

Final Annual Report to the Pennsylvania Public Utility Commission

Phase III of Act 129

Program Year 8

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Energy Efficiency and Conservation Plan

Prepared by ADM Associates and Tetra Tech

For

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C.2	RESIDENTIAL PROGRAMS	150
C.3	RESIDENTIAL LOW-INCOME PROGRAM DIRECT INSTALL.....	154
APPENDIX D	EVALUATION DETAIL – RESIDENTIAL APPLIANCE TURN-IN INITIATIVE.....	162
D.1	GROSS IMPACT EVALUATION	162
D.2	NET IMPACT EVALUATION.....	167
APPENDIX E	EVALUATION DETAIL – EE KITS INITIATIVE	169
E.1	GROSS IMPACT EVALUATION	169
E.2	NET IMPACT EVALUATION.....	177
APPENDIX F	HOME ENERGY REPORTS IMPACT EVALUATION DETAIL	179
F.1	GROSS IMPACT EVALUATION	179
kWhimy	183	
APPENDIX G	EVALUATION DETAIL – RESIDENTIAL DIRECT INSTALL INITIATIVE.....	190
G.1	GROSS IMPACT EVALUATION	190
G.2	NET IMPACT EVALUATION.....	195
APPENDIX H	– RESIDENTIAL NEW CONSTRUCTION INITIATIVE	196
H.1	GROSS IMPACT EVALUATION	196
H.2	NET IMPACT EVALUATION.....	200
APPENDIX I	EVALUATION DETAIL – RESIDENTIAL UPSTREAM LIGHTING INITIATIVE	201
I.1	GROSS IMPACT EVALUATION	201
I.2	NET IMPACT EVALUATION.....	207
APPENDIX J	EVALUATION DETAIL – RESIDENTIAL UPSTREAM ELECTRONICS INITIATIVE...209	
J.1	GROSS IMPACT EVALUATION	209
J.2	NET IMPACT EVALUATION.....	213
APPENDIX K	EVALUATION DETAIL – RESIDENTIAL HVAC INITIATIVE	214
K.1	GROSS IMPACT EVALUATION	214
K.2	NET IMPACT EVALUATION.....	223
APPENDIX L	EVALUATION DETAIL – RESIDENTIAL APPLIANCES AND LI RESIDENTIAL APPLIANCES INITIATIVES	225
L.1	GROSS IMPACT EVALUATION	225
L.2	NET IMPACT EVALUATION.....	236
APPENDIX M	EVALUATION DETAIL – LOW INCOME RESIDENTIAL APPLIANCE TURN-IN INITIATIVE.....	238
M.1	GROSS IMPACT EVALUATION	238

M.2	NET IMPACT EVALUATION.....	242
APPENDIX N	– RESIDENTIAL LOW-INCOME DIRECT INSTALL INITIATIVE.....	243
N.1	GROSS IMPACT EVALUATION	243
N.2	NET IMPACT EVALUATION.....	248
APPENDIX O	EVALUATION DETAIL – LI EE KITS INITIATIVE	249
O.1	GROSS IMPACT EVALUATION	249
O.2	NET IMPACT EVALUATION.....	255
APPENDIX P	EVALUATION DETAIL – COMMERCIAL AND INDUSTRIAL LIGHTING INITIATIVE.....	256
P.1	GROSS IMPACT EVALUATION	256
P.2	NET IMPACT EVALUATION.....	262
APPENDIX Q	EVALUATION DETAIL – COMMERCIAL AND INDUSTRIAL CUSTOM INITIATIVE.....	265
Q.1	GROSS IMPACT EVALUATION	265
Q.2	NET IMPACT EVALUATION.....	272
APPENDIX R	EVALUATION DETAIL – COMMERCIAL AND INDUSTRIAL PRESCRIPTIVE INITIATIVE	275
R.1	GROSS IMPACT EVALUATION	275
R.2	NET IMPACT EVALUATION.....	280
APPENDIX S	EVALUATION DETAIL – COMMERCIAL AND INDUSTRIAL DIRECT INSTALL INITIATIVE.....	282
S.1	GROSS IMPACT EVALUATION	282
S.2	NET IMPACT EVALUATION.....	282
APPENDIX T	EVALUATION DETAIL – C&I APPLIANCE TURN-IN INITIATIVE	283
T.1	GROSS IMPACT EVALUATION	283
T.2	NET IMPACT EVALUATION.....	286
APPENDIX U	EVALUATION DETAIL – COMMERCIAL AND INDUSTRIAL DIRECT INSTALL INITIATIVE.....	287
U.1	GROSS IMPACT EVALUATION	287
U.2	NET IMPACT EVALUATION.....	287

Figures

FIGURE 1: CARRYOVER SAVINGS FROM PHASE II OF ACT 129	19
FIGURE 2: LOW-INCOME CARRYOVER FROM PHASE II	20
FIGURE 3: GNI CARRYOVER FROM PHASE II	20
FIGURE 4: EE&C PLAN PERFORMANCE TOWARD PHASE III PORTFOLIO COMPLIANCE TARGET.....	22

FIGURE 5: EE&C PLAN PERFORMANCE TOWARD PHASE III LOW-INCOME COMPLIANCE TARGET	23
FIGURE 6: EE&C PLAN PERFORMANCE AGAINST PHASE III GNI COMPLIANCE TARGET	24
FIGURE 7: PYTD ENERGY SAVINGS BY PROGRAM FOR MET-ED	32
FIGURE 8: PYTD ENERGY SAVINGS BY PROGRAM FOR PENELEC	32
FIGURE 9: PYTD ENERGY SAVINGS BY PROGRAM FOR PENN POWER	33
FIGURE 10: PYTD ENERGY SAVINGS BY PROGRAM FOR WPP	33
FIGURE 11: P3TD ENERGY SAVINGS BY PROGRAM FOR MET-ED	34
FIGURE 12: P3TD ENERGY SAVINGS BY PROGRAM FOR PENELEC	34
FIGURE 13: P3TD ENERGY SAVINGS BY PROGRAM FOR PENN POWER	35
FIGURE 14: P3TD ENERGY SAVINGS BY PROGRAM FOR WPP	35
FIGURE 15: PYTD DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR MET-ED	40
FIGURE 16: PYTD DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR PENELEC	40
FIGURE 17: PYTD DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR PENN POWER	41
FIGURE 18: PYTD DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR WPP	41
FIGURE 19: P3TD DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR MET-ED	42
FIGURE 20: P3TD DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR PENELEC	42
FIGURE 21: P3TD DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR PENN POWER	43
FIGURE 22: P3TD DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR WPP	43
FIGURE 23: EVALUATION ACTIVITY MATRIX	62
FIGURE 24: ISR VS. SURVEY LAG FOR KIT COMPONENTS	171
FIGURE 25 – REALIZATION RATES VS. KIT TYPE AND SURVEY MODE	172
FIGURE 26: SURVEY RESPONSE RATES AND REPORTED KIT NON-RECEIPT RATES BY INCOME QUALIFICATION AND SURVEY MODE.	172
FIGURE 27: ISRs BY MEASURE FOR NON-LI AND LI KITS.	249
FIGURE 28: REPORTED INCOME BRACKETS FOR LI AND NON-LI EE KIT RECIPIENTS	251
FIGURE 29: REPORTED INCOME BRACKETS FOR LI AND NON-LI SCHOOL KIT RECIPIENTS	252
FIGURE 30 – FRACTION OF VERIFIED ENERGY SAVINGS BY EVALUATION ACTIVITY	257
FIGURE 31: VERIFIED VS. REPORTED ENERGY SAVINGS FOR SAMPLED LIGHTING PROJECTS.	260
FIGURE 32 – FRACTION OF VERIFIED ENERGY SAVINGS BY EVALUATION ACTIVITY	266
FIGURE 33: VERIFIED VS. REPORTED ENERGY SAVINGS FOR SAMPLED CUSTOM PROJECTS	269
FIGURE 34: VERIFIED VS. REPORTED ENERGY SAVINGS FOR SAMPLED CUSTOM PROJECTS	277

Tables

TABLE 1: CARRYOVER SAVINGS FROM PHASE II	19
TABLE 2: GROSS REPORTED AND VERIFIED ELECTRIC AND DEMAND SAVINGS FOR PY8	21
TABLE 3: GROSS REPORTED AND VERIFIED ELECTRIC AND DEMAND SAVINGS SINCE THE BEGINNING OF PHASE III OF ACT 129	21
TABLE 4: PHASE III ELECTRIC SAVINGS INCLUDING PHASE II CARRYOVER	21
TABLE 5: PROPORTION OF MEASURES OFFERED TO LOW-INCOME CUSTOMERS	22
TABLE 6: LOW-INCOME PROGRAM ENERGY SAVINGS AND TARGETS	23
TABLE 7: GNI SAVINGS AND TARGETS	24
TABLE 8: PROGRAM YEAR 8 SUMMARY STATISTICS BY CUSTOMER SEGMENT	26

TABLE 9: PHASE III SUMMARY STATISTICS BY CUSTOMER SEGMENT	27
TABLE 10: EE&C PORTFOLIO PARTICIPATION BY PROGRAM	29
TABLE 11: IMPACT EVALUATION RESULTS SUMMARY FOR MET-ED AND PENELEC.....	30
TABLE 12: IMPACT EVALUATION RESULTS SUMMARY FOR PENN POWER AND WPP	30
TABLE 13: HIGH-IMPACT MEASURE NET-TO-GROSS FOR MET-ED AND PENELEC.....	31
TABLE 14: HIGH-IMPACT MEASURE NET-TO-GROSS FOR PENN POWER AND WPP	31
TABLE 15: INCREMENTAL ANNUAL ENERGY SAVINGS BY PROGRAM - MET-ED	36
TABLE 16: INCREMENTAL ANNUAL ENERGY SAVINGS BY PROGRAM - PENELEC.....	36
TABLE 17: INCREMENTAL ANNUAL ENERGY SAVINGS BY PROGRAM – PENN POWER	36
TABLE 18: INCREMENTAL ANNUAL ENERGY SAVINGS BY PROGRAM - WPP.....	37
TABLE 19: LIFETIME ENERGY SAVINGS BY PROGRAM FOR MET-ED.....	38
TABLE 20: LIFETIME ENERGY SAVINGS BY PROGRAM FOR PENELEC.....	38
TABLE 21: LIFETIME ENERGY SAVINGS BY PROGRAM FOR PENN POWER	38
TABLE 22: LIFETIME ENERGY SAVINGS BY PROGRAM FOR WPP.....	39
TABLE 23: PEAK DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR MET-ED	44
TABLE 24: PEAK DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR PENELEC.....	44
TABLE 25: PEAK DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR PENN POWER	44
TABLE 26: PEAK DEMAND SAVINGS BY ENERGY EFFICIENCY PROGRAM FOR WPP.....	45
TABLE 27: LINE LOSS MULTIPLIERS BY EDC AND CUSTOMER SECTOR	45
TABLE 28: VERIFIED GROSS DEMAND RESPONSE IMPACTS BY PROGRAM.....	46
TABLE 29: FUEL SWITCHING SUMMARY	46
TABLE 30 – PORTFOLIO TRC WITH AND WITHOUT DUAL BASELINE CALCULATIONS	47
TABLE 31: PY8 GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR MET-ED	48
TABLE 32: PY8 GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR PENELEC	48
TABLE 33: PY8 GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR PENN POWER.....	49
TABLE 34: PY8 GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR WPP	49
TABLE 35: PY8 NET TRC RATIOS BY PROGRAM (\$1,000) FOR MET-ED.....	50
TABLE 36: PY8 NET TRC RATIOS BY PROGRAM (\$1,000) FOR PENELEC	50
TABLE 37: PY8 NET TRC RATIOS BY PROGRAM (\$1,000) FOR PENN POWER.....	51
TABLE 38: PY8 NET TRC RATIOS BY PROGRAM (\$1,000) FOR WPP	51
TABLE 39: P3TD GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR MET-ED.....	52
TABLE 40: P3TD GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR PENELEC	52
TABLE 41: P3TD GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR PENN POWER	53
TABLE 42: P3TD GROSS TRC RATIOS BY PROGRAM (\$1,000) FOR WPP	53
TABLE 43: P3TD NET TRC RATIOS BY PROGRAM (\$1,000) FOR MET-ED.....	54
TABLE 44: P3TD NET TRC RATIOS BY PROGRAM (\$1,000) FOR PENELEC.....	54
TABLE 45: P3TD NET TRC RATIOS BY PROGRAM (\$1,000) FOR PENN POWER	55
TABLE 46: P3TD NET TRC RATIOS BY PROGRAM (\$1,000) FOR WPP.....	55
TABLE 47: COMPARISON OF P3TD EXPENDITURES TO EE&C PLAN (\$1,000) MET-ED.....	56
TABLE 48: COMPARISON OF P3TD EXPENDITURES TO EE&C PLAN (\$1,000) PENELEC.....	56
TABLE 49: COMPARISON OF P3TD EXPENDITURES TO EE&C PLAN (\$1,000) PENN POWER	56
TABLE 50: COMPARISON OF P3TD EXPENDITURES TO EE&C PLAN (\$1,000) WPP.....	57
TABLE 51: COMPARISON OF PHASE III ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PHASE III FOR MET-Ed	57

TABLE 52: COMPARISON OF PHASE III ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PHASE III FOR PENELEC	58
TABLE 53: COMPARISON OF PHASE III ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PHASE III FOR PENN POWER.....	58
TABLE 54: COMPARISON OF PHASE III ACTUAL PROGRAM SAVINGS TO EE&C PLAN PROJECTIONS FOR PHASE III FOR WPP	58
TABLE 55: SUMMARY OF EVALUATION RECOMMENDATIONS	61
TABLE 56: APPLIANCE TURN-IN PROGRAM PARTICIPATION AND REPORTED IMPACTS	63
TABLE 57: APPLIANCE TURN-IN PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY8.....	63
TABLE 58: APPLIANCE TURN-IN PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY8	64
TABLE 59: PYTD AND P3TD SAVINGS SUMMARY	64
TABLE 60: ATI PROGRAM PROCESS EVALUATION SAMPLE DESIGN	65
TABLE 61: SUMMARY OF PROGRAM FINANCES – MET-ED.....	66
TABLE 62: SUMMARY OF PROGRAM FINANCES – PENELEC.....	67
TABLE 63: SUMMARY OF PROGRAM FINANCES – PENN POWER	68
TABLE 64: SUMMARY OF PROGRAM FINANCES – WPP.....	69
TABLE 65: EEH PROGRAM PARTICIPATION AND REPORTED IMPACTS	72
TABLE 66: EEH PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY8	73
TABLE 67: EEH PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY8.....	74
TABLE 68: PYTD AND P3TD SAVINGS SUMMARY	75
TABLE 69: EEH PROGRAM PROCESS EVALUATION SAMPLE DESIGN	75
TABLE 70: SUMMARY OF PROGRAM FINANCES – MET-ED.....	77
TABLE 71: SUMMARY OF PROGRAM FINANCES – PENELEC.....	78
TABLE 72: SUMMARY OF PROGRAM FINANCES – PENN POWER	79
TABLE 73: SUMMARY OF PROGRAM FINANCES – WPP.....	80
TABLE 74: EEP PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR MET-ED	83
TABLE 75: EEP PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR PENELEC.....	84
TABLE 76: EEP PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR PENN POWER	84
TABLE 77: EEP PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR WPP	84
TABLE 78: EEP PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY8	85
TABLE 79: EEP PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY8.....	86
TABLE 80: PYTD AND P3TD SAVINGS SUMMARY	86
TABLE 81: EEP PROGRAM PROCESS EVALUATION SAMPLE DESIGN.....	87
TABLE 82 – ENERGY EFFICIENT PRODUCTS PROGRAM TRC WITH AND WITHOUT DUAL BASELINE CALCULATIONS.....	88
TABLE 83: SUMMARY OF PROGRAM FINANCES – MET-ED.....	89
TABLE 84: SUMMARY OF PROGRAM FINANCES – PENELEC.....	90
TABLE 85: SUMMARY OF PROGRAM FINANCES – PENN POWER	91
TABLE 86: SUMMARY OF PROGRAM FINANCES – WPP.....	92
TABLE 87: LIEEP PARTICIPATION AND REPORTED IMPACTS.....	97
TABLE 88: LIEEP GROSS IMPACT EVALUATION SUMMARY FOR PY8	98
TABLE 89: PYTD AND P3TD SAVINGS SUMMARY	99
TABLE 90: LIP PROGRAM PROCESS EVALUATION SAMPLE DESIGN	99
TABLE 91: SUMMARY OF PROGRAM FINANCES – MET-ED.....	100

TABLE 92: SUMMARY OF PROGRAM FINANCES – PENELEC.....	101
TABLE 93: SUMMARY OF PROGRAM FINANCES – PENN POWER	102
TABLE 94: SUMMARY OF PROGRAM FINANCES – WPP.....	103
TABLE 95: ESB-SMALL PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR MET-ED AND PENELEC.....	105
TABLE 96: ESB-SMALL PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR PENN POWER AND WPP.....	105
TABLE 97: ESB-SMALL PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY8	106
TABLE 98: ESB-SMALL PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY8	107
TABLE 99: PYTD AND P3TD SAVINGS SUMMARY	108
TABLE 100: ESB-SMALL PROGRAM PROCESS EVALUATION SAMPLE DESIGN	109
TABLE 101: SUMMARY OF PROGRAM FINANCES – MET-ED.....	110
TABLE 102: SUMMARY OF PROGRAM FINANCES – PENELEC.....	111
TABLE 103: SUMMARY OF PROGRAM FINANCES – PENN POWER	112
TABLE 104: SUMMARY OF PROGRAM FINANCES – WPP.....	113
TABLE 105: ESB-LARGE PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR MET-ED AND PENELEC.....	116
TABLE 106: ESB-LARGE PROGRAM PARTICIPATION AND REPORTED IMPACTS FOR PENN POWER AND WPP.....	116
TABLE 107: ESB-LARGE PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY8	117
TABLE 108: ESB-LARGE PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY8	118
TABLE 109: PYTD AND P3TD SAVINGS SUMMARY	118
TABLE 110: SUMMARY OF PROGRAM FINANCES – MET-ED.....	120
TABLE 111: SUMMARY OF PROGRAM FINANCES – PENELEC.....	121
TABLE 112: SUMMARY OF PROGRAM FINANCES – PENN POWER	122
TABLE 113: SUMMARY OF PROGRAM FINANCES – WPP.....	123
TABLE 114: GAIT PROGRAM PARTICIPATION AND REPORTED IMPACTS	124
TABLE 115: GAIT PROGRAM GROSS IMPACT EVALUATION SUMMARY FOR PY8.....	125
TABLE 116: GAIT PROGRAM NET IMPACT EVALUATION SUMMARY FOR PY8.....	126
TABLE 117: PYTD AND P3TD SAVINGS SUMMARY	126
TABLE 118: SUMMARY OF PROGRAM FINANCES – MET-ED.....	128
TABLE 119: SUMMARY OF PROGRAM FINANCES – PENELEC.....	129
TABLE 120: SUMMARY OF PROGRAM FINANCES – PENN POWER	130
TABLE 121: SUMMARY OF PROGRAM FINANCES – WPP.....	131
TABLE 122: SUMMARY OF FINANCES FOR C&I DEMAND RESPONSE PROGRAM – SMALL – MET-ED.....	133
TABLE 123: SUMMARY OF FINANCES FOR C&I DEMAND RESPONSE PROGRAM – SMALL – PENN POWER	134
TABLE 124: SUMMARY OF FINANCES FOR C&I DEMAND RESPONSE PROGRAM – SMALL – WPP.....	135
TABLE 125: SUMMARY OF FINANCES FOR C&I DEMAND RESPONSE PROGRAM – LARGE – MET-ED.....	137
TABLE 126: SUMMARY OF FINANCES FOR C&I DEMAND RESPONSE PROGRAM – LARGE – PENN POWER	138

TABLE 127: SUMMARY OF FINANCES FOR C&I DEMAND RESPONSE PROGRAM – LARGE – WPP	139
TABLE 128: MET-ED EE&C EXPENDITURES BY COST-RECOVERY CATEGORY (\$1,000)	140
TABLE 129: PENELEC EE&C EXPENDITURES BY COST-RECOVERY CATEGORY (\$1,000)	141
TABLE 130: PENN POWER EE&C EXPENDITURES BY COST-RECOVERY CATEGORY (\$1,000)	141
TABLE 131: WPP EE&C EXPENDITURES BY COST-RECOVERY CATEGORY (\$1,000)	142
TABLE 132: UPSTREAM LIGHTING FUNDING ALLOCATION BETWEEN PROGRAMS	144
TABLE 133: PY8 SITE VISIT SUMMARY	145
TABLE 134: ASSIGNMENT OF MEASURES TO INITIATIVES FOR NONRESIDENTIAL PROGRAMS	146
TABLE 135: ASSIGNMENT OF MEASURES TO INITIATIVES FOR RESIDENTIAL PROGRAMS	150
TABLE 136: DATA SOURCES FOR THE ATI INITIATIVE GROSS IMPACT EVALUATION	162
TABLE 137: ATI INITIATIVE GROSS IMPACT EVALUATION SURVEY MODE COMPARISON	163
TABLE 138: ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED	163
TABLE 139: ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	163
TABLE 140: ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	164
TABLE 141: ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	164
TABLE 142: ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED	164
TABLE 143: ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	164
TABLE 144: ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER	165
TABLE 145: ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	165
TABLE 146: ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED	165
TABLE 147: ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	166
TABLE 148: ATI INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	166
TABLE 149: ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	166
TABLE 150: ATI INITIATIVE NET TO GROSS SAMPLING FOR MET-ED	167
TABLE 151: ATI INITIATIVE NET TO GROSS SAMPLING FOR PENELEC	167
TABLE 152: ATI INITIATIVE NET TO GROSS SAMPLING FOR PENN POWER	168
TABLE 153: ATI INITIATIVE NET TO GROSS SAMPLING FOR WPP	168
TABLE 154: ATI INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED	168
TABLE 155: ATI INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC	168
TABLE 156: ATI INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER	168
TABLE 157: ATI INITIATIVE NET-TO-GROSS RESULTS FOR WPP	168
TABLE 158: EE KITS INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED	173
TABLE 159: EE KITS INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	173
TABLE 160: EE KITS INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	173
TABLE 161: EE KITS INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	173
TABLE 162: EE KITS INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED	174
TABLE 163: EE KITS INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	174
TABLE 164: EE KITS INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER	174
TABLE 165: EE KITS INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	174
TABLE 166: EE KITS INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED	175
TABLE 167: EE KITS INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	175
TABLE 168: EE KITS INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	175
TABLE 169: EE KITS INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	176

