study sample designs for the four Rate Districts are shown in Table 387, Table 388, Table 389, and Table 390 for Met-Ed, Penelec, Penn Power, and WPP respectively. Tetra Tech attempted outreach to the census of participants but it was not possible to achieve the desired quotas due to high refusal rates and high rates of partial survey completions. It was particularly difficult to reach and garner participation of Large C/I participants, although those that installed solar panels had higher response rates. Results from all four Rate Districts were combined as a remediation measure for the low response rates. Note that, while the MODIFY program was included in the PY16 net impact evaluation, it was not offered in PY17.

Table 387: CI EMNC Initiative Net-to-Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Building Improvements	128	46	36%
New Construction	7	1	14%
BOC	8	5	63%
Building Tune-Ups	757	68	9%
MODIFY	2,329	67	3%
Program Total	3,229	120	4%

Table 388: CI EMNC Initiative Net-to-Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Building Improvements	128	46	36%
New Construction	7	1	14%
BOC	8	5	63%
Building Tune-Ups	757	68	9%
MODIFY	2,493	69	3%
Program Total	3,393	120	4%

Table 389: CI EMNC Initiative Net-to-Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Building Improvements	128	46	36%
New Construction	7	1	14%
BOC	8	5	63%
Building Tune-Ups	757	68	9%
MODIFY	0	0	na
Program Total	900	120	13%

Table 390: CI EMNC Initiative Net-to-Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Building Improvements	128	46	36%
New Construction	7	1	14%
BOC	8	5	63%
Building Tune-Ups	757	68	9%
MODIFY	0	0	na
Program Total	900	120	13%

T.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 391, Table 392, Table 393, and Table 394 for Met-Ed, Penelec, Penn Power, and WPP respectively. In PY16, the CBI and RCx components were evaluated together for net-to-gross, and the resulting NTG is applied to both, now separate components in PY17. No VCx projects were approved in PY16, but we assign the CBI-RCx NTG values to VCx due to VCx's close similarity to RCx.

Table 391: CI EMNC Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Building Tune-Ups	5,164	25.6%	3.5%	78.0%	8.5%
BOC	4,226	15.5%	0.0%	84.5%	66.7%
RCXVCX	829	21.8%	0.3%	78.5%	19.7%
CBI	19,947	21.8%	0.3%	78.5%	8.3%
CNC	2,385	62.5%	0.0%	37.5%	8.7%
Program Total	32,552	24.5%	0.7%	76.2%	11.1%

Table 392: CI EMNC Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Building Tune-Ups	4,616	25.6%	3.5%	78.0%	8.5%
BOC	2,417	15.5%	0.0%	84.5%	66.7%
RCXVCX	350	21.8%	0.3%	78.5%	19.7%
CBI	37,265	21.8%	0.3%	78.5%	8.3%
CNC	309	62.5%	0.0%	37.5%	8.5%
Program Total	44,957	22.1%	0.6%	78.5%	8.0%

Table 393: CI EMNC Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Building Tune-Ups	454	25.6%	3.5%	78.0%	8.5%
BOC	196	15.5%	0.0%	84.5%	66.7%
RCXVCX	5	21.8%	0.3%	78.5%	19.7%
CBI	2,261	21.8%	0.3%	78.5%	8.3%
CNC	113	62.5%	0.0%	0.0%	0.0%
Program Total	3,029	23.5%	0.7%	77.3%	8.0%

Table 394: CI EMNC Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Building Tune-Ups	3,376	25.6%	3.5%	78.0%	8.5%
BOC	329	15.5%	0.0%	84.5%	66.7%
RCXVCX	148	21.8%	0.3%	78.5%	19.7%
CBI	10,110	21.8%	0.3%	78.5%	8.3%
CNC	143	62.5%	0.0%	0.0%	0.0%
Program Total	14,107	23.0%	1.0%	78.1%	6.6%

Appendix U Evaluation Detail – Commercial and Master-Metered Multifamily Direct Install Initiative

The Commercial Master-Metered Multifamily Direct Install (CI MF) Initiative targets master-metered communities that house income-qualified tenants. A participant in this program is defined as a unique address in the program, multiple projects can be installed at one address. This program consists of brief energy audits performed by CLEAResult along with energy efficiency measures directly installed in customers' dwelling units and in common areas. The audit is used to identify low-cost energy savings opportunities, with associated energy savings measures directly installed in the unit during the audit. Low-cost measures installed in PY17 included light bulbs, refrigerator replacement, nightlights, smart power strips, energy saving showerheads and aerators, LED exit signs, and common area lighting. Refrigerator replacement and lighting upgrades were the two most significant measures.