TABLE 170: EE KITS INITIATIVE NET TO GROSS SAMPLING FOR MET-ED.....	177
TABLE 171: EE KITS INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED.....	178
TABLE 172: DEFINITION OF INPUTS FOR ADJUSTED USAGE CALCULATION.....	180
TABLE 173: DEFINITION OF INPUTS FOR MONTHLY USAGE CALCULATION.....	182
TABLE 174: DEFINITION OF VARIABLES IN THE LAGGED SEASONAL REGRESSION MODEL.....	183
TABLE 175: ADJUSTMENT FACTORS FOR DUAL PARTICIPATION IN UPSTREAM PROGRAMS.....	184
TABLE 176: DEFINITION OF VARIABLES FOR KWH SAVINGS CALCULATION.....	185
TABLE 177: DUAL PARTICIPATION CORRECTION RESULTS BY EDC AND PARTICIPATION WAVE.....	185
TABLE 178 – PY8 PARTICIPATION BILL COUNTS BY MONTH AND COHORT.....	187
TABLE 179: VERIFIED ENERGY SAVINGS AND ABSOLUTE PRECISIONS BY EDC AND WAVE.....	189
TABLE 180: DEMAND REPORTED AND VERIFIED DEMAND REDUCTIONS FOR THE HER INITIATIVE.....	189
TABLE 181: DATA SOURCES FOR THE ATI INITIATIVE GROSS IMPACT EVALUATION.....	192
TABLE 182: RES DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED.....	193
TABLE 183: RES DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	193
TABLE 184: RES DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	193
TABLE 185: RES DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	193
TABLE 186: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	193
TABLE 187: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	194
TABLE 188: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	194
TABLE 189: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP.....	194
TABLE 190: RES DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED.....	194
TABLE 191: RES DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	195
TABLE 192: RES DI INITIATIVE GROSS REALIZATION RATES FOR PENN POWER.....	195
TABLE 193: RES DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	195
TABLE 194: RES NC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED.....	198
TABLE 195: RES NC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	198
TABLE 196: RES NC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	198
TABLE 197: RES NC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	199
TABLE 198: RES NC INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	199
TABLE 199: RES NC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	199
TABLE 200: RES NC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	199
TABLE 201: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP.....	199
TABLE 202: RES NC INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED.....	200
TABLE 203: RES NC INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	200
TABLE 204: RES NC INITIATIVE GROSS REALIZATION RATES FOR PENN POWER.....	200
TABLE 205: RES NC INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	200
TABLE 206: MAPPING OF CROSS SECTOR SALES SURVEY RESPONSES TO TRM BUILDING TYPES AND GNI STATUS.....	203
TABLE 207: HOU, CF, IF, AND OVERALL WEIGHTING FOR CROSS-SECTOR SALES.....	204
TABLE 208: DETERMINATION OF THE FRACTION OF LAMPS IN CONDITIONED SPACE BY EDC.....	204
TABLE 209: ORIGINAL AND ADJUSTED ENERGY AND DEMAND INTERACTIVE EFFECTS BY EDC.....	205
TABLE 210: DATA SOURCES FOR THE ATI INITIATIVE GROSS IMPACT EVALUATION.....	205

TABLE 211: GROSS IMPACT SAMPLE DESIGN FOR THE UPSTREAM LIGHTING INITIATIVE.....	206
TABLE 212: UPSTREAM LIGHTING INITIATIVE ENERGY GROSS REALIZATION RATES.....	206
TABLE 213: UPSTREAM LIGHTING INITIATIVE DEMAND GROSS REALIZATION	206
TABLE 214: UPSTREAM LIGHTING INITIATIVE NET TO GROSS SAMPLING.....	208
TABLE 215: UPSTREAM LIGHTING INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED.....	208
TABLE 216: UPSTREAM ELECTRONICS INITIATIVE SAMPLE DESIGN	210
TABLE 217: UPSTREAM ELECTRONICS INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	210
TABLE 218: UPSTREAM ELECTRONICS INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	211
TABLE 219: UPSTREAM ELECTRONICS INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER	211
TABLE 220: UPSTREAM ELECTRONICS INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	211
TABLE 221: UPSTREAM ELECTRONICS INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED.....	212
TABLE 222: UPSTREAM ELECTRONICS INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	212
TABLE 223: UPSTREAM ELECTRONICS INITIATIVE GROSS REALIZATION RATES FOR PENN POWER.....	212
TABLE 224: UPSTREAM ELECTRONICS INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	213
TABLE 225: DATA SOURCES FOR THE RES HVAC INITIATIVE GROSS IMPACT EVALUATION.....	215
TABLE 226: RES HVAC INITIATIVE GROSS IMPACT EVALUATION SURVEY MODE COMPARISON.....	216
TABLE 227: RES HVAC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED.....	218
TABLE 228: RES HVAC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	219
TABLE 229: RES HVAC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	219
TABLE 230: RES HVAC INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	219
TABLE 231: RES HVAC INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED	220
TABLE 232: RES HVAC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	220
TABLE 233: RES HVAC INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER	220
TABLE 234: RES HVAC INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP.....	221
TABLE 235: RES HVAC INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED.....	221
TABLE 236: RES HVAC INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC	221
TABLE 237: RES HVAC INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	222
TABLE 238: RES HVAC INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	222
TABLE 239: RES HVAC INITIATIVE NET TO GROSS SAMPLING FOR MET-ED	223
TABLE 240: RES HVAC INITIATIVE NET TO GROSS SAMPLING FOR PENELEC	223
TABLE 241: RES HVAC INITIATIVE NET TO GROSS SAMPLING FOR PENN POWER.....	223
TABLE 242: RES HVAC INITIATIVE NET TO GROSS SAMPLING FOR WPP	223
TABLE 243: RES HVAC INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED	224
TABLE 244: RES HVAC INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC	224
TABLE 245 RES HVAC INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER	224

TABLE 246 RES HVAC INITIATIVE NET-TO-GROSS RESULTS FOR WPP	224
TABLE 247: DATA SOURCES FOR THE RES APPLIANCES INITIATIVE GROSS IMPACT EVALUATION.....	226
TABLE 248: RES APPLIANCES INITIATIVE GROSS IMPACT EVALUATION SURVEY MODE COMPARISON.....	227
TABLE 249: RES APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED.....	227
TABLE 250: RES APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	227
TABLE 251: RES APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	228
TABLE 252: RES APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	228
TABLE 253: RES LI APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED.....	228
TABLE 254: RES LI APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	229
TABLE 255: RES LI APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	229
TABLE 256: RES LI APPLIANCES INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	229
TABLE 257: RES APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	230
TABLE 258: RES APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	230
TABLE 259: RES APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	230
TABLE 260: RES APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	231
TABLE 261: RES LI APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED	231
TABLE 262: RES LI APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	231
TABLE 263: RES LI APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	232
TABLE 264: RES LI APPLIANCES INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	232
TABLE 265: RES APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED.....	232
TABLE 266: RES APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	233
TABLE 267: RES APPLIANCES INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	233
TABLE 268: RES APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	233
TABLE 269: RES LI APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED	234
TABLE 270: RES LI APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	234
TABLE 271: RES LI APPLIANCES INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	234
TABLE 272: RES LI APPLIANCES INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	235
TABLE 273: RES APPLIANCES INITIATIVE NET TO GROSS SAMPLING FOR MET-ED	236
TABLE 274: RES APPLIANCES INITIATIVE NET TO GROSS SAMPLING FOR PENELEC	236
TABLE 275: RES APPLIANCES INITIATIVE NET TO GROSS SAMPLING FOR PENN POWER.....	236
TABLE 276: RES APPLIANCES INITIATIVE NET TO GROSS SAMPLING FOR WPP	236
TABLE 277: RES APPLIANCES INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED	237
TABLE 278: RES APPLIANCES INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC	237

TABLE 279 RES APPLIANCES INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER	237
TABLE 280 RES APPLIANCES INITIATIVE NET-TO-GROSS RESULTS FOR WPP	237
TABLE 281: DATA SOURCES FOR THE LI ATI INITIATIVE GROSS IMPACT EVALUATION	238
TABLE 282: LI ATI INITIATIVE GROSS IMPACT EVALUATION SURVEY MODE COMPARISON	239
TABLE 283: LI ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED	239
TABLE 284: LI ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	239
TABLE 285: LI ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	240
TABLE 286: LI ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	240
TABLE 287: LI ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	240
TABLE 288: LI ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	240
TABLE 289: LI ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	241
TABLE 290: LI ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	241
TABLE 291: LI ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED	241
TABLE 292: LI ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	242
TABLE 293: LI ATI INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	242
TABLE 294: LI ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	242
TABLE 295: LI DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED	245
TABLE 296: LI DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	245
TABLE 297: LI DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	246
TABLE 298: LI DI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	246
TABLE 299: LI DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	246
TABLE 300: LI DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	246
TABLE 301: LI DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	247
TABLE 302: RES DI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	247
TABLE 303: LI DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED	247
TABLE 304: LI DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	247
TABLE 305: LI DI INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	248
TABLE 306: LI DI INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	248
TABLE 307: LI EE KITS INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED	250
TABLE 308: LI EE KITS INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	250
TABLE 309: LI EE KITS INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	250
TABLE 310: LI EE KITS INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	250
TABLE 311 – LOW INCOME FRACTIONS DETERMINED FROM PA DEPT. OF EDUCATION DATA	253
TABLE 312 – DETAILED COMPARISON OF REPORTED AND VERIFIED IMPACTS FOR THE SCHOOL EDUCATION KITS PROGRAM.....	253
TABLE 313: EE KITS INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	254
TABLE 314: EE KITS INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	254
TABLE 315: EE KITS INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	254
TABLE 316: EE KITS INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	254
TABLE 317: EE KITS INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED	255
TABLE 318: EE KITS INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	255
TABLE 319: EE KITS INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	255
TABLE 320: EE KITS INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	255
TABLE 321: CI LIGHTING INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED	258

TABLE 322: CI LIGHTING INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	258
TABLE 323: CI LIGHTING INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	258
TABLE 324: CI LIGHTING INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	259
TABLE 325: CI LIGHTING INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	260
TABLE 326: CI LIGHTING INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	260
TABLE 327: CI LIGHTING INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	260
TABLE 328: CI LIGHTING INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	260
TABLE 329: CI LIGHTING INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED	261
TABLE 330: CI LIGHTING INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	261
TABLE 331: CI LIGHTING INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	261
TABLE 332: CI LIGHTING INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	261
TABLE 333: CI LIGHTING INITIATIVE NET TO GROSS SAMPLING FOR MET-ED.....	263
TABLE 334: CI LIGHTING INITIATIVE NET TO GROSS SAMPLING FOR PENELEC.....	263
TABLE 335: CI LIGHTING INITIATIVE NET TO GROSS SAMPLING FOR PENN POWER	263
TABLE 336: CI LIGHTING INITIATIVE NET TO GROSS SAMPLING FOR WPP.....	263
TABLE 337: CI LIGHTING INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED	264
TABLE 338: CI LIGHTING INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC	264
TABLE 339: CI LIGHTING INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER.....	264
TABLE 340: CI LIGHTING INITIATIVE NET-TO-GROSS RESULTS FOR WPP	264
TABLE 341: CI CUSTOM INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED.....	267
TABLE 342: CI CUSTOM INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC.....	267
TABLE 343: CI CUSTOM INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER	268
TABLE 344: CI CUSTOM INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP.....	268
TABLE 345: CI CUSTOM INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED.....	270
TABLE 346: CI CUSTOM INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC	270
TABLE 347: CI CUSTOM INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	270
TABLE 348: CI CUSTOM INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	270
TABLE 349: CI CUSTOM INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED.....	271
TABLE 350: CI CUSTOM INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	271
TABLE 351: CI CUSTOM INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	271
TABLE 352: CI CUSTOM INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	271
TABLE 353: CI CUSTOM INITIATIVE NET TO GROSS SAMPLING FOR MET-ED	273
TABLE 354: CI CUSTOM INITIATIVE NET TO GROSS SAMPLING FOR PENELEC	273
TABLE 355: CI CUSTOM INITIATIVE NET TO GROSS SAMPLING FOR PENN POWER	273
TABLE 356: CI CUSTOM INITIATIVE NET TO GROSS SAMPLING FOR WPP	273
TABLE 357: CI CUSTOM INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED.....	274
TABLE 358: CI CUSTOM INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC	274
TABLE 359: CI CUSTOM INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER.....	274
TABLE 360: CI CUSTOM INITIATIVE NET-TO-GROSS RESULTS FOR WPP	274
TABLE 361: CI PRESCRIPTIVE INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-ED.....	275
TABLE 362: CI PRESCRIPTIVE INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	275
TABLE 363: CI PRESCRIPTIVE INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	276
TABLE 364: CI PRESCRIPTIVE INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	276

TABLE 365: CI PRESCRIPTIVE INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-ED	277
TABLE 366: CI PRESCRIPTIVE INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	277
TABLE 367: CI PRESCRIPTIVE INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	278
TABLE 368: CI PRESCRIPTIVE INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	278
TABLE 369: CI PRESCRIPTIVE INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-ED.....	278
TABLE 370: CI PRESCRIPTIVE INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	279
TABLE 371: CI PRESCRIPTIVE INITIATIVE GROSS REALIZATION RATES FOR PENN POWER.....	279
TABLE 372: CI PRESCRIPTIVE INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP	279
TABLE 373: CI PRESCRIPTIVE INITIATIVE NET TO GROSS SAMPLING FOR MET-ED	280
TABLE 374: CI PRESCRIPTIVE INITIATIVE NET TO GROSS SAMPLING FOR PENELEC	280
TABLE 375: CI PRESCRIPTIVE INITIATIVE NET TO GROSS SAMPLING FOR PENN POWER.....	280
TABLE 376: CI PRESCRIPTIVE INITIATIVE NET TO GROSS SAMPLING FOR WPP	280
TABLE 377: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS RESULTS FOR MET-ED	281
TABLE 378: CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS RESULTS FOR PENELEC.....	281
TABLE 379 CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS RESULTS FOR PENN POWER	281
TABLE 380 CI PRESCRIPTIVE INITIATIVE NET-TO-GROSS RESULTS FOR WPP.....	281
TABLE 381: C&I ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR MET-Ed	283
TABLE 382: C&I ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENELEC	283
TABLE 383: C&I ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR PENN POWER.....	283
TABLE 384: C&I ATI INITIATIVE GROSS IMPACT SAMPLE DESIGN FOR WPP	284
TABLE 385: C&I ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR MET-Ed.....	284
TABLE 386: C&I ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENELEC.....	284
TABLE 387: C&I ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR PENN POWER.....	284
TABLE 388: C&I ATI INITIATIVE ENERGY GROSS REALIZATION RATES FOR WPP	285
TABLE 389: C&I ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR MET-Ed	285
TABLE 390: C&I ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR PENELEC.....	285
TABLE 391: C&I ATI INITIATIVE GROSS REALIZATION RATES FOR PENN POWER	286
TABLE 392: C&I ATI INITIATIVE DEMAND GROSS REALIZATION RATES FOR WPP.....	286

Acronyms

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

Types of Savings

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

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

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

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

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

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

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

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

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

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

Phase III to Date (P3TD): The energy and peak demand savings achieved by an EE&C program or portfolio within Phase III of Act 129. Reported in several permutations described below.

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

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

Phase III to Date Preliminary Savings Achieved (PSA): The sum of the verified gross savings (VTD) from previous program years in Phase III where the impact evaluation is complete plus the reported gross savings from the current program year (PYTD). For PY8, the PSA savings will always equal the PYTD savings because PY8 is the first program year of the phase (no savings will be verified until the PY8 final annual report).

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

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

1 Introduction

Pennsylvania Act 129 of 2008, signed on October 15, 2008, mandated energy savings and demand reduction goals for the largest electric distribution companies (EDCs) in Pennsylvania for Phase I (2008 through 2013). Phase II of Act 129 began in June 2013 and concluded in May 2016. In late 2015, each EDC filed a new energy efficiency and conservation (EE&C) plan with the PA PUC detailing the proposed design of its portfolio for Phase III. These plans were updated based on stakeholder input and subsequently approved by the PUC in 2016.

Implementation of Phase III of the Act 129 programs began on June 1, 2016. This report documents the progress and effectiveness of the Phase III EE&C accomplishments in Program Year 8 (PY8) for Metropolitan Edison (Met-Ed), Pennsylvania Electric Company (Penelec), Pennsylvania Power Company (Penn Power), and West Penn Power Company (WPP), collectively referred to herein as the FirstEnergy PA Companies (Companies) or the four PA EDCs, as well as the cumulative accomplishments of the Phase III programs since inception. This report additionally documents the energy savings carried over from Phase II. The Phase II carryover savings count towards EDC savings compliance targets for Phase III.

This report details the participation, spending, reported gross, verified gross, and verified net impacts of the energy efficiency programs in PY8. Compliance with Act 129 savings goals are ultimately based on verified gross savings. This report also includes estimates of cost-effectiveness according to the Total Resource Cost test (TRC).¹ The Companies have retained ADM Associates, Inc. and Tetra Tech MA Inc (the ADM team, or ADM) as an independent evaluation contractor for Phase III of Act 129. The ADM team is responsible for the measurement and verification of the savings and calculation of gross verified and net verified savings.

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

Phase III of Act 129 includes a demand response goal for Met-Ed, Penn Power, and WPP. Demand response events are limited to the months of June through September, which are the first four months of the Act 129 program year. Because the demand response season is completed early in the program year, it is possible to complete the independent evaluation of verified gross savings for demand response sooner than is possible for energy efficiency programs. The first demand response events occurred in early PY9, and their impacts will be reported in the first Semi-Annual for PY9.

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

2 Summary of Achievements

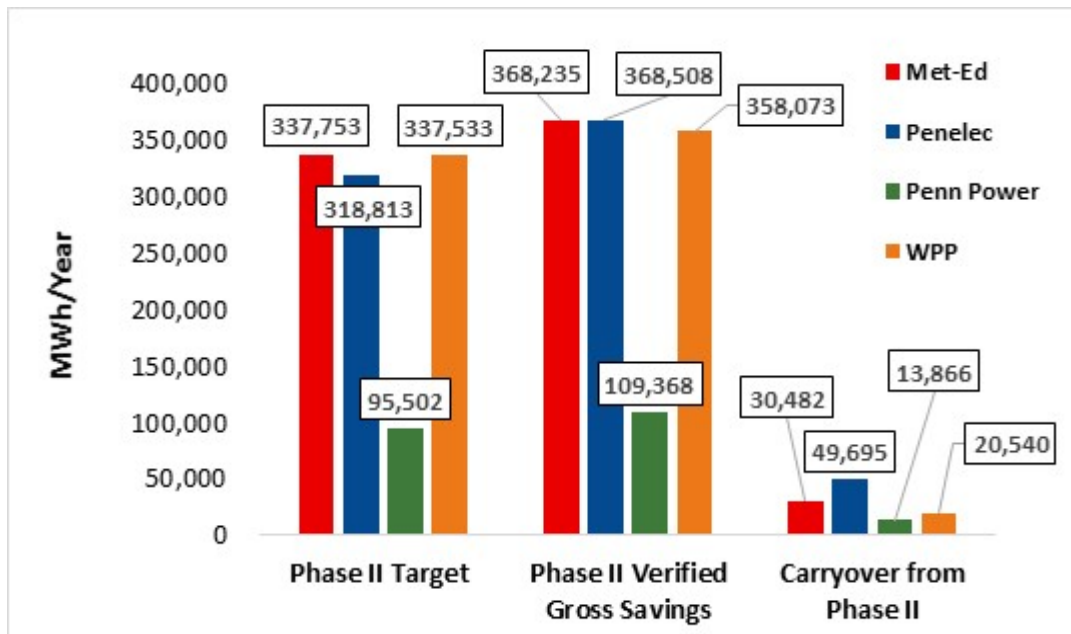
2.1 CARRYOVER SAVINGS FROM PHASE II OF ACT 129

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

Table 1: Carryover Savings from Phase II

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

Figure 1: Carryover Savings from Phase II of Act 129



The Commission's Phase III Implementation Order² also allowed EDCs to carry over savings in excess of the Phase II Government, Non-Profit, and Institutional (GNI) savings goal and excess savings from the Low-Income (LI) customer segment.³ Figure 2 shows the calculation of

² Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program Implementation Order*, at Docket No. M-2014-2424864, (*Phase III Implementation Order*), entered June 11, 2015.

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

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

Figure 2: Low-Income Carryover from Phase II

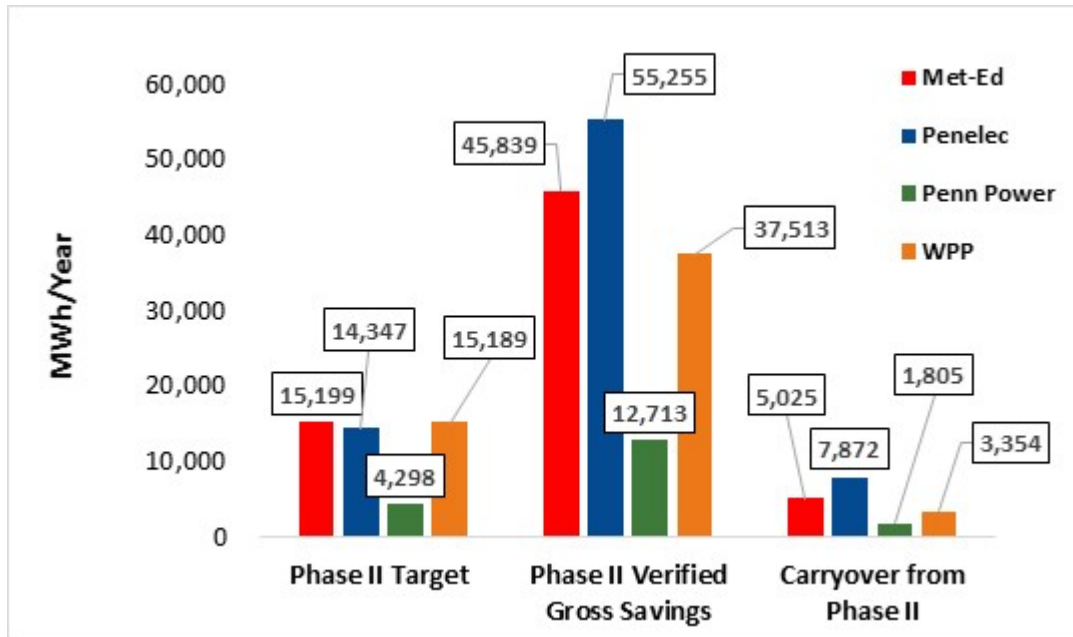
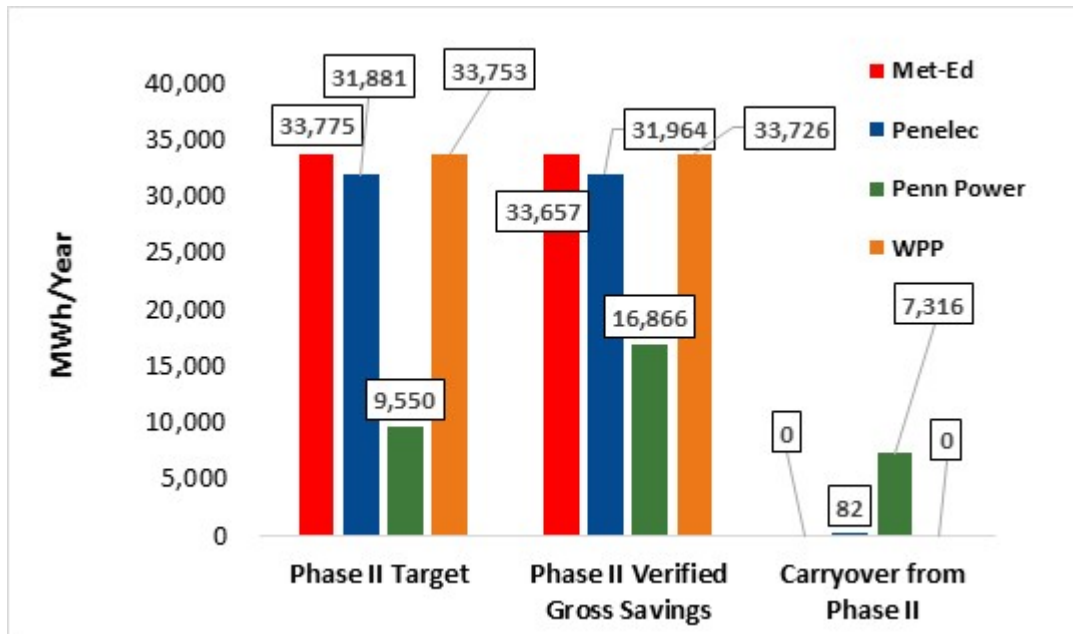


Figure 3: GNI Carryover from Phase II



2.2 PHASE III ENERGY EFFICIENCY ACHIEVEMENTS TO DATE

Since the beginning of Program Year 8 on June 1, 2016, the four FirstEnergy PA EDCs reported and verified gross electric energy savings and gross peak demand savings are shown in Table 2 below.

Table 2: Gross Reported and Verified Electric and Demand Savings for PY8

EDC	PYRTD MWh	PYRTD MW	PYVTD MWh	PYVTD MW
Met-Ed	130,422	17	139,875	18
Penelec	121,535	15	132,449	16
Penn Power	34,846	5	37,130	5
West Penn Power	122,460	17	131,330	17

Since the beginning of Program Year 8 on June 1, 2016, the four FirstEnergy PA EDCs reported and verified gross electric energy savings and gross peak demand savings are shown in Table 3 below.

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

EDC	RTD MWh	RTD MW	VTD MWh	VTD MW
Met-Ed	130,422	17	139,875	18
Penelec	121,535	15	132,449	16
Penn Power	34,846	5	37,130	5
West Penn Power	122,460	17	131,330	17

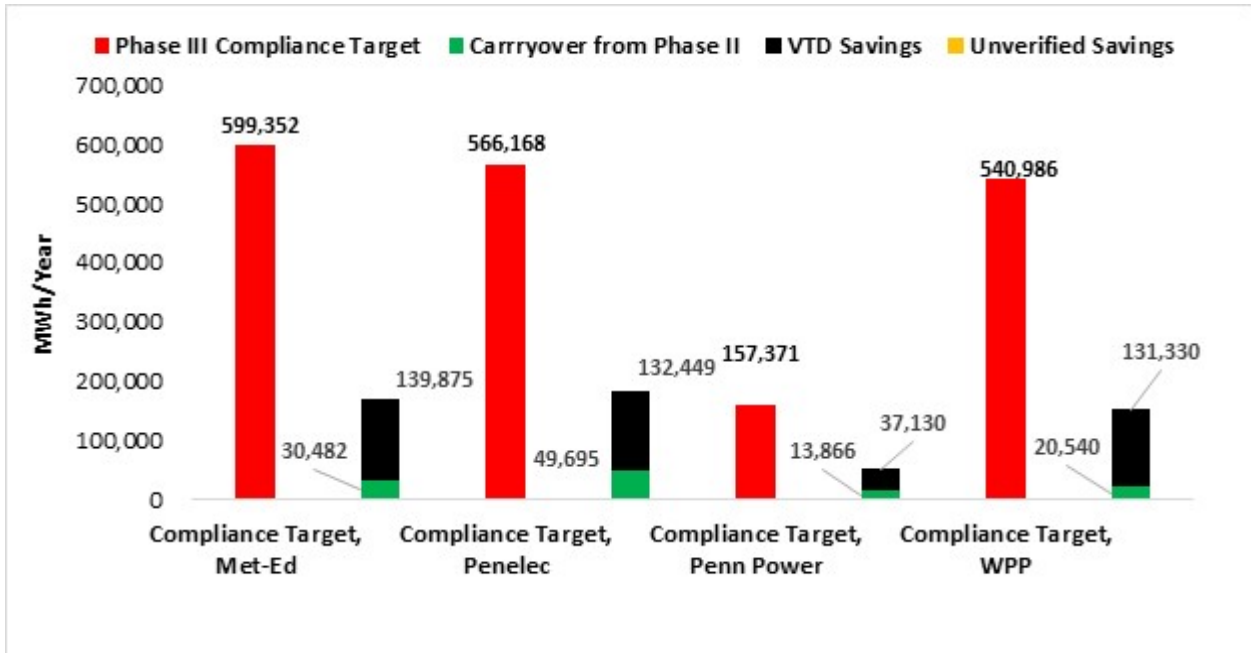
Achievements toward Phase III Energy Savings compliance, including carryover savings from Phase II, are shown in Table 4 below for the four PA EDCs.

Table 4: Phase III Electric Savings including Phase II Carryover

EDC	VTD +CO MWh	Compliance Target	Percent of Target to Date
Met-Ed	170,357	599,352	28%
Penelec	182,144	566,168	32%
Penn Power	50,996	157,371	32%
West Penn Power	151,870	540,986	28%

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

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



The Phase III Implementation Order directed EDCs to offer conservation measures to the low-income customer segment based on the proportion of electric sales attributable to low-income households. The proportionate number of measures targets for the EDCs are listed in the second column of Table 5. The number of EE&C measures offered by each EDC to its residential and non-residential customer classes are shown in the third column. The fourth column shows the number of measures available to the low-income customer segment at no cost to the customer. The last column shows the percentages of total measures offered in the EE&C plan. These percentages exceed the proportionate number of measures targets for each EDC.

Table 5: Proportion of Measures Offered to Low-Income Customers

EDC	% Proportionate Number of Measures Target	Total Measures Offered	Number Measures Available	% Measures Offered
Met-Ed	9%	158	59	37%
Penelec	10%	158	59	37%
Penn Power	11%	158	59	37%
West Penn Power	9%	158	59	37%

The PA PUC also established a low-income energy savings target of 5.5% of the portfolio savings goal. The second column of Table 6 shows the low-income savings targets, based on verified gross savings, for each EDC. The third column of the table shows the verified low-

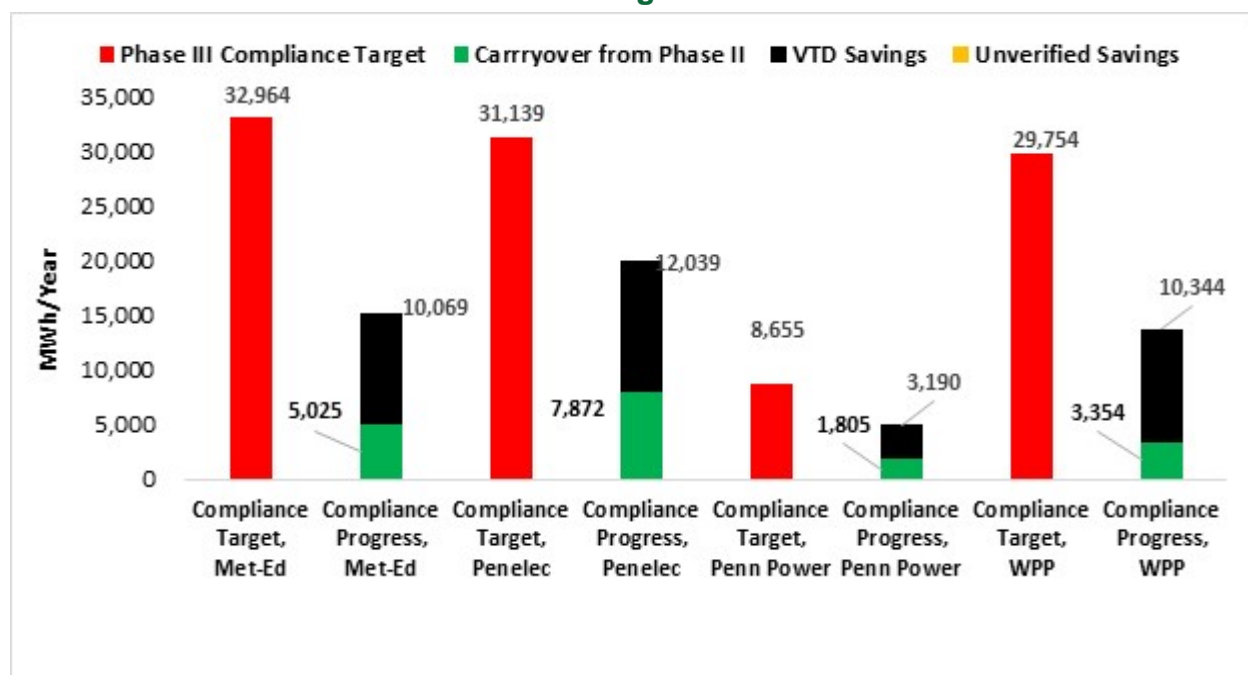
income impacts, inclusive of Phase II carryover. The percentages of the Phase III low-income energy savings targets achieved to date are shown in the last column of the table.

Table 6: Low-Income Program Energy Savings and Targets

EDC	Compliance Target	LI VTD +CO MWh	Percent of Target to Date
Met-Ed	32,964	15,093	46%
Penelec	31,139	19,912	64%
Penn Power	8,655	4,996	58%
West Penn Power	29,754	13,698	46%

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

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



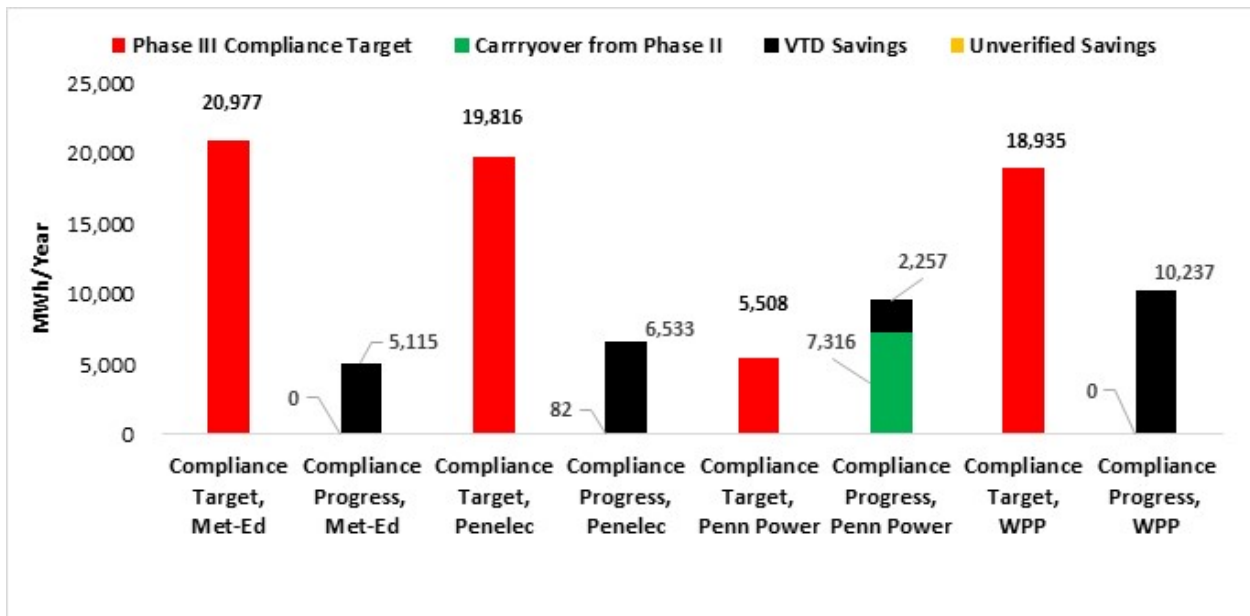
The Phase III Implementation Order established a GNI energy savings target of 3.5% of the portfolio savings goal. The second column of Table 7 shows the GNI savings targets, based on verified gross savings, for each EDC. The third column of the table shows the verified low-income impacts, inclusive of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

Table 7: GNI Savings and Targets

EDC	Compliance Target	GNI VTD +CO MWh	Percent of Target to Date
Met-Ed	20,977	5,115	24%
Penelec	19,816	6,615	33%
Penn Power	5,508	9,574	174%
West Penn Power	18,935	10,237	54%

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

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



2.3 PHASE III DEMAND RESPONSE ACHIEVEMENTS TO DATE

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

Act 129 demand response events are triggered by PJM’s day-ahead load forecast. When the day-ahead forecast is above 96% of the peak load forecast for the year, a demand response event is initiated for the following day.

The Commission’s Phase III Implementation Order also established a requirement that EDCs achieve at least 85% of the Phase III compliance reduction target in each DR event. For each DR event, this translates to a 41.7 MW minimum for Met-Ed, a 14.5 MW minimum for Penn

Power, and a 54.4 MW minimum for West Penn Power. Penelec does not have DR targets in Phase III.

The first demand response events occurred in early PY9, and their impacts will be reported in the first Semi-Annual for PY9.

2.4 PHASE III PERFORMANCE BY CUSTOMER SEGMENT

Table 8 presents the participation, savings, and spending by customer sector for PY8. The residential, small C&I, large C&I sectors are defined by EDC tariff and the residential low-income and governmental/educational/non-profit sector were defined by statute (66 Pa. C.S. § 2806.1). The residential low-income segment is a subset of the residential customer class and the GNI segment will include customers who are part of the Small C&I or Large C&I rate classes. The savings, spending, and participation values for the LI and GNI segments have been removed from the parent sectors in Table 8. The values in Table 8 and Table 9 below also reflect adjustments related to cross sector sales of upstream lighting. Participant counts, incentive amounts, and reported impacts removed from the parent (residential) sector, and allocated to Small C&I and GNI sectors, to reflect cross-sector sales adjustments to reported data for the Energy Efficient Products Program in Table 74, Table 75, Table 76, and Table 77 Section 3.3.1.

Table 8: Program Year 8 Summary Statistics by Customer Segment

EDC	Parameter	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI
Met-Ed	# participants	498,167	26,955	22,849	79	2,013
	PYRTD MWh/yr	75,627	9,107	13,227	27,435	5,025
	PYRTD MW (Energy Efficiency)	10.06	1.15	1.99	3.53	0.75
	PYVTD MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$4,199.60	\$58.27	\$742.18	\$1,365.27	\$261.01
Penelec	# participants	555,164	37,329	28,061	82	2,689
	PYRTD MWh/yr	73,161	10,950	17,811	12,873	6,740
	PYRTD MW (Energy Efficiency)	8.79	1.30	2.75	1.58	0.81
	PYVTD MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$4,095.25	\$79.10	\$1,083.01	\$597.90	\$381.08
Penn Power	# participants	103,971	7,481	4,811	16	608
	PYRTD MWh/yr	17,917	3,280	8,248	3,036	2,364
	PYRTD MW (Energy Efficiency)	2.57	0.43	1.33	0.29	0.20
	PYVTD MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$1,219.71	\$22.84	\$474.35	\$167.09	\$132.18
West Penn Power	# participants	550,108	31,238	25,615	31	2,425
	PYRTD MWh/yr	79,159	10,388	15,491	7,433	9,990
	PYRTD MW (Energy Efficiency)	11.48	1.39	2.28	0.96	1.06
	PYVTD MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$3,663.13	\$60.33	\$880.09	\$372.93	\$520.12

Table 9 summarizes plan performance by sector since the beginning of Phase III.

Table 9: Phase III Summary Statistics by Customer Segment

EDC	Parameter	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI
Met-Ed	# participants	498,167	26,955	22,849	79	2,013
	PSA MWh/yr	75,627	9,107	13,227	27,435	5,025
	PSA MW (Energy Efficiency)	10.06	1.15	1.99	3.53	0.75
	Phase III MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$4,199.60	\$58.27	\$742.18	\$1,365.27	\$261.01
Penelec	# participants	555,164	37,329	28,061	82	2,689
	PSA MWh/yr	73,161	10,950	17,811	12,873	6,740
	PSA MW (Energy Efficiency)	8.79	1.30	2.75	1.58	0.81
	Phase III MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$4,095.25	\$79.10	\$1,083.01	\$597.90	\$381.08
Penn Power	# participants	103,971	7,481	4,811	16	608
	PSA MWh/yr	17,917	3,280	8,248	3,036	2,364
	PSA MW (Energy Efficiency)	2.57	0.43	1.33	0.29	0.20
	Phase III MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$1,219.71	\$22.84	\$474.35	\$167.09	\$132.18
West Penn Power	# participants	550,108	31,238	25,615	31	2,425
	PSA MWh/yr	79,159	10,388	15,491	7,433	9,990
	PSA MW (Energy Efficiency)	11.48	1.39	2.28	0.96	1.06
	Phase III MW (Demand Response)	0.00	0.00	0.00	0.00	0.00
	Incentives (\$1000)	\$3,663.13	\$60.33	\$880.09	\$372.93	\$520.12

2.5 SUMMARY OF PARTICIPATION BY PROGRAM

Participation is defined differently for certain programs depending on the program delivery channel and data tracking practices. The nuances of the participant definition vary by program and are summarized by program in the bullets below. Table 10 provides the current participation totals for PY8 and Phase III.

- For the Appliance Turn-In Program and the low-income Appliance Turn-In components of the Low Income Energy Efficiency Program and Energy Solutions for Business – Small Program, participation is the count of rebate applications, which corresponds to appliance pick-up events. If a homeowner recycles two refrigerators on one occasion, that counts as one participant.

- For the Home Energy Reports components of the Energy Efficient Homes and Low Income Energy Efficiency Programs, the number of participants is taken as the maximum number of participants in the treatment group during the year. This definition of participant is selected because it aligns with the gross impact evaluation protocol for Home Energy Reports.
- For the Conservation Kits components of the Energy Efficient Homes Program and Low Income Energy Efficiency Programs, the participant counts are equal to the overall count of kits distributed by each program. In nearly all cases, one kit is sent to a household.
- For the Residential New Construction components of the Energy Efficient Homes Program and Low Income Energy Efficiency Programs, the participant count is equal to the number of houses (or in the case of multifamily housing, the number of dwelling units)
- For the Direct Install component of the Energy Efficient Homes Program, the participant count is equal to the number of rebate homes treated in the program.
- For Upstream Lighting component of the Energy Efficient Products Program, the participant count is equal to the number of packs sold. This is approximately equal to number of bulbs divided by three.
- For the Upstream Electronics component of the Energy Efficient Products Program, the participant count is equal to the number of electronics equipment sold.
- For the HVAC component of the Energy Efficient Products Program, the participant count is equal to the sum of HVAC units and HVAC tune-ups rebated by the program. If a customer purchases multiple HVAC units or tune-ups, then the customer counts as two participants. The majority of rebates applications however, are for a single HVAC system or service.
- For the Appliances components of the Energy Efficient Products Program and the Low Income Energy Efficiency Program, the participant count is equal to the sum of Appliances rebated by the program. If a customer purchases multiple Appliances, then the customer counts as multiple participants. The majority of rebate applications however, are for a single appliance.
- For the Direct Install component of the Low Income Energy Efficiency Program, the participant count is equal to the number of rebate homes treated in the program.
- For the downstream rebates in all nonresidential energy efficiency programs, the participant count is equal to the number of unique account numbers associated with rebate applications for the program year.

Table 10: EE&C Portfolio Participation by Program

Utility	Program	PYTD Participation	P3TD Participation
Met-Ed	Appliance Turn-in	3,974	3,974
	Energy Efficient Homes	202,956	202,956
	Energy Efficient Products	315,681	315,681
	Low Income Energy Efficiency	26,955	26,955
	C&I Energy Solutions for Business - Small	348	348
	C&I Demand Response - Small	0	0
	C&I Energy Solutions for Business - Large	116	116
	C&I Demand Response - Large	0	0
	Governmental & Institutional Tariff	32	32
	Portfolio Total	550,062	550,062
Penelec	Appliance Turn-in	3,483	3,483
	Energy Efficient Homes	209,088	209,088
	Energy Efficient Products	372,475	372,475
	Low Income Energy Efficiency	37,329	37,329
	C&I Energy Solutions for Business - Small	608	608
	C&I Demand Response - Small	0	0
	C&I Energy Solutions for Business - Large	110	110
	C&I Demand Response - Large	0	0
	Governmental & Institutional Tariff	233	233
	Portfolio Total	623,326	623,326
Penn Power	Appliance Turn-in	1,167	1,167
	Energy Efficient Homes	40,404	40,404
	Energy Efficient Products	67,382	67,382
	Low Income Energy Efficiency	7,481	7,481
	C&I Energy Solutions for Business - Small	249	249
	C&I Demand Response - Small	0	0
	C&I Energy Solutions for Business - Large	18	18
	C&I Demand Response - Large	0	0
	Governmental & Institutional Tariff	186	186
	Portfolio Total	116,887	116,887
West Penn Power	Appliance Turn-in	4,660	4,660
	Energy Efficient Homes	208,421	208,421
	Energy Efficient Products	364,320	364,320
	Low Income Energy Efficiency	31,238	31,238
	C&I Energy Solutions for Business - Small	506	506
	C&I Demand Response - Small	0	0
	C&I Energy Solutions for Business - Large	68	68
	C&I Demand Response - Large	0	0
	Governmental & Institutional Tariff	229	229
	Portfolio Total	609,442	609,442

2.6 SUMMARY OF IMPACT EVALUATION RESULTS

During PY8 ADM completed impact evaluations for many of the energy efficiency programs in the portfolio. Table 11 and Table 12 summarize the realization rates and net-to-gross ratios by program. Initiative-level evaluation detail is available in the Appendices to this report.

Table 11: Impact Evaluation Results Summary for Met-Ed and Penelec

Program/ Initiative	Met-Ed			Penelec		
	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio
Appliance Turn-In	100.1%	94.5%	50.0%	89.0%	87.9%	43.0%
Energy Efficient Homes	111.3%	94.9%	92.3%	117.1%	98.7%	90.8%
Energy Efficient Products	121.1%	131.0%	37.8%	117.1%	131.6%	34.5%
Low Income Program	111.0%	100.8%	100.0%	112.9%	102.2%	100.0%
C&I Solutions for Business Program - Small	91.6%	104.9%	64.9%	93.4%	98.1%	82.3%
C&I Solutions for Business Program - Large	95.9%	104.1%	54.6%	92.8%	89.4%	75.7%
Government and Institutional Tariff Program	91.3%	104.4%	66.3%	93.4%	101.7%	84.6%

Table 12: Impact Evaluation Results Summary for Penn Power and WPP

Program/ Initiative	Penn Power			West Penn Power		
	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio
Appliance Turn-In	78.1%	80.2%	50.0%	91.3%	96.1%	45.0%
Energy Efficient Homes	118.2%	101.7%	89.8%	106.8%	84.6%	93.9%
Energy Efficient Products	127.3%	139.3%	39.6%	118.3%	124.9%	28.2%
Low Income Program	93.9%	80.4%	100.0%	105.1%	90.6%	100.0%
C&I Solutions for Business Program - Small	93.7%	104.6%	72.1%	99.9%	96.2%	82.1%
C&I Solutions for Business Program - Large	90.9%	109.8%	60.0%	99.4%	96.3%	73.7%
Government and Institutional Tariff Program	94.4%	103.6%	75.2%	100.7%	102.2%	82.9%

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 13 and Table 14 present net-to-gross findings for High-Impact Measures (HIMs) studied in PY8.