U.1 GROSS IMPACT EVALUATION

U.1.1.1 Gross Impact Evaluation Activities.

Each sampled project first undergoes a desk review. The desk review includes reconciliation of invoices with fixture or equipment specification sheets (cut sheets), re-calculating reported savings using TRM algorithms and/or ex-ante assumptions, and identifying key parameters to be researched in the M&V plan. Qualus opted for on-site inspections for about two-thirds of sampled projects, as weighted by reported savings. The following sections describe the previous evaluation activities that informed the PY17 realization rates.

U.1.2 Sampling

Table 395, Table 396, Table 397, and Table 398 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 395: CI MF Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	6	4	Desk Review, On-Site Verification.
Program Total	n/a	6	4	

Table 396: CI MF Initiative Gross Impact Sample Design for Penelec

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

Table 397: CI MF Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	2	2	Desk Review, On-Site Verification,
Program Total	n/a	2	2	

Table 398: CI MF Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Multifamily-1	750	5	5	Desk Review, On-Site Verification,
Program Total	n/a	5	5	

U.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 399, Table 400, Table 401, and Table 402 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 13 plots the verified energy savings against the reported energy savings for all projects evaluated in the program year. The figure includes data points from all four Rate Districts and is designed to show the reader the correspondence between reported and verified impacts.

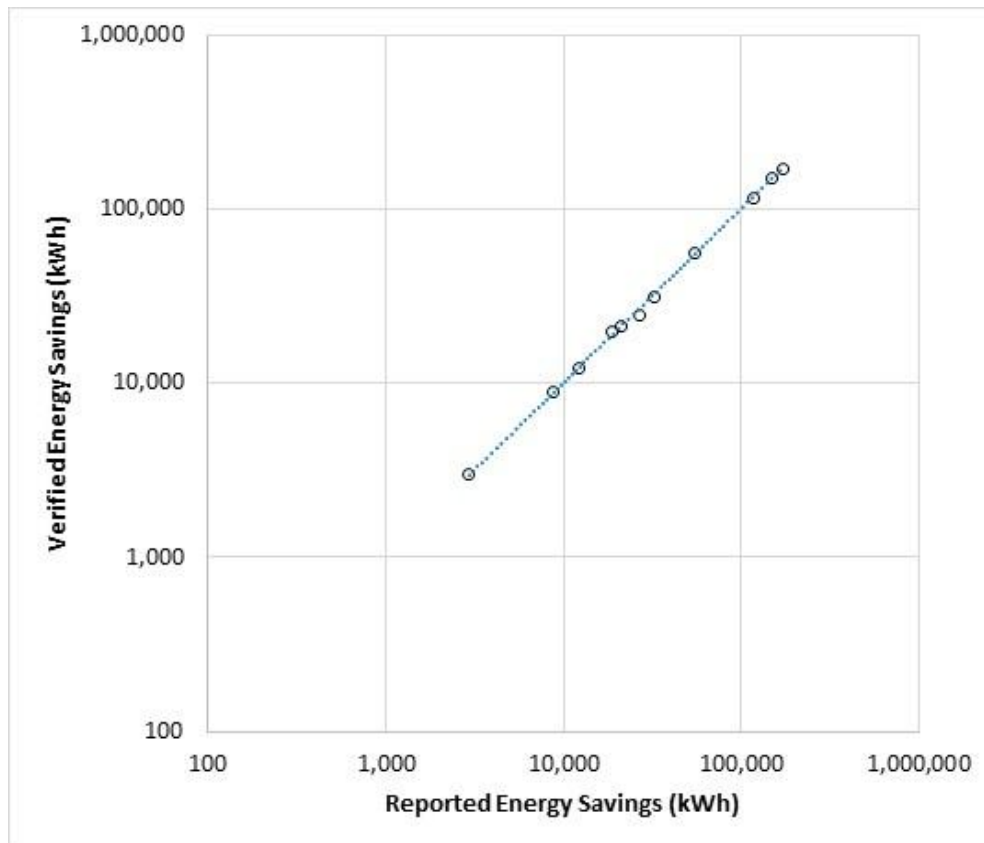
**Figure 13: Verified vs. Reported Energy Savings for Sampled Multifamily Projects.**

Table 399: CI MF Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	445	100.9%	0.5	21%
Program Total	n/a	445	100.9%		21.0%

Table 400: CI MF Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	0.0	0.0%	0.5	0%
Program Total	n/a	0	0.0%		0.0%

Table 401: CI MF Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	73	102.9%	0.5	0%
Program Total	n/a	73	102.9%		0.0%

Table 402: CI MF Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	101	96.9%	0.5	0%
Program Total	n/a	101	96.9%		0.0%