Table 13: High-Impact Measure Net-to-Gross for Met-Ed and Penelec

HIM	Met-Ed			Penelec		
	Free ridership	Spillover	Net to Gross Ratio	Free ridership	Spillover	Net to Gross Ratio
Res Appliance Turn-In	50.0%	0.0%	50.0%	57.0%	0.0%	43.0%
Res Upstream Lighting	63.0%	0.0%	37.0%	66.2%	0.0%	33.8%
Res EE Kits	21.0%	3.0%	82.0%	20.0%	3.0%	83.0%
C&I Lighting	35.6%	2.0%	66.3%	19.7%	4.8%	85.0%
C&I Custom	62.6%	0.0%	37.4%	44.1%	0.4%	56.3%

Table 14: High-Impact Measure Net-to-Gross for Penn Power and WPP

HIM	Penn Power			West Penn Power		
	Free ridership	Spillover	Net to Gross Ratio	Free ridership	Spillover	Net to Gross Ratio
Res Appliance Turn-In	50.0%	0.0%	50.0%	55.0%	0.0%	45.0%
Res Upstream Lighting	61.2%	0.0%	38.8%	73.4%	0.0%	26.6%
Res EE Kits	20.0%	2.0%	82.0%	20.0%	2.0%	82.0%
C&I Lighting	28.1%	3.3%	75.2%	22.1%	5.0%	82.9%
C&I Custom	52.3%	0.0%	47.7%	47.0%	0.0%	53.0%

2.7 SUMMARY OF ENERGY IMPACTS BY PROGRAM

Act 129 compliance targets are based on annualized savings estimates (MWh/year). Each program year, the annual savings achieved by EE&C program activity are recorded as incremental annual, or “first-year”, savings and added to an EDC’s progress toward compliance. Incremental annual savings estimates are presented in Section 2.7.1. Lifetime energy savings incorporate the Effective Useful Life (EUL) of installed measures and estimate the total energy savings associated with EE&C program activity. Lifetime savings are used in the TRC test, by program participants when assessing the economics of upgrades, and by the SWE when calculating the emissions benefits of Act 129 programs. Section 2.7.2 presents the lifetime energy savings by program.

2.7.1 Incremental Annual Energy Savings by Program

Figure 7, Figure 8, Figure 9, and Figure 10 present summaries of the PYTD energy savings by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Program Year 8. The energy impacts in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. The verified gross savings are adjusted by energy realization rates and the verified net savings are adjustments by both the gross realization rates and the net-to-gross ratios.

Figure 7: PYTD Energy Savings by Program for Met-Ed

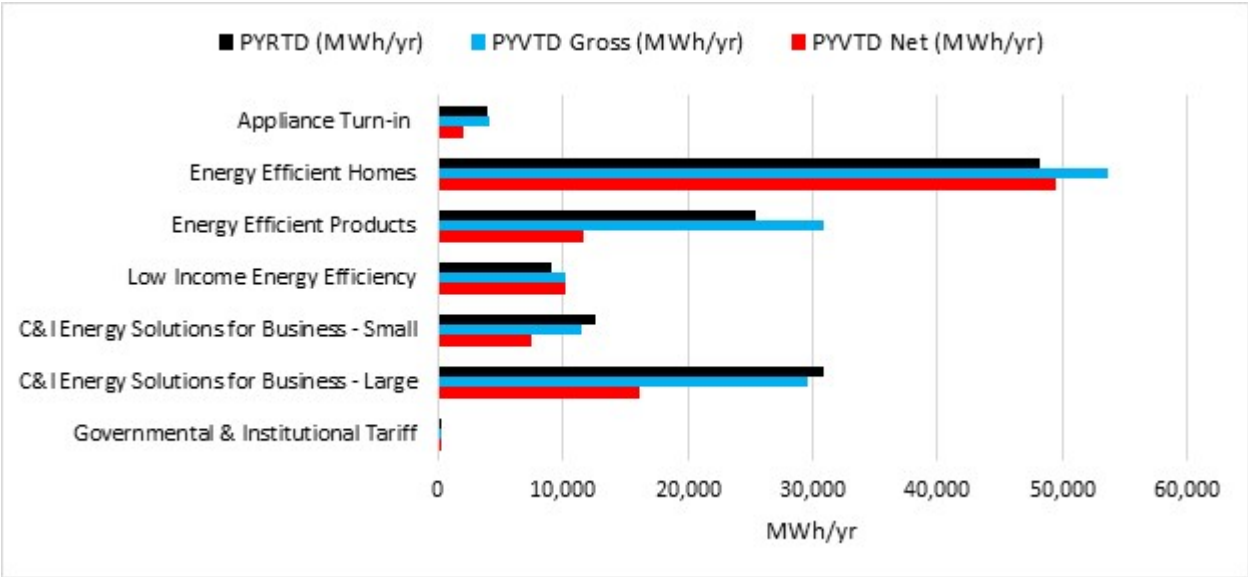


Figure 8: PYTD Energy Savings by Program for Penelec

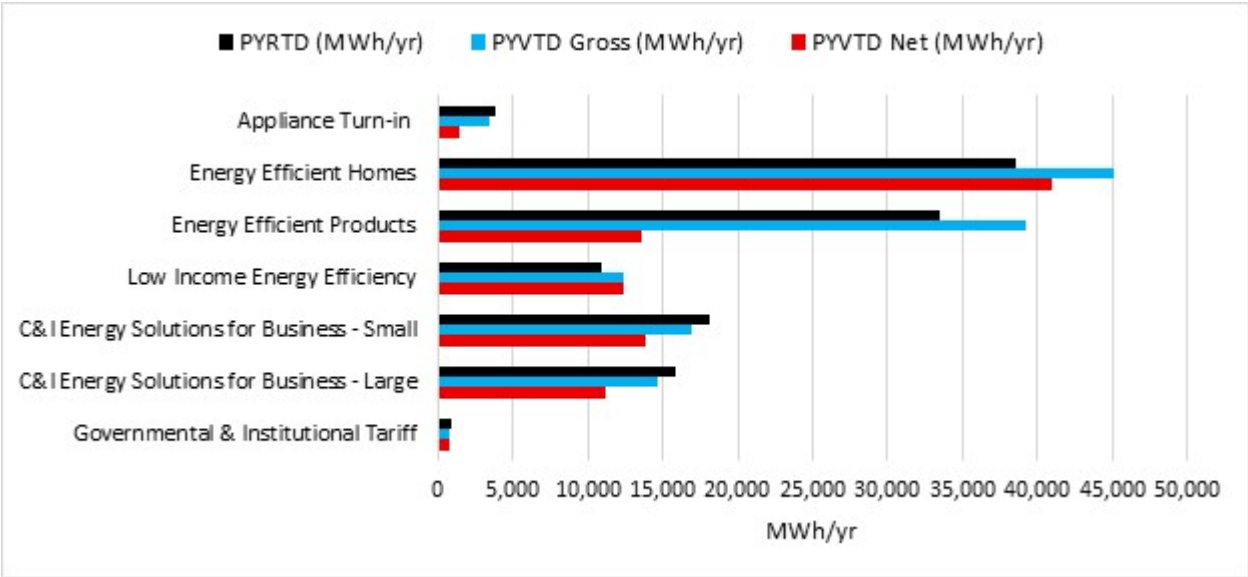


Figure 9: PYTD Energy Savings by Program for Penn Power

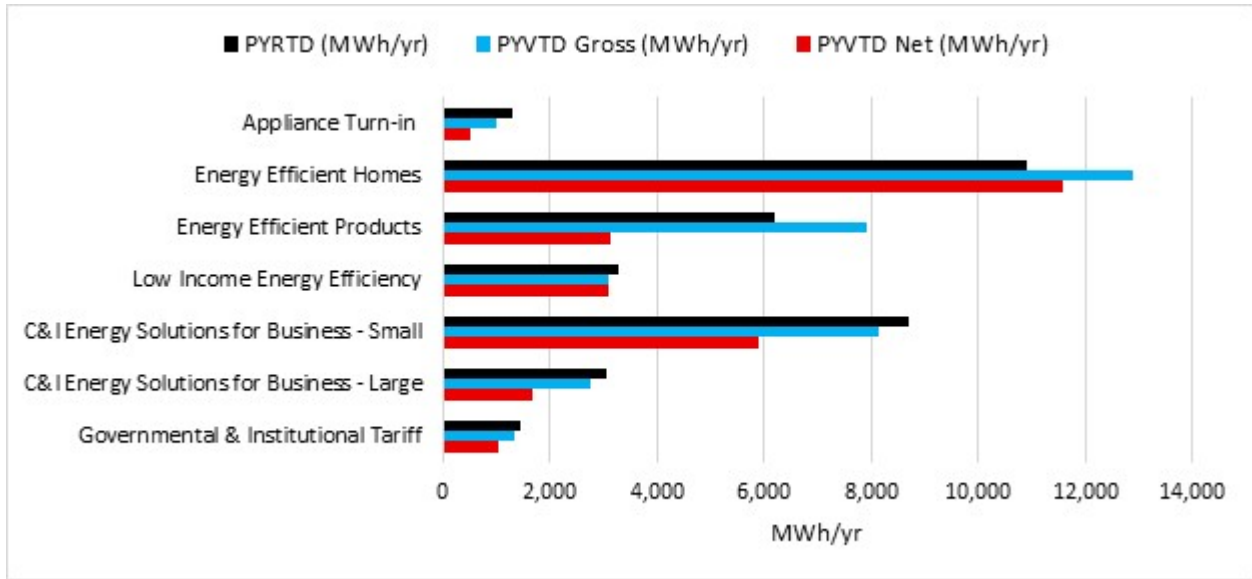


Figure 10: PYTD Energy Savings by Program for WPP

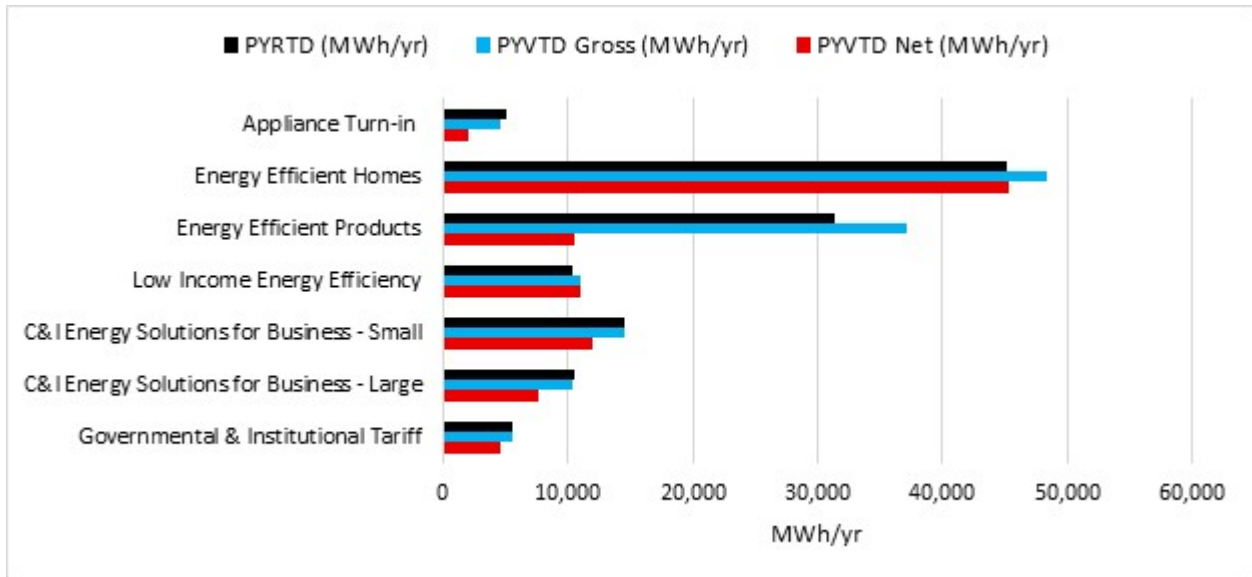


Figure 11, Figure 12, Figure 13, and Figure 14 present summaries of the energy savings by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Phase III of Act 129.

Figure 11: P3TD Energy Savings by Program for Met-Ed

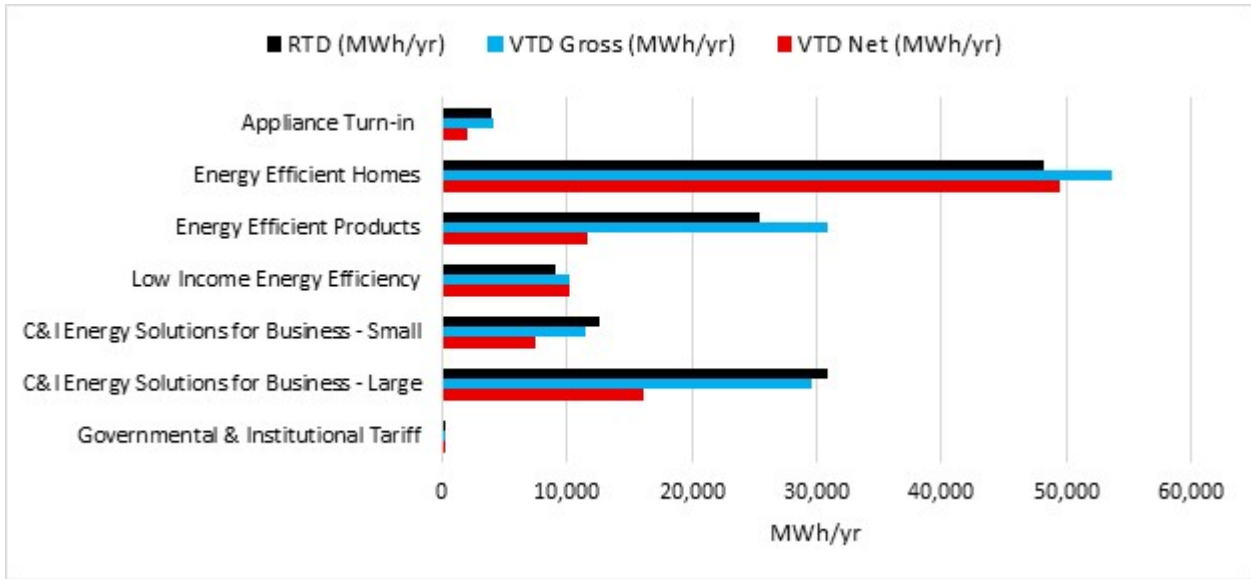


Figure 12: P3TD Energy Savings by Program for Penelec

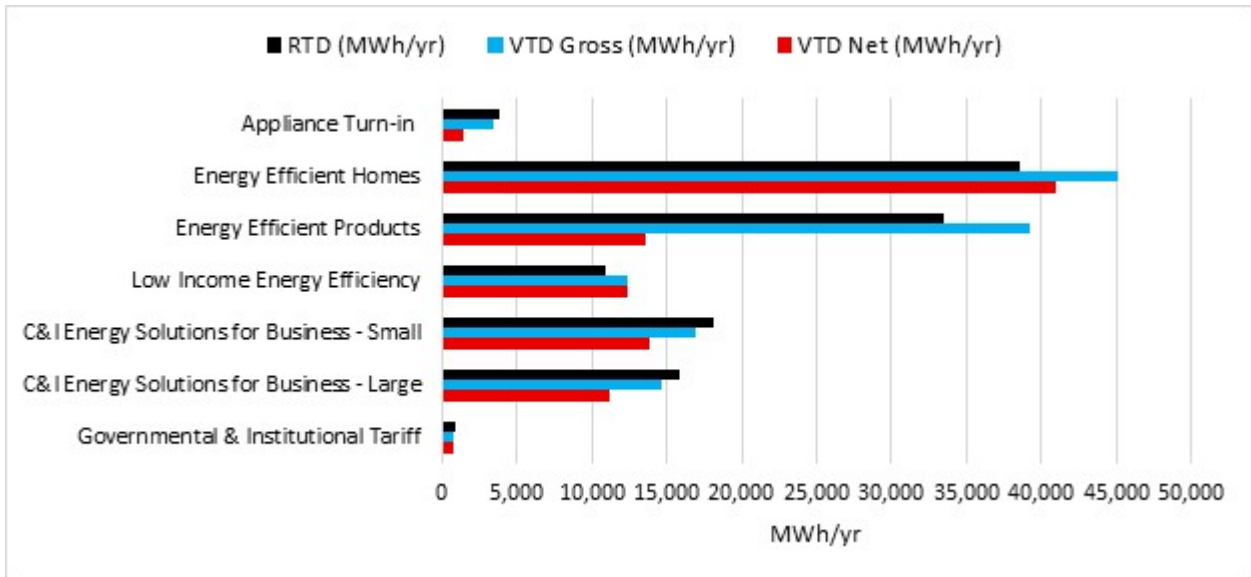


Figure 13: P3TD Energy Savings by Program for Penn Power

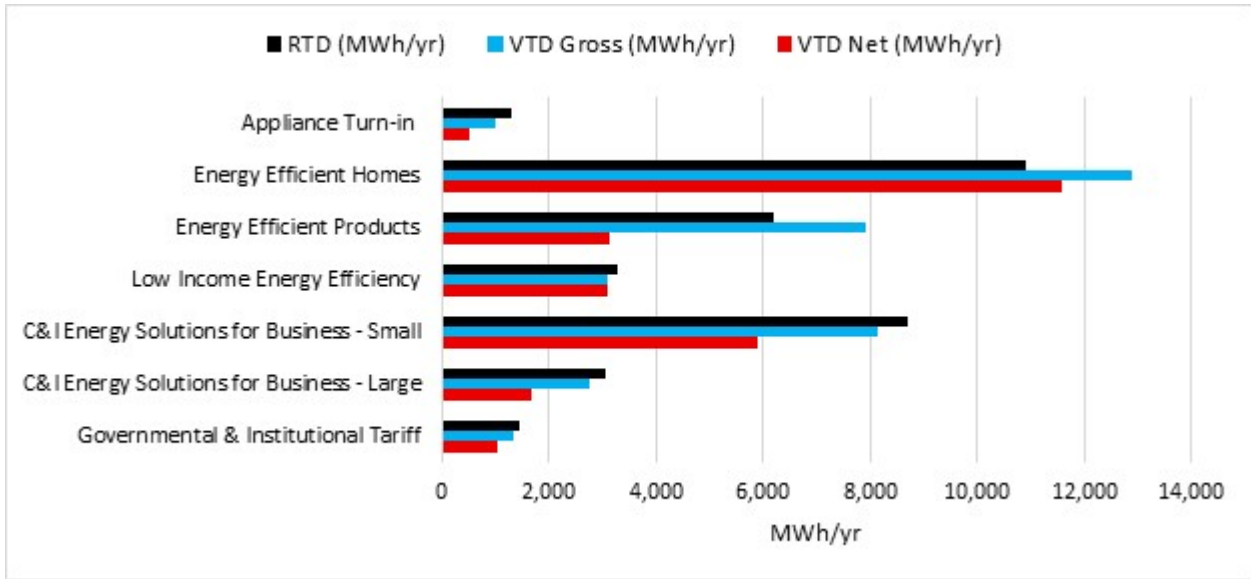
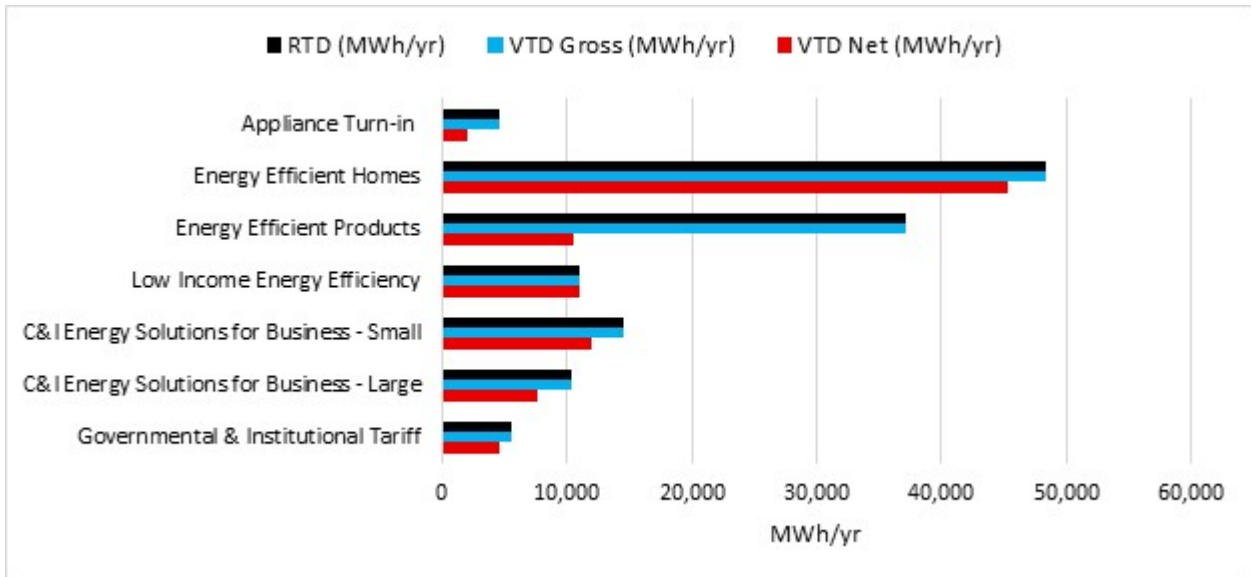


Figure 14: P3TD Energy Savings by Program for WPP



Summaries of energy impacts by program through PY8 are presented in Table 15, Table 16, Table 17, and Table 18 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 15: Incremental Annual Energy Savings by Program - Met-Ed

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Appliance Turn-in	4,009	4,014	2,007	4,009	4,014	2,007
Energy Efficient Homes	48,126	53,569	49,445	48,126	53,569	49,445
Energy Efficient Products	25,460	30,825	11,656	25,460	30,825	11,656
Low Income Energy Efficiency	9,107	10,105	10,105	9,107	10,105	10,105
C&I Energy Solutions for Business - Small	12,526	11,469	7,441	12,526	11,469	7,441
C&I Energy Solutions for Business - Large	30,919	29,643	16,188	30,919	29,643	16,188
Governmental & Institutional Tariff	274	250	166	274	250	166
Portfolio Total	130,422	139,875	97,008	130,422	139,875	97,008

Table 16: Incremental Annual Energy Savings by Program - Penelec

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Appliance Turn-in	3,826	3,407	1,465	3,826	3,407	1,465
Energy Efficient Homes	38,523	45,106	40,962	38,523	45,106	40,962
Energy Efficient Products	33,501	39,241	13,528	33,501	39,241	13,528
Low Income Energy Efficiency	10,950	12,359	12,359	10,950	12,359	12,359
C&I Energy Solutions for Business - Small	18,071	16,874	13,889	18,071	16,874	13,889
C&I Energy Solutions for Business - Large	15,811	14,666	11,106	15,811	14,666	11,106
Governmental & Institutional Tariff	852	796	673	852	796	673
Portfolio Total	121,535	132,449	93,982	121,535	132,449	93,982

Table 17: Incremental Annual Energy Savings by Program – Penn Power

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Appliance Turn-in	1,288	1,007	503	1,288	1,007	503
Energy Efficient Homes	10,902	12,883	11,564	10,902	12,883	11,564
Energy Efficient Products	6,202	7,896	3,130	6,202	7,896	3,130
Low Income Energy Efficiency	3,280	3,080	3,080	3,280	3,080	3,080
C&I Energy Solutions for Business - Small	8,703	8,151	5,880	8,703	8,151	5,880
C&I Energy Solutions for Business - Large	3,046	2,768	1,661	3,046	2,768	1,661
Governmental & Institutional Tariff	1,424	1,345	1,012	1,424	1,345	1,012
Portfolio Total	34,846	37,130	26,831	34,846	37,130	26,831

Table 18: Incremental Annual Energy Savings by Program - WPP

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
Appliance Turn-in	4,999	4,565	2,054	4,999	4,565	2,054
Energy Efficient Homes	45,219	48,291	45,324	45,219	48,291	45,324
Energy Efficient Products	31,349	37,095	10,456	31,349	37,095	10,456
Low Income Energy Efficiency	10,388	10,915	10,915	10,388	10,915	10,915
C&I Energy Solutions for Business - Small	14,540	14,523	11,919	14,540	14,523	11,919
C&I Energy Solutions for Business - Large	10,477	10,414	7,673	10,477	10,414	7,673
Governmental & Institutional Tariff	5,489	5,528	4,580	5,489	5,528	4,580
Portfolio Total	122,460	131,330	92,922	122,460	131,330	92,922

2.7.2 Lifetime Energy Savings by Program

Table 19, Table 20, Table 21, and Table 22 present the PYTD and P3TD lifetime energy savings by program for Met-Ed, Penelec, Penn Power, and WPP respectively. Lifetime savings are calculated by using expected useful lives (EULs) listed in the PA TRM for each measure, subject to a 15-year cap. For commercial and industrial projects, the measure lives are first determined for each sampled project during gross impact evaluation. The measure lives are then weighted by sampling initiative and EDC as the ratio between verified lifetime energy savings and program-year verified savings. This step is conducted in part because measure lives, as determined post-verification, may differ from ex-ante measure lives in the tracking database⁴, and in part to maintain consistency between verified impacts, measure lives, and incremental costs for all sampled projects. For the residential upstream lighting program, the measure life is reduced to replicate the effect of a dual-baseline benefits stream⁵. To develop the modified measured lives, we perform dual-baseline calculations for five archetypal lamps in the most common baseline wattage bins (72W, 53W, 53W, 29W, and 25W) and perform dual-baseline calculations with lower baseline wattages (23W, 18W, 15W, 9W, and 9W respectively) post 2020. The modified measure life is the product of the original measure life and the ratio of the net-present value of delta-Watt-years for the dual-baseline stream to a single-baseline stream.

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

⁵ See also comments in Section 2.10.

Table 19: Lifetime Energy Savings by Program for Met-Ed

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Appliance Turn-in	31,482	15,741	31,482	15,741
Energy Efficient Homes	209,070	173,080	209,070	173,080
Energy Efficient Products	230,149	87,711	230,149	87,711
Low Income Energy Efficiency	56,530	56,530	56,530	56,530
C&I Energy Solutions for Business - Small	165,012	107,194	165,012	107,194
C&I Energy Solutions for Business - Large	433,327	235,811	433,327	235,811
Governmental & Institutional Tariff	3,608	2,392	3,608	2,392
Portfolio Total	1,129,179	678,459	1,129,179	678,459

Table 20: Lifetime Energy Savings by Program for Penelec

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Appliance Turn-in	24,155	10,387	24,155	10,387
Energy Efficient Homes	214,661	181,031	214,661	181,031
Energy Efficient Products	299,034	104,280	299,034	104,280
Low Income Energy Efficiency	72,695	72,695	72,695	72,695
C&I Energy Solutions for Business - Small	245,975	203,614	245,975	203,614
C&I Energy Solutions for Business - Large	205,252	157,726	205,252	157,726
Governmental & Institutional Tariff	11,756	9,957	11,756	9,957
Portfolio Total	1,073,528	739,690	1,073,528	739,690

Table 21: Lifetime Energy Savings by Program for Penn Power

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Appliance Turn-in	7,909	3,954	7,909	3,954
Energy Efficient Homes	60,341	47,403	60,341	47,403
Energy Efficient Products	64,750	25,798	64,750	25,798
Low Income Energy Efficiency	20,404	20,404	20,404	20,404
C&I Energy Solutions for Business - Small	120,996	87,333	120,996	87,333
C&I Energy Solutions for Business - Large	40,920	24,591	40,920	24,591
Governmental & Institutional Tariff	20,008	15,054	20,008	15,054
Portfolio Total	335,328	224,536	335,328	224,536

Table 22: Lifetime Energy Savings by Program for WPP

Program	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
Appliance Turn-in	36,013	16,206	36,013	16,206
Energy Efficient Homes	156,838	128,997	156,838	128,997
Energy Efficient Products	275,574	79,145	275,574	79,145
Low Income Energy Efficiency	66,434	66,434	66,434	66,434
C&I Energy Solutions for Business - Small	209,700	172,852	209,700	172,852
C&I Energy Solutions for Business - Large	138,710	105,175	138,710	105,175
Governmental & Institutional Tariff	81,294	67,361	81,294	67,361
Portfolio Total	964,562	636,170	964,562	636,170

2.8 SUMMARY OF DEMAND IMPACTS BY PROGRAM

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

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

2.8.1 Energy Efficiency

Act 129 defines peak demand savings from energy efficiency as the average expected reduction in electric demand from 2:00 p.m. to 6:00 p.m. EDT on non-holiday weekdays from June through August. Unlike Phase I and Phase II Act 129 reporting, the peak demand impacts from energy efficiency in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. Figure 15, Figure 16, Figure 17, and Figure 18 present summaries of the PYTD demand savings by energy efficiency program for Met-Ed, Penelec, Penn Power, and WPP respectively for Program Year 8.

Figure 15: PYTD Demand Savings by Energy Efficiency Program for Met-Ed

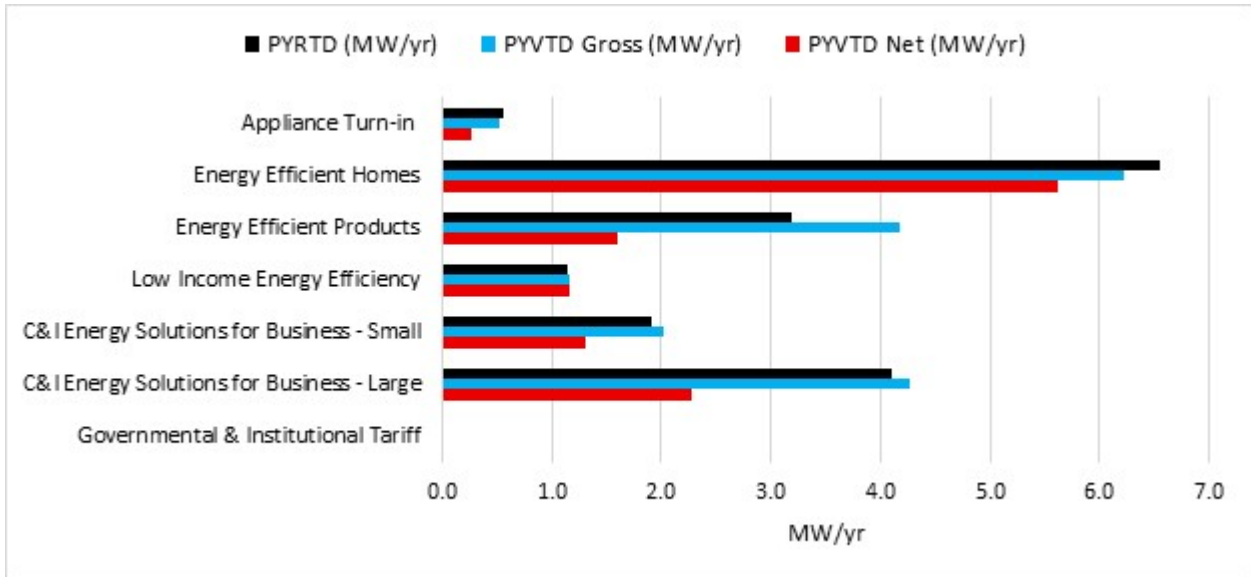


Figure 16: PYTD Demand Savings by Energy Efficiency Program for Penelec

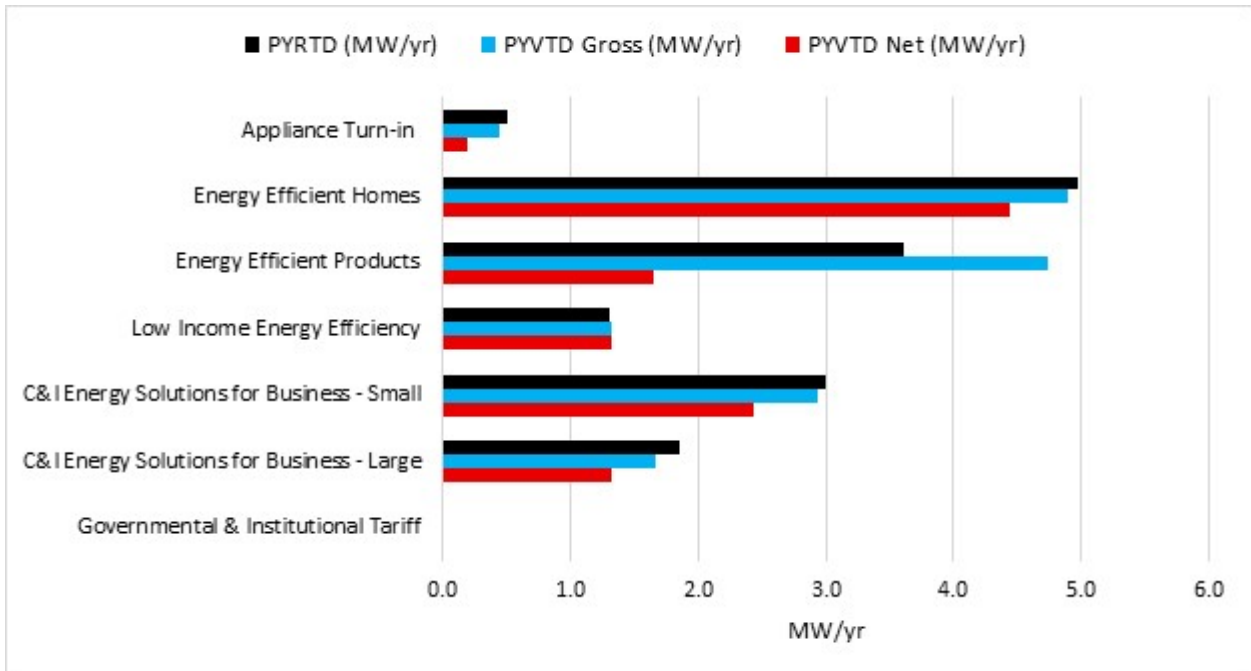


Figure 17: PYTD Demand Savings by Energy Efficiency Program for Penn Power

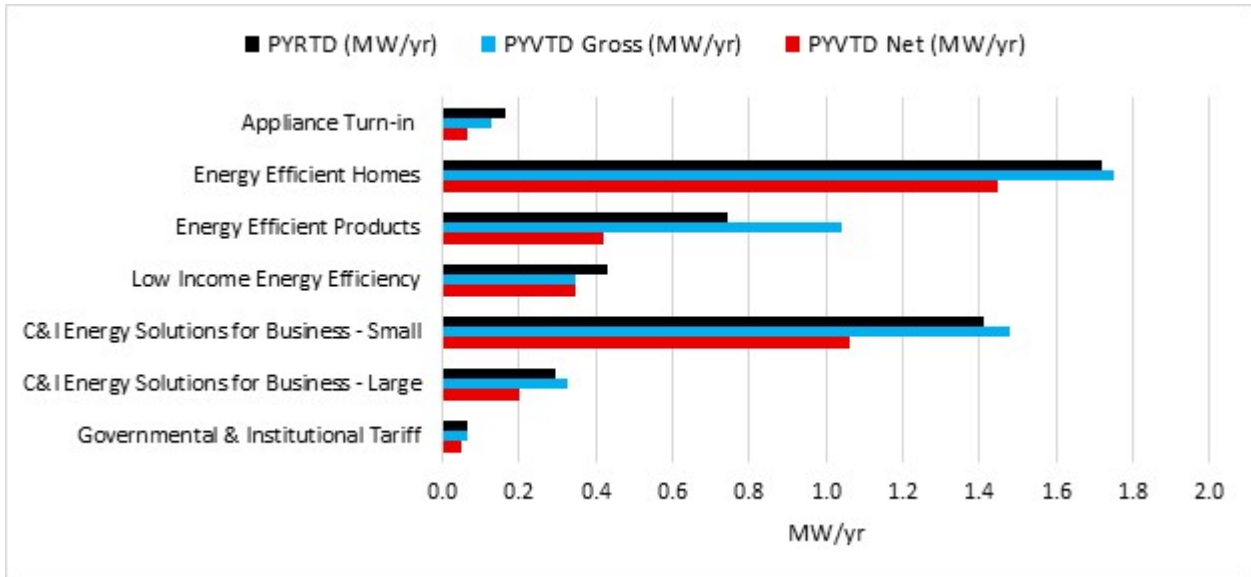


Figure 18: PYTD Demand Savings by Energy Efficiency Program for WPP

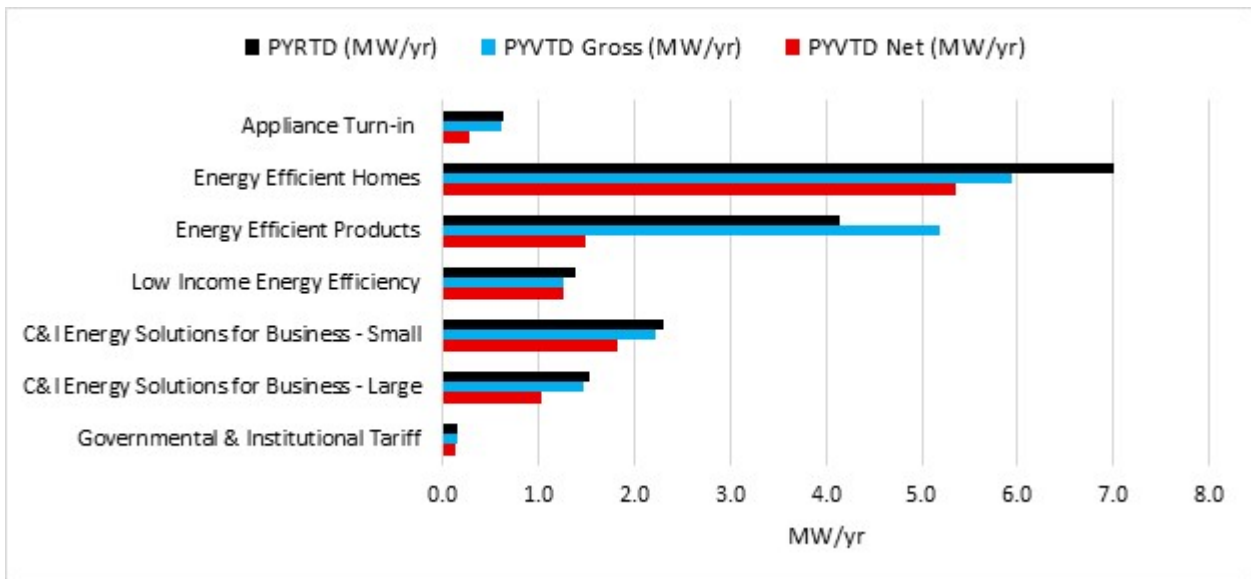


Figure 19, Figure 20, Figure 21, and Figure 22 present summaries of the P3TD demand savings by energy efficiency program for Met-Ed, Penelec, Penn Power, and WPP respectively for Phase III of Act 129.

Figure 19: P3TD Demand Savings by Energy Efficiency Program for Met-Ed

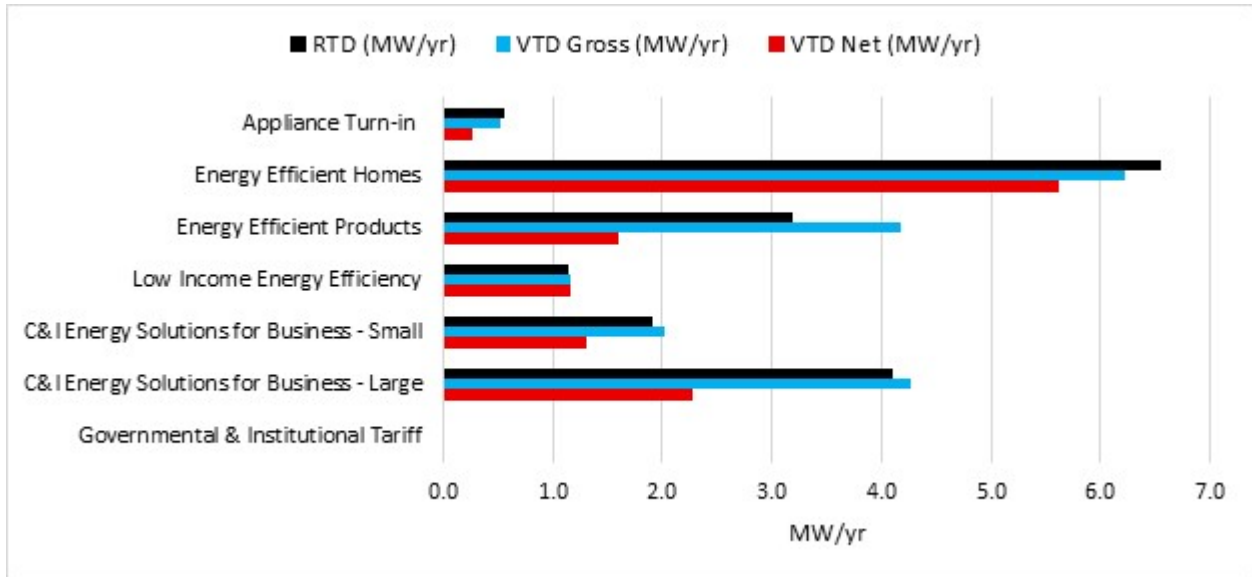


Figure 20: P3TD Demand Savings by Energy Efficiency Program for Penelec

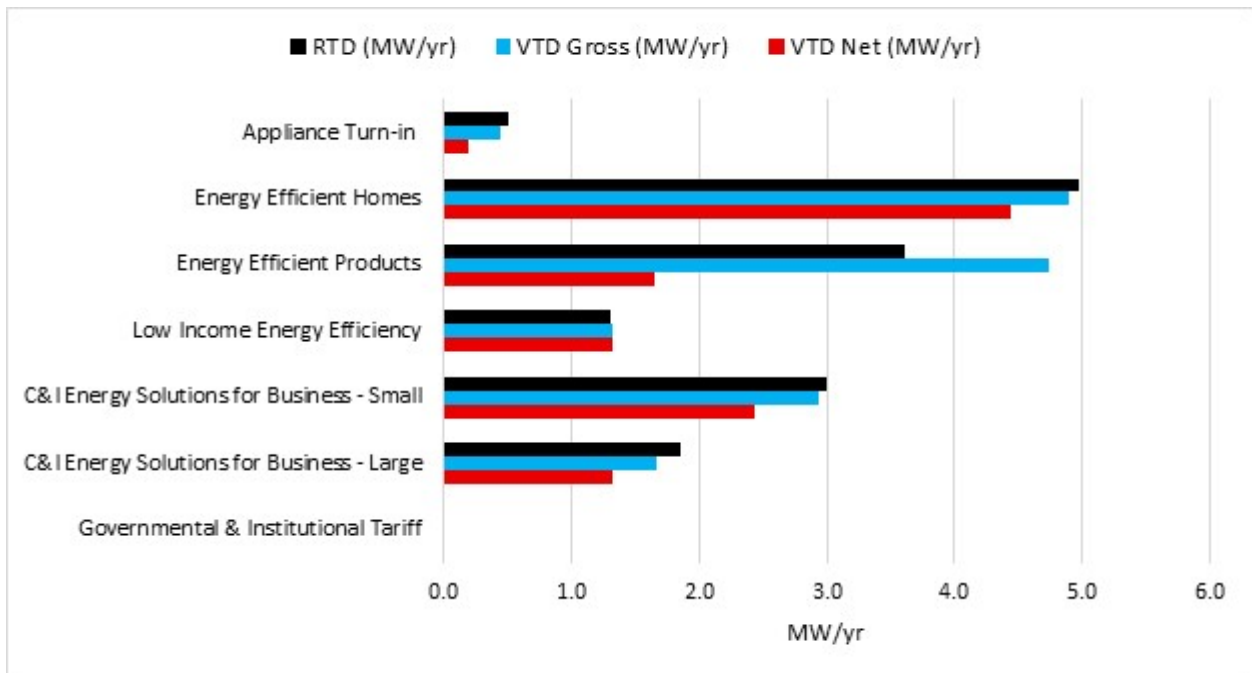


Figure 21: P3TD Demand Savings by Energy Efficiency Program for Penn Power

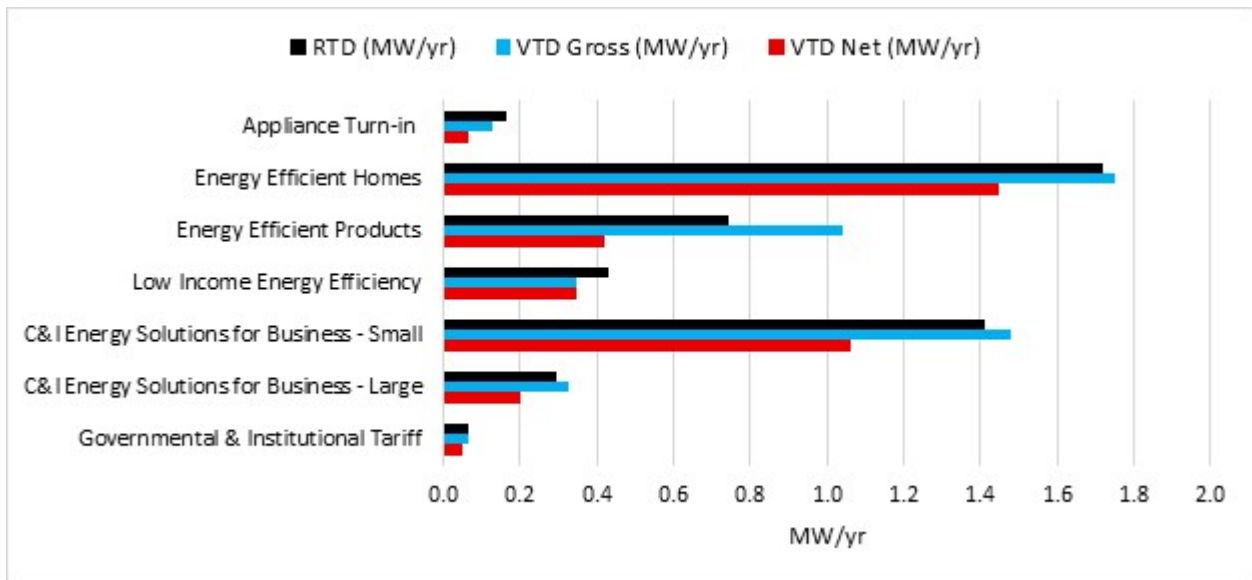
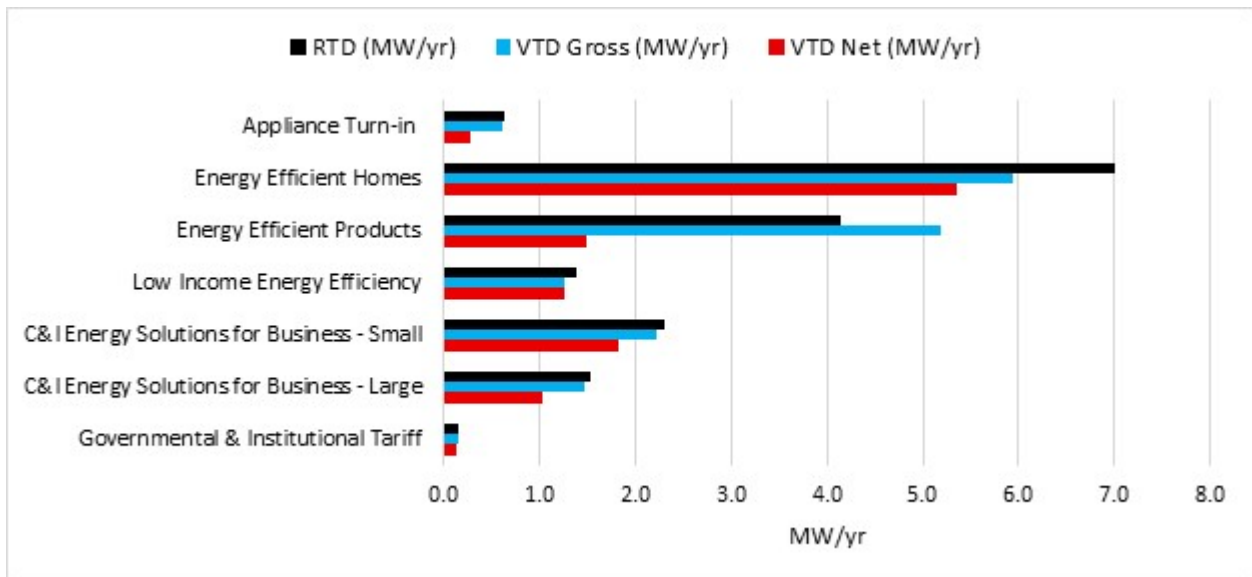