U.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 403, Table 404, Table 405, and Table 406 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 403: CI MF Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	0.07	91.1%	0.5	21%
Program Total	n/a	0.07	91.1%		18.9%

Table 404: CI MF Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	0.00	100.0%	0.5	0%
Program Total	n/a	0.00	0.0%		0.0%

Table 405: CI MF Initiative Demand Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	0.01	102.9%	0.5	0%
Program Total	n/a	0.01	102.9%		0.0%

Table 406: CI MF Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Multifamily-1	750	0.02	96.8%	0.5	0%
Program Total	n/a	0.02	96.8%		0.0%

U.2 NET IMPACT EVALUATION

Tetra Tech conducted a net impact evaluation for the CI MF initiative in PY15. The NTG evaluation relies on the survey of building owners/managers, who can report on behalf of multiple buildings because they are the decision-makers for what services and energy-saving upgrades can be provided to tenants or in common areas. Survey questions to estimate free-ridership and spillover and analysis algorithms follow the standardized self-report methodology described in the evaluation framework. Due to the small population size and a limited number of respondents, NTG ratios are estimated across the Multifamily subprograms (combining the residential and C&I components) and across Rate Districts. The population sizes, achieved sample sizes, and response rates from the study are shown in Table 214 in Appendix H.2. Although sample sizes were small – limited by the small number of distinct property managers or apartment owners – both freeridership and spillover estimates were consistently low among Rate District-specific subpopulations. A total of 14 owners/managers responded to the NTG survey (a response rate of 30.4%). The average freeridership was 0.6%, the average spillover was 0%, and the average NTG ratio was 99.5%.

Appendix V Evaluation Detail – C&I Appliance Recycling Sub-Initiative

V.1 GROSS IMPACT EVALUATION

Gross impact evaluation for the C&I Appliance Recycling sub-initiative consisted of applying realization rates from the broader initiative-level evaluation which includes the dominant residential and low-income residential components.

V.1.1 Sampling

Table 407, Table 408, Table 409, and Table 410 show sample sizes for Met-Ed, Penelec, Penn Power, and WPP respectively. A census of sites was not selected for customer surveys. Rather, tracking and reporting data were reviewed for consistency in formulation with the residential components so that the realization rates from the residential surveys could be applied. Note that the overall precision for the ATI initiative is the combined precision of the low income, non-low-income, and nonresidential components. The combined precisions for each Rate District are shown in Table 233 in Appendix J. The sample size is set to equal the population size because the main evaluation activities - reviewing tracking data and deeming realization rates from residential and low-income ATI projects - applied to the census of sites.

Table 407: C&I ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	90	90	T&R Review, Deem RR from ATI
Program Total	90	90	

Table 408: C&I ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	60	60	T&R Review, Deem RR from ATI
Program Total	60	60	

Table 409: C&I ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	0	0	T&R Review, Deem RR from ATI
Program Total	0	0	

Table 410: C&I ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
ApplianceRecycling-1	20	20	T&R Review, Deem RR from ATI
Program Total	20	20	

V.1.2 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 411, Table 412, Table 413, Table 414, and for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 411: C&I ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	85	106.8%	0.5	0.0%
Program Total	85	106.8%		0.0%

Table 412: C&I ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	52	97.9%	0.5	0.0%
Program Total	52	97.9%		0.0%

Table 413: C&I ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0	100.0%	0.5	0.0%
Program Total	0	100.0%		0.0%

Table 414: C&I ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	18	95.4%	0.5	0.0%
Program Total	18	95.4%		0.0%

V.1.3 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 415, Table 416, Table 417, and Table 418 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 415: C&I ATI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0.03	108.0%	0.5	0.0%
Program Total	0.03	108.0%		0.0%

Table 416: C&I ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0.02	112.2%	0.5	0.0%
Program Total	0.02	112.2%		0.0%

Table 417: C&I ATI Initiative Demand Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0.00	100.0%	0.5	0.0%
Program Total	0.00	100.0%		0.0%

Table 418: C&I ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ApplianceRecycling-1	0.01	111.3%	0.5	0.0%
Program Total	0.01	111.3%		0.0%

V.2 NET IMPACT EVALUATION

V.2.1 Net Impact Evaluation Methodology

An independent net impact evaluation was not conducted for this initiative because the initiative accounts for less than 0.1% of portfolio impacts, as averaged for the four PA Rate Districts. The Net-to-Gross ratios for the C&I Appliance Recycling program were taken to be the same as the Net-to-Gross ratios for the residential component of the Appliance Recycling program.

Appendix W Report Validation

W.1 LINKED IMAGES

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

Table 419: Report Update Timestamp

Tables and Charts Updated on 09/19/26, at 15:33
--