Figure 22: P3TD Demand Savings by Energy Efficiency Program for WPP



Summaries of the peak demand impacts by energy efficiency program through the current reporting period are presented in Table 23, Table 24, Table 25, and Table 26 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 23: Peak Demand Savings by Energy Efficiency Program for Met-Ed

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Appliance Turn-in	0.56	0.53	0.26	0.56	0.53	0.26
Energy Efficient Homes	6.55	6.22	5.62	6.55	6.22	5.62
Energy Efficient Products	3.18	4.17	1.59	3.18	4.17	1.59
Low Income Energy Efficiency	1.15	1.16	1.16	1.15	1.16	1.16
C&I Energy Solutions for Business - Small	1.92	2.01	1.31	1.92	2.01	1.31
C&I Energy Solutions for Business - Large	4.11	4.27	2.27	4.11	4.27	2.27
Governmental & Institutional Tariff	0.01	0.01	0.01	0.01	0.01	0.01
Portfolio Total	17.47	18.37	12.23	17.47	18.37	12.23

Table 24: Peak Demand Savings by Energy Efficiency Program for Penelec

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Appliance Turn-in	0.50	0.44	0.19	0.50	0.44	0.19
Energy Efficient Homes	4.96	4.90	4.44	4.96	4.90	4.44
Energy Efficient Products	3.60	4.74	1.65	3.60	4.74	1.65
Low Income Energy Efficiency	1.30	1.33	1.33	1.30	1.33	1.33
C&I Energy Solutions for Business - Small	2.99	2.94	2.43	2.99	2.94	2.43
C&I Energy Solutions for Business - Large	1.86	1.66	1.32	1.86	1.66	1.32
Governmental & Institutional Tariff	0.01	0.01	0.01	0.01	0.01	0.01
Portfolio Total	15.23	16.02	11.37	15.23	16.02	11.37

Table 25: Peak Demand Savings by Energy Efficiency Program for Penn Power

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Appliance Turn-in	0.16	0.13	0.07	0.16	0.13	0.07
Energy Efficient Homes	1.72	1.75	1.45	1.72	1.75	1.45
Energy Efficient Products	0.75	1.04	0.42	0.75	1.04	0.42
Low Income Energy Efficiency	0.43	0.35	0.35	0.43	0.35	0.35
C&I Energy Solutions for Business - Small	1.41	1.48	1.06	1.41	1.48	1.06
C&I Energy Solutions for Business - Large	0.29	0.32	0.20	0.29	0.32	0.20
Governmental & Institutional Tariff	0.06	0.07	0.05	0.06	0.07	0.05
Portfolio Total	4.83	5.13	3.59	4.83	5.13	3.59

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

Program	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Appliance Turn-in	0.63	0.61	0.27	0.63	0.61	0.27
Energy Efficient Homes	7.01	5.93	5.36	7.01	5.93	5.36
Energy Efficient Products	4.15	5.18	1.49	4.15	5.18	1.49
Low Income Energy Efficiency	1.39	1.26	1.26	1.39	1.26	1.26
C&I Energy Solutions for Business - Small	2.31	2.22	1.83	2.31	2.22	1.83
C&I Energy Solutions for Business - Large	1.53	1.47	1.04	1.53	1.47	1.04
Governmental & Institutional Tariff	0.16	0.16	0.13	0.16	0.16	0.13
Portfolio Total	17.18	16.84	11.39	17.18	16.84	11.39

2.8.2 Demand Response

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

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

The peak demand impacts from demand response in this report are presented at the system level and reflect adjustments to account for transmission and distribution losses. Table 27 lists the line loss multipliers by EDC and by sector. These values are taken from Table 1-4 of the 2016 PA TRM.

Table 27: Line Loss Multipliers by EDC and Customer Sector

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

Table 28 summarizes the PYVTD and VTD demand reductions for each of the demand response programs in the EE&C plan and for the demand response portfolio as a whole. VTD demand reductions are the average performance across all Phase III demand response events independent of how many events occurred in a given program year. The relative precision

columns in Table 10 indicate the margin of error (at the 90% confidence interval) around the PYVTD and VTD demand reductions. The table shows zero values in each cell because there were no demand response events in PY8.

Table 28: Verified Gross Demand Response Impacts by Program

EDC	Program	PYVTD Gross MW	Relative Precision	VTD Gross MW	Relative Precision
Met-Ed	Residential Behavioral Demand Response	0.0	0.0	0.0	0.0
Met-Ed	C&I Demand Response Program – Small	0.0	0.0	0.0	0.0
Met-Ed	C&I Demand Response Program – Large	0.0	0.0	0.0	0.0
Penn Power	Residential Behavioral Demand Response	0.0	0.0	0.0	0.0
Penn Power	C&I Demand Response Program – Small	0.0	0.0	0.0	0.0
Penn Power	C&I Demand Response Program – Large	0.0	0.0	0.0	0.0
WPP	Residential Behavioral Demand Response	0.0	0.0	0.0	0.0
WPP	C&I Demand Response Program – Small	0.0	0.0	0.0	0.0
WPP	C&I Demand Response Program – Large	0.0	0.0	0.0	0.0

2.9 SUMMARY OF FUEL SWITCHING IMPACTS

Act 129 allows EDCs to achieve electric savings by converting electric equipment to non-electric equipment. Table 11 summarizes for each EDC, key fuel switching metrics to date in Phase III. Combined Heat and Power (CHP) and solar water heating are the only fuel switching measures offered by the Companies in Phase III. There were no rebates approved for these measures in PY8.

Table 29: Fuel Switching Summary

	Met-Ed	Penelec	Penn Power	WPP
Fuel Switching Measures Offered	CHP, Solar Water Heater			
Fuel Switching Measures Implemented	None	None	None	None
VTD Energy Savings Achieved via Fuel Switching (MWh/yr)	0	0	0	0
P3TD Increased Fossil Fuel Consumption Due to Fuel Switching Measures (MMBTU/yr)	0	0	0	0
P3TD Incentive Payments for Fuel Switching Measures (\$1000)	0	0	0	0

2.10 SUMMARY OF COST-EFFECTIVENESS RESULTS

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. It is important to note that TRC costs are materially different from the EDC spending and rate recovery tables presented later in the report. TRC costs include estimates of the full cost incurred by program participants to install efficient equipment, not just the portion covered by the EDC rebate. Table 31, Table 32, Table 33, and Table 34 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 PY8, cost and benefits are expressed in 2016 dollars.

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

If TRCs were to not use the dual baselines, portfolio gross and net TRCs for the Energy Efficient Products program would increase by 26 to 41%, portfolio gross TRCs would increase by 7 to 11% and portfolio net TRCs would increase by 5 to 6% depending on EDC. Gross and Net TRCs for the Portfolio with and without dual baseline treatment are presented in the following table:

Table 30 – Portfolio TRC with and without Dual Baseline Calculations

EDC	Gross		Net	
	Dual Baseline	Without Dual Baseline	Dual Baseline	Without Dual Baseline
Met-Ed	1.45	1.56	1.20	1.26
Penelec	1.53	1.69	1.25	1.32
Penn Power	1.55	1.72	1.35	1.43
WPP	1.26	1.40	0.98	1.02
Average	1.45	1.59	1.19	1.26

Table 31: PY8 Gross TRC Ratios by Program (\$1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$1,513	\$652	2.32	\$861
Energy Efficient Homes	\$10,004	\$7,154	1.40	\$2,850
Energy Efficient Products	\$13,647	\$7,070	1.93	\$6,578
Low Income Energy Efficiency	\$2,563	\$3,409	0.75	-\$847
Residential Subtotal	\$27,727	\$18,285	1.52	\$9,442
C&I Energy Solutions for Business - Small	\$5,872	\$4,136	1.42	\$1,736
C&I Energy Solutions for Business - Large	\$15,060	\$10,778	1.40	\$4,282
Governmental & Institutional Tariff	\$96	\$115	0.84	-\$18
C&I Demand Response Program – Small	\$0	\$40	0.00	-\$40
C&I Demand Response Program – Large	\$0	\$360	0.00	-\$360
Non-Residential Subtotal	\$21,028	\$15,428	1.36	\$5,600
Portfolio Total	\$48,755	\$33,712	1.45	\$15,042

Table 32: PY8 Gross TRC Ratios by Program (\$1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$1,156	\$648	1.78	\$508
Energy Efficient Homes	\$9,626	\$6,126	1.57	\$3,500
Energy Efficient Products	\$16,916	\$6,565	2.58	\$10,351
Low Income Energy Efficiency	\$3,048	\$3,504	0.87	-\$455
Residential Subtotal	\$30,746	\$16,842	1.83	\$13,904
C&I Energy Solutions for Business - Small	\$8,449	\$6,291	1.34	\$2,159
C&I Energy Solutions for Business - Large	\$6,485	\$6,571	0.99	-\$86
Governmental & Institutional Tariff	\$283	\$336	0.84	-\$54
Non-Residential Subtotal	\$15,218	\$13,198	1.15	\$2,019
Portfolio Total	\$45,964	\$30,041	1.53	\$15,923

Table 33: PY8 Gross TRC Ratios by Program (\$1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$319	\$226	1.41	\$93
Energy Efficient Homes	\$2,752	\$2,433	1.13	\$319
Energy Efficient Products	\$3,432	\$1,739	1.97	\$1,694
Low Income Energy Efficiency	\$788	\$973	0.81	-\$185
Residential Subtotal	\$7,292	\$5,371	1.36	\$1,920
C&I Energy Solutions for Business - Small	\$4,210	\$1,793	2.35	\$2,418
C&I Energy Solutions for Business - Large	\$1,317	\$1,065	1.24	\$252
Governmental & Institutional Tariff	\$520	\$247	2.10	\$273
C&I Demand Response Program – Small	\$0	\$12	0.00	-\$12
C&I Demand Response Program – Large	\$0	\$111	0.00	-\$111
Non-Residential Subtotal	\$6,048	\$3,229	1.87	\$2,819
Portfolio Total	\$13,339	\$8,600	1.55	\$4,739

Table 34: PY8 Gross TRC Ratios by Program (\$1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$1,444	\$775	1.86	\$670
Energy Efficient Homes	\$7,111	\$6,547	1.09	\$564
Energy Efficient Products	\$15,324	\$7,776	1.97	\$7,548
Low Income Energy Efficiency	\$2,599	\$3,573	0.73	-\$974
Residential Subtotal	\$26,478	\$18,670	1.42	\$7,808
C&I Energy Solutions for Business - Small	\$6,974	\$6,173	1.13	\$801
C&I Energy Solutions for Business - Large	\$4,582	\$4,173	1.10	\$409
Governmental & Institutional Tariff	\$2,035	\$2,178	0.93	-\$143
C&I Demand Response Program – Small	\$0	\$56	0.00	-\$56
C&I Demand Response Program – Large	\$0	\$502	0.00	-\$502
Non-Residential Subtotal	\$13,591	\$13,082	1.04	\$509
Portfolio Total	\$40,069	\$31,752	1.26	\$8,317

Table 35, Table 36, Table 37, and Table 38 present PY8 cost-effectiveness for Met-Ed, Penelec, Penn Power, and WPP respectively, using net verified savings to calculate benefits.

Table 35: PY8 Net TRC Ratios by Program (\$1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$756	\$652	1.16	\$105
Energy Efficient Homes	\$8,257	\$6,608	1.25	\$1,649
Energy Efficient Products	\$5,166	\$3,498	1.48	\$1,668
Low Income Energy Efficiency	\$2,563	\$3,409	0.75	-\$847
Residential Subtotal	\$16,742	\$14,167	1.18	\$2,575
C&I Energy Solutions for Business - Small	\$3,814	\$2,984	1.28	\$829
C&I Energy Solutions for Business - Large	\$8,037	\$6,202	1.30	\$1,835
Governmental & Institutional Tariff	\$64	\$91	0.70	-\$28
C&I Demand Response Program – Small	\$0	\$40	0.00	-\$40
C&I Demand Response Program – Large	\$0	\$360	0.00	-\$360
Non-Residential Subtotal	\$11,914	\$9,678	1.23	\$2,236
Portfolio Total	\$28,656	\$23,845	1.20	\$4,811

Table 36: PY8 Net TRC Ratios by Program (\$1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$497	\$648	0.77	-\$151
Energy Efficient Homes	\$8,135	\$5,999	1.36	\$2,136
Energy Efficient Products	\$5,853	\$3,119	1.88	\$2,734
Low Income Energy Efficiency	\$3,048	\$3,504	0.87	-\$455
Residential Subtotal	\$17,534	\$13,270	1.32	\$4,263
C&I Energy Solutions for Business - Small	\$6,981	\$5,296	1.32	\$1,685
C&I Energy Solutions for Business - Large	\$4,986	\$4,898	1.02	\$89
Governmental & Institutional Tariff	\$239	\$301	0.79	-\$62
Non-Residential Subtotal	\$12,206	\$10,494	1.16	\$1,712
Portfolio Total	\$29,740	\$23,765	1.25	\$5,975

Table 37: PY8 Net TRC Ratios by Program (\$1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$159	\$226	0.71	-\$67
Energy Efficient Homes	\$2,113	\$2,062	1.02	\$52
Energy Efficient Products	\$1,364	\$871	1.57	\$492
Low Income Energy Efficiency	\$788	\$973	0.81	-\$185
Residential Subtotal	\$4,424	\$4,132	1.07	\$292
C&I Energy Solutions for Business - Small	\$3,026	\$1,308	2.31	\$1,718
C&I Energy Solutions for Business - Large	\$789	\$650	1.21	\$139
Governmental & Institutional Tariff	\$392	\$199	1.96	\$192
C&I Demand Response Program – Small	\$0	\$12	0.00	-\$12
C&I Demand Response Program – Large	\$0	\$111	0.00	-\$111
Non-Residential Subtotal	\$4,206	\$2,281	1.84	\$1,925
Portfolio Total	\$8,631	\$6,413	1.35	\$2,217

Table 38: PY8 Net TRC Ratios by Program (\$1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$650	\$775	0.84	-\$125
Energy Efficient Homes	\$5,842	\$5,986	0.98	-\$143
Energy Efficient Products	\$4,334	\$3,540	1.22	\$794
Low Income Energy Efficiency	\$2,599	\$3,573	0.73	-\$974
Residential Subtotal	\$13,426	\$13,873	0.97	-\$448
C&I Energy Solutions for Business - Small	\$5,746	\$5,276	1.09	\$470
C&I Energy Solutions for Business - Large	\$3,408	\$3,308	1.03	\$100
Governmental & Institutional Tariff	\$1,686	\$1,839	0.92	-\$152
C&I Demand Response Program – Small	\$0	\$56	0.00	-\$56
C&I Demand Response Program – Large	\$0	\$502	0.00	-\$502
Non-Residential Subtotal	\$10,839	\$10,980	0.99	-\$141
Portfolio Total	\$24,265	\$24,854	0.98	-\$588

Table 39, Table 40, Table 41, and Table 42 summarize cost-effectiveness by program respectively for Met-Ed, Penelec, Penn Power, and WPP for Phase III of Act 129. P3TD costs and benefits are expressed in 2016 dollars regardless of program or reporting year.

Table 39: P3TD Gross TRC Ratios by Program (\$1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$1,513	\$652	2.32	\$861
Energy Efficient Homes	\$10,004	\$7,154	1.40	\$2,850
Energy Efficient Products	\$13,647	\$7,070	1.93	\$6,578
Low Income Energy Efficiency	\$2,563	\$3,409	0.75	-\$847
Residential Subtotal	\$27,727	\$18,285	1.52	\$9,442
C&I Energy Solutions for Business - Small	\$5,872	\$4,136	1.42	\$1,736
C&I Energy Solutions for Business - Large	\$15,060	\$10,778	1.40	\$4,282
Governmental & Institutional Tariff	\$96	\$115	0.84	-\$18
C&I Demand Response Program – Small	\$0	\$40	0.00	-\$40
C&I Demand Response Program – Large	\$0	\$360	0.00	-\$360
Non-Residential Subtotal	\$21,028	\$15,428	1.36	\$5,600
Portfolio Total	\$48,755	\$33,712	1.45	\$15,042

Table 40: P3TD Gross TRC Ratios by Program (\$1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$1,156	\$648	1.78	\$508
Energy Efficient Homes	\$9,626	\$6,126	1.57	\$3,500
Energy Efficient Products	\$16,916	\$6,565	2.58	\$10,351
Low Income Energy Efficiency	\$3,048	\$3,504	0.87	-\$455
Residential Subtotal	\$30,746	\$16,842	1.83	\$13,904
C&I Energy Solutions for Business - Small	\$8,449	\$6,291	1.34	\$2,159
C&I Energy Solutions for Business - Large	\$6,485	\$6,571	0.99	-\$86
Governmental & Institutional Tariff	\$283	\$336	0.84	-\$54
Non-Residential Subtotal	\$15,218	\$13,198	1.15	\$2,019
Portfolio Total	\$45,964	\$30,041	1.53	\$15,923

Table 41: P3TD Gross TRC Ratios by Program (\$1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$319	\$226	1.41	\$93
Energy Efficient Homes	\$2,752	\$2,433	1.13	\$319
Energy Efficient Products	\$3,432	\$1,739	1.97	\$1,694
Low Income Energy Efficiency	\$788	\$973	0.81	-\$185
Residential Subtotal	\$7,292	\$5,371	1.36	\$1,920
C&I Energy Solutions for Business - Small	\$4,210	\$1,793	2.35	\$2,418
C&I Energy Solutions for Business - Large	\$1,317	\$1,065	1.24	\$252
Governmental & Institutional Tariff	\$520	\$247	2.10	\$273
C&I Demand Response Program – Small	\$0	\$12	0.00	-\$12
C&I Demand Response Program – Large	\$0	\$111	0.00	-\$111
Non-Residential Subtotal	\$6,048	\$3,229	1.87	\$2,819
Portfolio Total	\$13,339	\$8,600	1.55	\$4,739

Table 42: P3TD Gross TRC Ratios by Program (\$1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$1,444	\$775	1.86	\$670
Energy Efficient Homes	\$7,111	\$6,547	1.09	\$564
Energy Efficient Products	\$15,324	\$7,776	1.97	\$7,548
Low Income Energy Efficiency	\$2,599	\$3,573	0.73	-\$974
Residential Subtotal	\$26,478	\$18,670	1.42	\$7,808
C&I Energy Solutions for Business - Small	\$6,974	\$6,173	1.13	\$801
C&I Energy Solutions for Business - Large	\$4,582	\$4,173	1.10	\$409
Governmental & Institutional Tariff	\$2,035	\$2,178	0.93	-\$143
C&I Demand Response Program – Small	\$0	\$56	0.00	-\$56
C&I Demand Response Program – Large	\$0	\$502	0.00	-\$502
Non-Residential Subtotal	\$13,591	\$13,082	1.04	\$509
Portfolio Total	\$40,069	\$31,752	1.26	\$8,317

Table 43, Table 44, Table 45, and Table 46 present P3TD cost-effectiveness results for Met-Ed, Penelec, Penn Power, and WPP respectively using net verified savings to calculate benefits. Cost and benefits are expressed in 2016 dollars.

Table 43: P3TD Net TRC Ratios by Program (\$1,000) for Met-Ed

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$756	\$652	1.16	\$105
Energy Efficient Homes	\$8,257	\$6,608	1.25	\$1,649
Energy Efficient Products	\$5,166	\$3,498	1.48	\$1,668
Low Income Energy Efficiency	\$2,563	\$3,409	0.75	-\$847
Residential Subtotal	\$16,742	\$14,167	1.18	\$2,575
C&I Energy Solutions for Business - Small	\$3,814	\$2,984	1.28	\$829
C&I Energy Solutions for Business - Large	\$8,037	\$6,202	1.30	\$1,835
Governmental & Institutional Tariff	\$64	\$91	0.70	-\$28
C&I Demand Response Program – Small	\$0	\$40	0.00	-\$40
C&I Demand Response Program – Large	\$0	\$360	0.00	-\$360
Non-Residential Subtotal	\$11,914	\$9,678	1.23	\$2,236
Portfolio Total	\$28,656	\$23,845	1.20	\$4,811

Table 44: P3TD Net TRC Ratios by Program (\$1,000) for Penelec

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$497	\$648	0.77	-\$151
Energy Efficient Homes	\$8,135	\$5,999	1.36	\$2,136
Energy Efficient Products	\$5,853	\$3,119	1.88	\$2,734
Low Income Energy Efficiency	\$3,048	\$3,504	0.87	-\$455
Residential Subtotal	\$17,534	\$13,270	1.32	\$4,263
C&I Energy Solutions for Business - Small	\$6,981	\$5,296	1.32	\$1,685
C&I Energy Solutions for Business - Large	\$4,986	\$4,898	1.02	\$89
Governmental & Institutional Tariff	\$239	\$301	0.79	-\$62
Non-Residential Subtotal	\$12,206	\$10,494	1.16	\$1,712
Portfolio Total	\$29,740	\$23,765	1.25	\$5,975

Table 45: P3TD Net TRC Ratios by Program (\$1,000) for Penn Power

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$159	\$226	0.71	-\$67
Energy Efficient Homes	\$2,113	\$2,062	1.02	\$52
Energy Efficient Products	\$1,364	\$871	1.57	\$492
Low Income Energy Efficiency	\$788	\$973	0.81	-\$185
Residential Subtotal	\$4,424	\$4,132	1.07	\$292
C&I Energy Solutions for Business - Small	\$3,026	\$1,308	2.31	\$1,718
C&I Energy Solutions for Business - Large	\$789	\$650	1.21	\$139
Governmental & Institutional Tariff	\$392	\$199	1.96	\$192
C&I Demand Response Program – Small	\$0	\$12	0.00	-\$12
C&I Demand Response Program – Large	\$0	\$111	0.00	-\$111
Non-Residential Subtotal	\$4,206	\$2,281	1.84	\$1,925
Portfolio Total	\$8,631	\$6,413	1.35	\$2,217

Table 46: P3TD Net TRC Ratios by Program (\$1,000) for WPP

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
Appliance Turn-in	\$650	\$775	0.84	-\$125
Energy Efficient Homes	\$5,842	\$5,986	0.98	-\$143
Energy Efficient Products	\$4,334	\$3,540	1.22	\$794
Low Income Energy Efficiency	\$2,599	\$3,573	0.73	-\$974
Residential Subtotal	\$13,426	\$13,873	0.97	-\$448
C&I Energy Solutions for Business - Small	\$5,746	\$5,276	1.09	\$470
C&I Energy Solutions for Business - Large	\$3,408	\$3,308	1.03	\$100
Governmental & Institutional Tariff	\$1,686	\$1,839	0.92	-\$152
C&I Demand Response Program – Small	\$0	\$56	0.00	-\$56
C&I Demand Response Program – Large	\$0	\$502	0.00	-\$502
Non-Residential Subtotal	\$10,839	\$10,980	0.99	-\$141
Portfolio Total	\$24,265	\$24,854	0.98	-\$588

2.11 COMPARISON OF PERFORMANCE TO APPROVED EE&C PLAN

Table 47, Table 48, Table 49, and Table 50 present P3TD expenditures, by program, compared to the budget estimates set forth in the EE&C plan through PY8 for Met-Ed, Penelec, Penn Power, and WPP respectively. All of the dollars in Table 16 are presented in 2016 dollars.

Table 47: Comparison of P3TD Expenditures to EE&C Plan (\$1,000) Met-Ed

Program	Phase III Budget from EE&C Plan through PY8	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 1,173.93	\$ 879.99	0.75
Energy Efficient Homes Program	\$ 6,602.46	\$ 6,061.76	0.92
Energy Efficient Products Program	\$ 3,943.32	\$ 2,406.77	0.61
Low Income Energy Efficiency Program	\$ 3,848.44	\$ 3,391.51	0.88
C&I Energy Solutions for Business Program - Small	\$ 3,959.03	\$ 1,627.09	0.41
C&I Demand Response Program - Small	\$ 49.84	\$ 40.10	0.80
C&I Energy Solutions for Business Program - Large	\$ 2,891.60	\$ 2,749.40	0.95
C&I Demand Response Program - Large	\$ 448.52	\$ 359.97	0.80
Governmental & Institutional Tariff Program	\$ 263.18	\$ 59.30	0.23
Total	\$ 23,180.32	\$ 17,575.87	0.76

Table 48: Comparison of P3TD Expenditures to EE&C Plan (\$1,000) Penelec

Program	Phase III Budget from EE&C Plan through PY8	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 1,216.32	\$ 845.54	0.70
Energy Efficient Homes Program	\$ 6,156.38	\$ 5,871.97	0.95
Energy Efficient Products Program	\$ 3,816.54	\$ 2,577.57	0.68
Low Income Energy Efficiency Program	\$ 4,218.89	\$ 3,496.73	0.83
C&I Energy Solutions for Business Program - Small	\$ 4,119.56	\$ 2,222.12	0.54
C&I Energy Solutions for Business Program - Large	\$ 2,571.54	\$ 1,572.01	0.61
Governmental & Institutional Tariff Program	\$ 464.38	\$ 146.23	0.31
Total	\$ 22,563.59	\$ 16,732.16	0.74

Table 49: Comparison of P3TD Expenditures to EE&C Plan (\$1,000) Penn Power

Program	Phase III Budget from EE&C Plan through PY8	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 280.70	\$ 290.72	1.04
Energy Efficient Homes Program	\$ 1,833.59	\$ 1,690.05	0.92
Energy Efficient Products Program	\$ 932.04	\$ 511.06	0.55
Low Income Energy Efficiency Program	\$ 1,321.79	\$ 971.01	0.73
C&I Energy Solutions for Business Program - Small	\$ 1,136.21	\$ 836.20	0.74
C&I Demand Response Program - Small	\$ 14.23	\$ 12.39	0.87
C&I Energy Solutions for Business Program - Large	\$ 618.70	\$ 345.02	0.56
C&I Demand Response Program - Large	\$ 128.07	\$ 111.06	0.87
Governmental & Institutional Tariff Program	\$ 108.91	\$ 126.72	1.16
Total	\$ 6,374.24	\$ 4,894.23	0.77

Table 50: Comparison of P3TD Expenditures to EE&C Plan (\$1,000) WPP

Program	Phase III Budget from EE&C Plan through PY8	P3TD Actual Expenditures	Ratio (Actual/Plan)
Appliance Turn In Program	\$ 1,168.28	\$ 1,035.09	0.89
Energy Efficient Homes Program	\$ 4,912.17	\$ 5,424.83	1.10
Energy Efficient Products Program	\$ 3,744.32	\$ 2,862.06	0.76
Low Income Energy Efficiency Program	\$ 4,012.74	\$ 3,565.02	0.89
C&I Energy Solutions for Business Program - Small	\$ 3,762.23	\$ 1,929.63	0.51
C&I Demand Response Program - Small	\$ 58.33	\$ 55.82	0.96
C&I Energy Solutions for Business Program - Large	\$ 2,722.00	\$ 1,212.48	0.45
C&I Demand Response Program - Large	\$ 524.99	\$ 501.89	0.96
Governmental & Institutional Tariff Program	\$ 347.20	\$ 471.11	1.36
Total	\$ 21,252.26	\$ 17,057.93	0.80

Table 51, Table 52, Table 53, and Table 54 compare Phase III verified gross program savings compare to the energy savings projections filed in the EE&C plan for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 51: Comparison of Phase III Actual Program Savings to EE&C Plan Projections for Phase III for Met-Ed

Program	EE&C Plan Through PY8	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,129	4,014	0.65
Energy Efficient Homes Program	34,695	53,569	1.54
Energy Efficient Products Program	22,747	30,825	1.36
Low Income Energy Efficiency Program	7,590	10,105	1.33
C&I Energy Solutions for Business Program - Small	22,267	11,469	0.52
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	23,233	29,643	1.28
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	824	250	0.30
Total	117,486	139,875	1.19

Table 52: Comparison of Phase III Actual Program Savings to EE&C Plan Projections for Phase III for Penelec

Program	EE&C Plan Through PY8	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,925	3,407	0.49
Energy Efficient Homes Program	29,763	45,106	1.52
Energy Efficient Products Program	24,141	39,241	1.63
Low Income Energy Efficiency Program	7,243	12,359	1.71
C&I Energy Solutions for Business Program - Small	22,754	16,874	0.74
C&I Energy Solutions for Business Program - Large	20,783	14,666	0.71
Governmental & Institutional Tariff Program	1,106	796	0.72
Total	112,716	132,449	1.18

Table 53: Comparison of Phase III Actual Program Savings to EE&C Plan Projections for Phase III for Penn Power

Program	EE&C Plan Through PY8	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	1,645	1,007	0.61
Energy Efficient Homes Program	8,482	12,883	1.52
Energy Efficient Products Program	6,300	7,896	1.25
Low Income Energy Efficiency Program	2,041	3,080	1.51
C&I Energy Solutions for Business Program - Small	6,972	8,151	1.17
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	5,206	2,768	0.53
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	433	1,345	3.11
Total	31,079	37,130	1.19

Table 54: Comparison of Phase III Actual Program Savings to EE&C Plan Projections for Phase III for WPP

Program	EE&C Plan Through PY8	VTD Gross MWh Savings	Ratio (Actual/Plan)
Appliance Turn In Program	6,671	4,565	0.68
Energy Efficient Homes Program	29,878	48,291	1.62
Energy Efficient Products Program	22,059	37,095	1.68
Low Income Energy Efficiency Program	6,812	10,915	1.60
C&I Energy Solutions for Business Program - Small	19,977	14,523	0.73
C&I Demand Response Program - Small	0	0	n/a
C&I Energy Solutions for Business Program - Large	21,510	10,414	0.48
C&I Demand Response Program - Large	0	0	n/a
Governmental & Institutional Tariff Program	1,072	5,528	5.15
Total	107,978	131,330	1.22

Overall, the Companies exceeded their annual MWh targets while staying within budget. Participation levels in the Appliance Turn-In program were lower than planned amounts for all four PA Companies. As of this writing this is not a major concern, as marketing efforts can be increased if participation again falls short of targets in PY9. One possible cause for the lower than expected participation rates is that the program may have lost momentum and marketing continuity after the previous ICSP unexpectedly became insolvent during PY7.

All other residential programs generally exceeded expectations, while remaining within budget (normalized to MWh). Part of the reason for the apparent over performance of the Energy Efficient Homes and Low Income Energy Efficiency programs is attributable to the Home Energy Reports (“HER”) program component. On average, HER customers saved 10% to 15% more than the 180 kWh/home that was used in portfolio planning assumptions. This may be due to a number of reasons including increased savings with the duration of messaging and weather-related factors. Energy efficiency kits also constituted a greater proportion of the Energy Efficient Homes program, with approximately ten percent more participation than planned. This tends to increase savings and cost-effectiveness as kits are generally more cost effective than the direct install and new homes program components. The Energy Efficient Products program was buoyed by higher than expected participation in the upstream lighting component, and also by cross-sector sales (which are only accounted for in the verified impacts, not in planned or reported impacts). The Companies monitor overall spending and achievements for the residential sector as well as specific achievements in the low-income sector. As of this writing there are no significant program changes pending for PY9.

The Commercial and Industrial Programs typically had lower participation levels than planned. This is to be expected for the first year of a phase since the typical backlog of projects is nearly eliminated between phases. Participation for the small rate-restricted Government and Institutional Tariff Program was volatile, as expected for such programs. Penn Power and West Penn Power had far higher savings than planned, while Met-Ed and Penelec fell short of participation and savings targets. The Companies monitor overall spending and achievements for the nonresidential sector as well as specific achievements in the GNI sector. As of this writing there are no significant program changes pending for PY9.

2.12 FINDINGS AND RECOMMENDATIONS

The impact and process evaluation activities completed by the ADM and Tetra Tech team led to recommendations for program improvement. Table 55 lists the overarching recommendations that affect more than one program, the evaluation activity(s) that uncovered the finding, and the ADM and Tetra Tech team's recommendation(s) to the Companies to address the finding. As the tracking and reporting system affects all programs, the overarching comments address this key operational element. Program specific recommendations can be found in subsections 3.1.7, 3.2.7, 3.3.7, 3.4.7, and 3.5.7.

Table 55: Summary of Evaluation Recommendations

Evaluation Activity	Finding	Recommendation
Tracking and Reporting	The EDCs have scheduled weekly meetings between the tracking and reporting team and the EDC impact evaluator to discuss tracking and reporting issues and to implement automated quality checks for data uploaded by ICSPs.	These meetings have generally improved data quality and have allowed the EDC evaluator to gain a better understanding of data flow through each program. Continue to meet as needed to maintain data quality.
Tracking and Reporting	Reported data for the Home Energy Reports program component are maintained outside of the EDC's main tracking and reporting system.	Explore the possibility of maintaining report-level data (participant counts and impacts) within the main tracking and reporting system.
Tracking and Reporting	HVAC contractor and appliance, lighting, and electronics retailer information lacks detail in FirstEnergy's tracking system. HVAC contractor and appliance retailer details are completely excluded, and lighting and electronics retailers only indicate the retail chain.	Track the contractor or retailer associated with each measure. Not only is this needed during evaluation, it can also help programs monitor program allies' performance and target allies for follow-up contact. For mid- or upstream programs, this would ideally include the individual retail location, not only the retail chain.

3 Evaluation Results by Program

This section documents the gross impact, net impact, and process evaluation activities conducted in PY8 along with the outcomes of those activities. Not every program receives an evaluation every year. Planned evaluation activities for Phase III are shown in Figure 23. Activities shown beyond PY8 are subject to change, but the table provides the reader with a general idea of the frequency and timing of evaluation activities.

Figure 23: Evaluation Activity Matrix

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

3.1 APPLIANCE TURN-IN PROGRAM

The Companies have retained ARCA to administer the Appliance Turn-In Program. Through this program, residential customers are eligible for a cash incentive and disposal of up to two large older inefficient appliances (refrigerators or freezers); and two Room Air Conditioners (RAC) or dehumidifiers per household per calendar year. All units must be working and meet established size requirements. The participation count for reporting purposes is the count of rebate applications, which corresponds to appliance pick-up events.

3.1.1 Participation and Reported Savings by Customer Segment

Table 56 presents the participation counts, reported energy and demand savings, and incentive payments for the Appliance Turn-In Program in PY8 by customer segment and EDC. This program serves only the residential customer segment. The EE&C portfolios include separate Appliance Turn-In program components, also administered by ARCA, to serve the low-income residential and the nonresidential customer segments.

Table 56: Appliance Turn-In Program Participation and Reported Impacts

Parameter	Met-Ed Residential (Non-LI)	Penelec Residential (Non-LI)	Penn Power Residential (Non-LI)	WPP Residential (Non-LI)
PYTD # Participants	3,974	3,483	1,167	4,660
PYRTD MWh/yr	4,009	3,826	1,288	4,999
PYRTD MW/yr	0.56	0.50	0.16	0.63
PY8 Incentives (\$1000)	228.40	197.45	64.75	260.58

3.1.2 Gross Impact Evaluation

The impact evaluation of this program is described in detail in Appendix D.1. Table 57 summarizes program verified impacts and realization rates for each EDC.

Table 57: Appliance Turn-In Program Gross Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliance Turn-In	4,014	0.53	100.1%	94.5%
Penelec	Appliance Turn-In	3,407	0.44	89.0%	87.9%
Penn Power	Appliance Turn-In	1,007	0.13	78.1%	80.2%
WPP	Appliance Turn-In	4,565	0.61	91.3%	96.1%

The gross realization rates for energy savings were driven primarily by part-use factors for refrigerators and freezers as determined through verification surveys, and by the unit energy consumptions for refrigerators and freezers, as determined through measure attributes recorded in the tracking and reporting system. Although verification rates determined through surveys were approximately 100%, the realization rates are generally lower than 100% because the part-use factors are lower than the TRM default values, and the calculated unit energy consumptions were lower than what would expect from application of default parameters in the TRM.

3.1.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY8. The net impact evaluation for this program is described in Appendix D.2. Table 58 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 58: Appliance Turn-In Program Net Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Appliance Turn-In	4,014	50.0%	2,007
Penelec	Appliance Turn-In	3,407	43.0%	1,465
Penn Power	Appliance Turn-In	1,007	50.0%	503
WPP	Appliance Turn-In	4,565	45.0%	2,054

3.1.3.1 High-Impact Measure Research

The Appliance Turn-In Initiative was not treated as a High-Impact Measure for Net Impact Evaluation purposes in PY8. However, a full net impact evaluation was conducted by Tetra Tech. Details of the net impact evaluation can be found in Appendix D.2. Notably, the Net-to-gross ratios for this program are consistently higher than those reported in PY7.

3.1.4 Verified Savings Estimates

In Table 59 the realization rates and net-to-gross ratios determined by ADM are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Appliance Turn-In Program in PY8. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 59: PYTD and P3TD 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	4,009	0.56	3,826	0.50	1,288	0.16	4,999	0.63
PYVTD Gross	4,014	0.53	3,407	0.44	1,007	0.13	4,565	0.61
PYVTD Net	2,007	0.26	1,465	0.19	503	0.07	2,054	0.27
RTD	4,009	0.56	3,826	0.50	1,288	0.16	4,999	0.63
VTD Gross	4,014	0.53	3,407	0.44	1,007	0.13	4,565	0.61
VTD Net	2,007	0.26	1,465	0.19	503	0.07	2,054	0.27

3.1.5 Process Evaluation

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

The sample design is shown in Table 60.

Table 60: ATI Program Process Evaluation Sample Design

EDC	Population Size	Achieved Sample Size	Response Rate
Met-Ed	3,974	184	29.0%
Penelec	3,483	197	39.0%
Penn Power	1,167	152	30.6%
WPP	4,660	173	30.3%

Key findings and recommendations are listed in Section 3.1.7.

3.1.6 Cost-Effectiveness Reporting^{6 7}

A detailed breakdown of program finances and cost-effectiveness is presented in Table 61, Table 62, Table 63, and Table 64 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 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

⁶ Any negative values reflected within this section are due to issues such as, but not limited to, reversals of prior period accruals, accounting journal entries, and/or revenues received from participation in historic capacity auctions during prior Phases of Act 129.

⁷ Certain cost categories presented in the “Summary of Program Finances” tables reflect allocated percentages of actual costs.

Table 61: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	228		228		228		228	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	Incremental Measure Costs (Just row 3 for Appliance Recycling)	0		0		0		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	43	0	43	0	43	0	43
6	Administration, Management, and Technical Assistance ^[3]	54	84	54	84	54	84	54	84
7	Marketing ^[4]	15	96	15	96	15	96	15	96
8	Program Delivery ^[5]	0	296	0	296	0	296	0	296
9	EDC Evaluation Costs	31		31		31	0	31	0
10	SWE Audit Costs	34		34		34	0	34	0
11	Program Overhead Costs (Sum of rows 5 through 10)	652		652		652		652	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	652		652		652		652	
14	Total NPV Lifetime Electric Energy Benefits	1,020		1,020		510		510	
15	Total NPV Lifetime Electric Capacity Benefits	493		493		246		246	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	1,513		1,513		756		756	
19	TRC Benefit-Cost Ratio ^[8]	2.32		2.32		1.16		1.16	

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

Table 62: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	197		197		197		197	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	Incremental Measure Costs (Just row 3 for Appliance Recycling)	0		0		0		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	42	0	42	0	42	0	42
6	Administration, Management, and Technical Assistance ^[3]	61	82	61	82	61	82	61	82
7	Marketing ^[4]	14	91	14	91	14	91	14	91
8	Program Delivery ^[5]	0	288	0	288	0	288	0	288
9	EDC Evaluation Costs	33		33		33	0	33	0
10	SWE Audit Costs	37		37		37	0	37	0
11	Program Overhead Costs (Sum of rows 5 through 10)	648		648		648		648	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	648		648		648		648	
14	Total NPV Lifetime Electric Energy Benefits	754		754		324		324	
15	Total NPV Lifetime Electric Capacity Benefits	403		403		173		173	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	1,156		1,156		497		497	
19	TRC Benefit-Cost Ratio ^[8]	1.78		1.78		0.77		0.77	

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

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

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

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

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

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 63: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	65		65		65		65	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	Incremental Measure Costs (Just row 3 for Appliance Recycling)	0		0		0		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	16	0	16	0	16	0	16
6	Administration, Management, and Technical Assistance ^[3]	14	32	14	32	14	32	14	32
7	Marketing ^[4]	4	30	4	30	4	30	4	30
8	Program Delivery ^[5]	0	113	0	113	0	113	0	113
9	EDC Evaluation Costs	7		7		7	0	7	0
10	SWE Audit Costs	9		9		9	0	9	0
11	Program Overhead Costs (Sum of rows 5 through 10)	226		226		226		226	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	226		226		226		226	
14	Total NPV Lifetime Electric Energy Benefits	245		245		123		123	
15	Total NPV Lifetime Electric Capacity Benefits	73		73		37		37	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	319		319		159		159	
19	TRC Benefit-Cost Ratio ^[8]	1.41		1.41		0.71		0.71	
<p>[1] Includes direct install equipment costs and costs for EE&C kits.</p> <p>[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.</p> <p>[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

Table 64: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	261		261		261		261	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	Incremental Measure Costs (Just row 3 for Appliance Recycling)	0		0		0		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	52	0	52	0	52	0	52
6	Administration, Management, and Technical Assistance ^[3]	59	103	59	103	59	103	59	103
7	Marketing ^[4]	15	123	15	123	15	123	15	123
8	Program Delivery ^[5]	0	361	0	361	0	361	0	361
9	EDC Evaluation Costs	30		30		30	0	30	0
10	SWE Audit Costs	31		31		31	0	31	0
11	Program Overhead Costs (Sum of rows 5 through 10)	775		775		775		775	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	775		775		775		775	
14	Total NPV Lifetime Electric Energy Benefits	1,104		1,104		497		497	
15	Total NPV Lifetime Electric Capacity Benefits	340		340		153		153	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	1,444		1,444		650		650	
19	TRC Benefit-Cost Ratio ^[8]	1.86		1.86		0.84		0.84	

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

3.1.7 Status of Recommendations

The impact and process evaluation activities in PY8 led to the following findings and recommendations from Tetra Tech to the Companies, along with a summary of how the Companies plan to address the recommendation in program delivery.

Finding #1: Bill inserts continue to be the most common source of program information

Recommendation #1: Continue to market the program through bill inserts, and consider other marketing channels if additional participation is needed. Direct mailings were also mentioned, so they seem to be effective as well.

EDC Status Report #1: Recommendation accepted.

Finding #2: Program satisfaction remains high. The lowest satisfaction was with the wait time before pick-up, which was still over 4.0 on a 5-point scale.

Recommendation #2: Continue to operate the program with the current design. Work with the ICSP to monitor wait times between program contact and pick-up

EDC Status Report #2: The Companies have accepted the recommendation to monitor wait times between contact and pick-up.

3.2 ENERGY EFFICIENT HOMES PROGRAM

The Energy Efficiency Homes Program has four distinct program components: Energy Efficiency Kits (EE Kits), Home Energy Reports, Residential Direct Install, and New Homes.

The EE Kits component has two subcomponents: Energy Efficiency Kits distributed by PowerDirect, and School Education Kits distributed by AM Conservation Group (AMCG). Customers that received energy efficiency kits from PowerDirect either completed an online audit, phone audit, or submitted an online or telephonic request. Customers that received kits from the School Education program had students that completed a special energy efficiency curriculum developed by AMGC. The participant counts for this program component are equal to the overall count of kits distributed by each program.

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

The Companies have retained GoodCents to administer Direct Install (branded as Home Audit) component in Phase III. Through this program component, customers receive diagnostic assessments, followed by the direct installation of low-cost measures or incentivized installation of building shell measures. The participant count for this program component is equal to the number of rebate homes treated in the program.

The New Homes component is again administered by Performance System Development (PSD). The New Homes program component provides incentives to builders that choose to build new homes to higher efficiencies through the installation of efficient building shell measures, HVAC systems, appliances, lighting, or other features. The participant count for the New Homes program component is equal to the number of houses (or in the case of multifamily housing, the number of dwelling units).

The program also includes a Behavioral Demand Response (BDR) program component, which is administered by Oracle. No impacts are reported for the program in PY8, although some start-up costs for the program were incurred in PY8. The BDR program component is not discussed in the following sections, apart from PY8 costs that are included in the EE Homes cost effectiveness reporting for PY8.

3.2.1 Participation and Reported Savings by Customer Segment

Table 65 presents the participation counts, reported energy and demand savings, and incentive payments for the Energy Efficient Homes Program in PY8 by customer segment and EDC. This program serves only the residential customer segment. The EE&C portfolios include separate and corresponding program components, administered by the same ICSPs, to serve the low-income residential customer segment.

Table 65: 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	202,956	209,088	40,404	208,421
PYRTD MWh/yr	48,126	38,523	10,902	45,219
PYRTD MW/yr	6.55	4.96	1.72	7.01
PY8 Incentives (\$1000)	2,634.11	2,515.36	826.26	1,868.35

3.2.2 Gross Impact Evaluation

Each program component is treated as a separate evaluation initiative. The gross impact evaluation of the EE Kits Initiative is described in Appendix E. The impact evaluation of the HER Initiative is described in Appendix E. The impact evaluation of the Res DI Initiative is described in Appendix G. The impact evaluation of the Res NC Initiative is described in Table 66 summarizes program verified impacts and realization rates for each EDC.

Table 66: EEH Program Gross Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	EE Kits	20,484	2.32	121.7%	124.5%
Met-Ed	Home Energy Reports	32,212	3.55	106.3%	81.7%
Met-Ed	Direct Install	40	0.00	85.9%	86.2%
Met-Ed	New Homes	834	0.35	88.2%	102.8%
Met-Ed Total		53,569	6.22	111%	95%
Penelec	EE Kits	23,936	2.51	128.3%	137.1%
Penelec	Home Energy Reports	21,020	2.32	106.8%	75.7%
Penelec	Direct Install	18	0.00	107.6%	91.6%
Penelec	New Homes	131	0.07	74.5%	96.5%
Penelec Total		45,106	4.90	117%	99%
Penn Power	EE Kits	5,406	0.63	122.7%	130.0%
Penn Power	Home Energy Reports	6,787	0.75	119.6%	82.1%
Penn Power	Direct Install	13	0.00	106.7%	101.9%
Penn Power	New Homes	678	0.38	83.3%	114.3%
Penn Power Total		12,883	1.75	118%	102%
WPP	EE Kits	13,125	1.63	118.7%	124.4%
WPP	Home Energy Reports	33,957	3.75	103.7%	72.2%
WPP	Direct Install	69	0.01	85.7%	97.9%
WPP	New Homes	1,141	0.55	84.8%	108.1%
WPP Total		48,291	5.93	107%	85%

The gross realization rates for energy savings were driven primarily by part-use factors for refrigerators and freezers as determined through verification surveys, and by the unit energy consumptions for refrigerators and freezers, as determined through measure attributes recorded in the tracking and reporting system. Although verification rates determined through surveys were approximately 100%, the realization rates are generally lower than 100% because the part-use factors are lower than the TRM default values, and the calculated unit energy consumptions were lower than what would expect from application of default parameters in the TRM.

3.2.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for the EE Kits Initiative in PY8. The net impact evaluation for the EE Kits Initiative is described in Appendix E.2. Net Impact Evaluation was not conducted for the other three program components in PY8. The NTG for the HER program is estimated to be 1.0, which is a feature of the randomized control trial gross impact evaluation approach⁸. The NTG for the Res DI and Res NC Initiatives are estimated as 0.5 at this time for the purpose net cost effectiveness calculations.

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

Table 67 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 67: EEH Program Net Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	EE Kits	20,484	82.0%	16,797
Met-Ed	Home Energy Reports	32,212	100.0%	32,212
Met-Ed	Direct Install	40	50.0%	20
Met-Ed	New Homes	834	50.0%	417
Met-Ed Total		53,569	92.3%	49,445
Penelec	EE Kits	23,936	83.0%	19,867
Penelec	Home Energy Reports	21,020	100.0%	21,020
Penelec	Direct Install	18	50.0%	9
Penelec	New Homes	131	50.0%	66
Penelec Total		45,106	90.8%	40,962
Penn Power	EE Kits	5,406	82.0%	4,433
Penn Power	Home Energy Reports	6,787	100.0%	6,787
Penn Power	Direct Install	13	50.0%	6
Penn Power	New Homes	678	50.0%	339
Penn Power Total		12,883	89.8%	11,564
WPP	EE Kits	13,125	82.0%	10,762
WPP	Home Energy Reports	33,957	100.0%	33,957
WPP	Direct Install	69	50.0%	35
WPP	New Homes	1,141	50.0%	570
WPP Total		48,291	93.9%	45,324

3.2.3.1 High-Impact Measure Research

The EE Kits Initiative, which includes the EE Kits distributed in the Energy Efficient Homes Program, was treated as a High-Impact Measure for Net Impact Evaluation purposes in PY8. Details of the net impact evaluation can be found in Appendix E.2.

3.2.4 Verified Savings Estimates

In Table 68 the realization rates and net-to-gross ratios determined by ADM and Tetra Tech team are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Energy Efficient Homes Program] in PY8. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 68: PYTD and P3TD 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	48,126	6.55	38,523	4.96	10,902	1.72	45,219	7.01
PYVTD Gross	53,569	6.22	45,106	4.90	12,883	1.75	48,291	5.93
PYVTD Net	49,445	5.62	40,962	4.44	11,564	1.45	45,324	5.36
RTD	48,126	6.55	38,523	4.96	10,902	1.72	45,219	7.01
VTD Gross	53,569	6.22	45,106	4.90	12,883	1.75	48,291	5.93
VTD Net	49,445	5.62	40,962	4.44	11,564	1.45	45,324	5.36

3.2.5 Process Evaluation

Process evaluation activities were conducted for two of the four program components in PY8. The participant survey sample design for process evaluation is shown in Table 69.

Table 69: EEH Program Process Evaluation Sample Design

EDC	Population Size	Achieved Sample Size	Response Rate
ME-Kits	55,193	136	15%
PN-Kits	57,476	132	15%
PP-Kits	13,721	143	16%
WP-Kits	35,812	154	17%
ME-Behavioral	161,916	195	10%
PN-Behavioral	171,933	201	10%
PP-Behavioral	29,616	202	10%
WP-Behavioral	189,820	203	10%
Behavioral (Phase II Only)	250,590	114	6%
Program Total	966,077	1,480	10.9%

Key findings and recommendations are listed in Section 3.2.7.

3.2.5.1 Kits

The Energy Efficient Homes programs contains several subprograms that deliver kits of energy-efficient measures to customers through different channels. The evaluation began with program staff and ICSP interviews, and the bulk of the evaluation was conducted through a participant survey. The participant survey was administered through a combination of web and phone. Researchable issues for the kits sub-programs focused on participant satisfaction, program marketing, and awareness. The sample for the survey was randomly selected for each EDC.

3.2.5.2 Behavioral

We conducted both qualitative and quantitative research as part of the process evaluation activities. The qualitative research included semi-structured interviews with FirstEnergy program managers and the program implementer. A survey of participating customers was the primary

source of data to assess experiences of participants and their engagement with the program. The survey was primarily a quantitative study, but we asked open-ended questions to provide context for the quantitative results.

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

3.2.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented Table 70, Table 71, Table 72, and Table 73 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 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars. Note that the program costs include costs incurred in PY8 were for the Behavioral Demand Response program component (\$26,325, \$27,051, \$16,849, and \$23,888 respectively for Met-Ed, Penelec, Penn Power, and WPP). No benefits were reported for PY8 as the first Act 129 DR event occurred in PY9.

Table 70: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	2,634		2,634		2,634		2,634	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	1,092		1,092		546		546	
4	Incremental Measure Costs (Sum of rows 1 through 3)	3,726		3,726		3,180		3,180	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	1	412	1	412	1	412	1	412
6	Administration, Management, and Technical Assistance ^[3]	214	1,508	214	1,508	214	1,508	214	1,508
7	Marketing ^[4]	14	240	14	240	14	240	14	240
8	Program Delivery ^[5]	0	861	0	861	0	861	0	861
9	EDC Evaluation Costs	63		63		63	0	63	0
10	SWE Audit Costs	115		115		115	0	115	0
11	Program Overhead Costs (Sum of rows 5 through 10)	3,428		3,428		3,428		3,428	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	7,154		7,154		6,608		6,608	
14	Total NPV Lifetime Electric Energy Benefits	6,990		6,990		5,836		5,836	
15	Total NPV Lifetime Electric Capacity Benefits	3,014		3,014		2,421		2,421	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	10,004		10,004		8,257		8,257	
19	TRC Benefit-Cost Ratio ^[8]	1.40		1.40		1.25		1.25	
<p>[1] Includes direct install equipment costs and costs for EE&C kits.</p> <p>[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.</p> <p>[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

Table 71: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	2,515		2,515		2,515		2,515	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	254		254		127		127	
4	Incremental Measure Costs (Sum of rows 1 through 3)	2,769		2,769		2,642		2,642	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	1	411	1	411	1	411	1	411
6	Administration, Management, and Technical Assistance ^[3]	216	1,525	216	1,525	216	1,525	216	1,525
7	Marketing ^[4]	14	223	14	223	14	223	14	223
8	Program Delivery ^[5]	0	802	0	802	0	802	0	802
9	EDC Evaluation Costs	54		54		54	0	54	0
10	SWE Audit Costs	112		112		112	0	112	0
11	Program Overhead Costs (Sum of rows 5 through 10)	3,357		3,357		3,357		3,357	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	6,126		6,126		5,999		5,999	
14	Total NPV Lifetime Electric Energy Benefits	6,832		6,832		5,800		5,800	
15	Total NPV Lifetime Electric Capacity Benefits	2,794		2,794		2,334		2,334	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	9,626		9,626		8,135		8,135	
19	TRC Benefit-Cost Ratio ^[8]	1.57		1.57		1.36		1.36	

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

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

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

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

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

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 72: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	826		826		826		826	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	743		743		372		372	
4	Incremental Measure Costs (Sum of rows 1 through 3)	1,570		1,570		1,198		1,198	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	88	0	88	0	88	0	88
6	Administration, Management, and Technical Assistance ^[3]	103	302	103	302	103	302	103	302
7	Marketing ^[4]	3	71	3	71	3	71	3	71
8	Program Delivery ^[5]	0	238	0	238	0	238	0	238
9	EDC Evaluation Costs	23		23		23	0	23	0
10	SWE Audit Costs	35		35		35	0	35	0
11	Program Overhead Costs (Sum of rows 5 through 10)	864		864		864		864	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	2,433		2,433		2,062		2,062	
14	Total NPV Lifetime Electric Energy Benefits	1,930		1,930		1,540		1,540	
15	Total NPV Lifetime Electric Capacity Benefits	822		822		573		573	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	2,752		2,752		2,113		2,113	
19	TRC Benefit-Cost Ratio ^[8]	1.13		1.13		1.02		1.02	
<p>[1] Includes direct install equipment costs and costs for EE&C kits.</p> <p>[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.</p> <p>[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

Table 73: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	1,868		1,868		1,868		1,868	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	1,122		1,122		561		561	
4	Incremental Measure Costs (Sum of rows 1 through 3)	2,990		2,990		2,429		2,429	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	1	450	1	450	1	450	1	450
6	Administration, Management, and Technical Assistance ^[3]	252	1,688	252	1,688	252	1,688	252	1,688
7	Marketing ^[4]	11	193	11	193	11	193	11	193
8	Program Delivery ^[5]	0	796	0	796	0	796	0	796
9	EDC Evaluation Costs	58		58		58	0	58	0
10	SWE Audit Costs	107		107		107	0	107	0
11	Program Overhead Costs (Sum of rows 5 through 10)	3,556		3,556		3,556		3,556	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	6,547		6,547		5,986		5,986	
14	Total NPV Lifetime Electric Energy Benefits	5,158		5,158		4,321		4,321	
15	Total NPV Lifetime Electric Capacity Benefits	1,952		1,952		1,521		1,521	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	7,111		7,111		5,842		5,842	
19	TRC Benefit-Cost Ratio ^[8]	1.09		1.09		0.98		0.98	

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

3.2.7 Status of Recommendations

The impact and process evaluation activities in PY8 led to the following findings and recommendations from Tetra Tech to the Companies along with a summary of how the Companies plan to address the recommendation in program delivery.

3.2.7.1 Energy Efficiency Kits

Finding #1: FirstEnergy customers participating across all of the Kits subprograms report high levels of satisfaction (> 4 on a 5-pt scale) with all surveyed program components.

Recommendation #1: Continue to monitor program satisfaction in coordination with the ICSP and evaluation. No changes are needed because satisfaction suggests the program is operating smoothly.

EDC Status Report #1: Recommendation accepted.

Finding #2: Nearly half (48 percent) of Kits participants name e-mail as their preferred communication channel with their utility.

Recommendation #2: FirstEnergy should consider exploring e-mail marketing options for future campaigns given participants' comfort with electronic communications.

EDC Status Report #2: Recommendation accepted.

3.2.7.2 Home Energy Reports

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

Finding #1: Program participants express high levels of satisfaction with the overall quality of service provided by their utility.

Finding #2: Customer engagement with the Home Energy Reports (HERs) is high. A majority of households read the reports and say they have read all or almost all of the reports they have been sent. Readership is somewhat higher among low-income households.

Finding #3: Program participants engage in energy-saving behaviors and about 30 to 40 percent report doing these things more now than in previous years. Low income participants are somewhat more likely to engage in the energy-saving actions that were measured by the survey.

Finding #4: The main barriers to doing more to save energy are the cost of doing things and finding the time to do things. Knowing what to do, or how to prioritize their actions, is also a significant barrier as participants report they need more detailed tips or itemization of the main energy consuming equipment in their homes.

Finding #5: Participants generally rate the HERs positively, but they express concerns about the accuracy of the neighbor comparison and feel the tips can be too general or repetitive. Some suggestions for improvement are available from the program (e.g., electronic access) or through other FirstEnergy programs (e.g., home energy audits).

Recommendation #1: Continue the program and continue sending the HERs regularly. Many participants find the information useful and motivational. They study the reports for ideas on

what to do to save energy and, even if the suggestions are already known to them, find the HERs to be helpful reminders.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: Work with the program implementer to identify ways to present a “model” or “typical” household that defines its characteristics, how it is equipped, and the actions taken to save energy. Participants are eager to better understand the neighbor comparison or what the “most efficient” households represent, but there is limited information provided by the program implementer for participants to understand the comparison group. Providing participants with a “model household” and enumerating how the characteristics of that home and its occupants achieve energy-savings can address participants’ concerns and may yield additional energy-saving insights.

EDC Status Report #2: This is an interesting idea, but is not in the scope of the current ICSP contract and cannot be accommodated within budgets negotiated with the ICSP.

Recommendation #3: Work with the program implementer to include charts comparing a household’s energy consumption over time more often. The historical comparison of their own energy usage was deemed most useful by participants.

EDC Status Report #3: Recommendation accepted.

Recommendation #4: Work with the program implementer to raise awareness of electronic and online resources. Participants who cited concerns about the cost of paper reports or a desire for access to information online may be not be aware that HERs can be sent by email (including email-only options) or that the program has a web portal with more information.

EDC Status Report #4: Recommendation under consideration.

Recommendation #5: Work with the program implementer to raise awareness about the availability and value of home energy audits. Participants seeking more detailed energy-saving tips mention a desire to know which of their appliances are using the most energy and how to prioritize their energy-saving investments. While promotion of other energy efficiency programs is already a component of the HERs, consider more prominent messaging that emphasizes that audits will provide more personalized and prioritized feedback.

EDC Status Report #5: Recommendation under consideration.

3.3 ENERGY EFFICIENT PRODUCTS PROGRAM

Through the Residential Energy Efficient Products Program, customers receive incentives for installing ENERGY STAR® qualified appliances, energy efficient HVAC equipment, and energy efficient water heaters. Qualifying appliances include items such as clothes washers, dehumidifiers, and refrigerators. HVAC equipment qualifying as part of the program include central air conditioners, air source heat pumps, ground source heat pumps, and mini-split heat pumps. The program also provides incentives to customers for the maintenance (tune-ups) of existing HVAC equipment. Water heaters rebated under the program include heat pump water heaters, efficient electric water heaters, and solar water heaters. The program also provides incentives to retailers for point of sale price cuts for customers purchasing energy efficient light bulbs and ENERGY STAR® qualified computers, printers, monitors, and televisions. The Companies have retained Honeywell to administer the program.

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

3.3.1 Participation and Reported Savings by Customer Segment

This program serves primarily the residential customer segment. However, some small commercial and GNI contributions result from “cross sector” sales, where a small fraction of the efficient lighting is purchased from participating retailers and installed in nonresidential settings. Table 74, Table 75, Table 76, and Table 77 present the participation counts, reported energy and demand savings, and incentive payments for the EEP Program in PY8 by customer segment and EDC.

Table 74: EEP Program Participation and Reported Impacts for Met-Ed

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	291,237	22,535	1,910	315,681
PYRTD MWh/yr	23,492	1,815	154	25,460
PYRTD MW/yr	2.95	0.22	0.02	3.18
PY8 Incentives (\$1000)	1,337.09	81.68	6.92	1,426

Table 75: EEP Program Participation and Reported Impacts for Penelec

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	342,593	27,547	2,334	372,475
PYRTD MWh/yr	30,812	2,479	210	33,501
PYRTD MW/yr	3.32	0.26	0.02	3.60
PY8 Incentives (\$1000)	1,382.44	102.80	8.71	1,494

Table 76: EEP Program Participation and Reported Impacts for Penn Power

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	62,400	4,593	389	67,382
PYRTD MWh/yr	5,726	438	37	6,202
PYRTD MW/yr	0.69	0.05	0.00	0.75
PY8 Incentives (\$1000)	328.70	19.77	1.68	350

Table 77: EEP Program Participation and Reported Impacts for WPP

Parameter	Residential (Non-LI)	Small C&I (Non-GNI)	GNI	Total
PYTD # Participants	337,027	25,161	2,132	364,320
PYRTD MWh/yr	28,941	2,219	188	31,349
PYRTD MW/yr	3.84	0.28	0.02	4.15
PY8 Incentives (\$1000)	1,534.21	91.97	7.79	1,634

3.3.2 Gross Impact Evaluation

This program is disaggregated into four initiatives for evaluation. The impact evaluation of the Upstream Lighting initiative is described in detail in Appendix I. The impact evaluation of the Upstream Electronics initiative is described in detail in Appendix J. The impact evaluation of the Res HVAC initiative is described in detail in Appendix K. The impact evaluation of the Res Appliances initiative is described in detail in Appendix L. Table 78 summarizes program verified impacts and realization rates for each EDC.

Table 78: EEP Program Gross Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Upstream Lighting	28,761	3.71	121.3%	130.3%
Met-Ed	Upstream Electronics	490	0.05	89.9%	84.6%
Met-Ed	HVAC	870	0.32	129.4%	155.7%
Met-Ed	Appliances	705	0.08	133.4%	127.2%
Met-Ed Total		30,825	4.17	121%	131%
Penelec	Upstream Lighting	37,706	4.45	116.4%	133.0%
Penelec	Upstream Electronics	254	0.03	90.1%	85.4%
Penelec	HVAC	814	0.19	182.5%	117.8%
Penelec	Appliances	466	0.07	125.5%	116.2%
Penelec Total		39,241	4.74	117%	132%
Penn Power	Upstream Lighting	7,346	0.93	128.3%	140.2%
Penn Power	Upstream Electronics	191	0.02	94.3%	89.7%
Penn Power	HVAC	177	0.06	115.5%	154.6%
Penn Power	Appliances	182	0.02	152.1%	136.0%
Penn Power Total		7,896	1.04	127%	139%
WPP	Upstream Lighting	34,457	4.69	118.8%	126.3%
WPP	Upstream Electronics	944	0.10	93.1%	87.9%
WPP	HVAC	926	0.29	117.8%	120.1%
WPP	Appliances	767	0.10	140.5%	128.7%
WPP Total		37,095	5.18	118%	125%

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

3.3.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY8. The net impact evaluation of the Upstream Lighting Initiative is described in Appendix I.2. The NTG from Phase II is used in PY8 for the Upstream Electronics Initiative as described in Appendix J.2. The net impact evaluation for the Res HVAC Initiative is described in Appendix K.2. The NTG evaluation for the Res Appliances Initiative is described in Appendix L.2. Table 79 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 79: EEP Program Net Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Upstream Lighting	28,761	37.0%	10,656
Met-Ed	Upstream Electronics	490	49.5%	242
Met-Ed	HVAC	870	45.0%	391
Met-Ed	Appliances	705	52.0%	366
Met-Ed Total		30,825	37.8%	11,656
Penelec	Upstream Lighting	37,706	33.8%	12,755
Penelec	Upstream Electronics	254	49.5%	126
Penelec	HVAC	814	52.0%	423
Penelec	Appliances	466	48.0%	224
Penelec Total		39,241	34.5%	13,528
Penn Power	Upstream Lighting	7,346	38.8%	2,851
Penn Power	Upstream Electronics	191	49.5%	94
Penn Power	HVAC	177	56.0%	99
Penn Power	Appliances	182	47.0%	86
Penn Power Total		7,896	39.6%	3,130
WPP	Upstream Lighting	34,457	26.6%	9,152
WPP	Upstream Electronics	944	49.5%	467
WPP	HVAC	926	49.0%	454
WPP	Appliances	767	50.0%	384
WPP Total		37,095	28.2%	10,456

3.3.3.1 High-Impact Measure Research

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

3.3.4 Verified Savings Estimates

In Table 80 the realization rates and net-to-gross ratios determined by the ADM and Tetra Tech team are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the Energy Efficient Products Program in PY8. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 80: PYTD and P3TD 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	25,460	3.18	33,501	3.60	6,202	0.75	31,349	4.15
PYVTD Gross	30,825	4.17	39,241	4.74	7,896	1.04	37,095	5.18
PYVTD Net	11,656	1.59	13,528	1.65	3,130	0.42	10,456	1.49
RTD	25,460	3.18	33,501	3.60	6,202	0.75	31,349	4.15
VTD Gross	30,825	4.17	39,241	4.74	7,896	1.04	37,095	5.18
VTD Net	11,656	1.59	13,528	1.65	3,130	0.42	10,456	1.49

3.3.5 Process Evaluation

Process evaluation activities were conducted for three of four program components in PY8. Process evaluation samples are combined over all four EDCs. The participant survey sample design for process evaluation shown in Table 81.

Table 81: EEP Program Process Evaluation Sample Design

EDC	Measure	Population Size	Achieved Sample Size	Response Rate
Met-Ed	Appliances and HVAC	5,765	150	26%
Penelec	Appliances and HVAC	2,416	144	26%
Penn Power	Appliances and HVAC	1,696	117	26%
WPP	Appliances and HVAC	6,866	146	26%
Met-Ed	Lighting	294,513	176	5.9%
Penelec	Lighting	360,025	169	5.6%
Penn Power	Lighting	60,029	183	6.1%
WPP	Lighting	328,833	143	4.8%
Program Total		1,060,143	1,228	15.0%

Key findings and recommendations are listed in Section 3.3.7.

3.3.5.1 Appliances & HVAC

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

3.3.5.2 Lighting

The lighting sub-program process evaluation began with interviews with FirstEnergy and ICSP program staff. Additionally, the evaluation included a web survey of FirstEnergy residential customers to gather information on their awareness, perception, and preference of different types of lighting, purchase behaviors, and awareness of the FirstEnergy program. Because the program provides a discount on the purchase price as opposed to a customer incentive, participants do not need to be aware of the program to participate. The survey reached customers who likely participated, as well as some who did not.

The evaluation planned additional activities to inform the process evaluation, including a survey of participating retailers and a shelf-stocking study. These activities are ongoing and the results will be included in the PY9 annual report.

3.3.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 83, Table 84, Table 85, and Table 86 for Met-Ed, Penelec, Penn Power, and WPP respectively. The last two columns of the tables show benefits as calculated with net verified impacts, along with net participant costs (if applicable). The third and fourth columns show results as calculated on a gross basis. PYTD costs and benefits are net present values (NPV) expressed in 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

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

If TRCs were to not use the dual baselines, gross and net TRCs for the Energy Efficient Products program would increase by 26% to 41% depending on EDC. Gross and Net TRCs for the EE Products programs, with and without dual baseline treatment are presented in the following table:

Table 82 – Energy Efficient Products Program TRC with and without Dual Baseline Calculations

EDC	Gross		Net	
	Dual Baseline	Without Dual Baseline	Dual Baseline	Without Dual Baseline
Met-Ed	1.93	2.45	1.48	1.86
Penelec	2.58	3.27	1.88	2.37
Penn Power	1.97	2.78	1.57	2.19
WPP	1.97	2.52	1.22	1.54
Average	2.11	2.75	1.54	1.99

Table 83: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	1,426		1,426		1,426		1,426	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	4,663		4,663		1,091		1,091	
4	Incremental Measure Costs (Sum of rows 1 through 3)	6,089		6,089		2,517		2,517	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	70	0	70	0	70	0	70
6	Administration, Management, and Technical Assistance ^[3]	29	139	29	139	29	139	29	139
7	Marketing ^[4]	6	133	6	133	6	133	6	133
8	Program Delivery ^[5]	0	488	0	488	0	488	0	488
9	EDC Evaluation Costs	68		68		68	0	68	0
10	SWE Audit Costs	48		48		48	0	48	0
11	Program Overhead Costs (Sum of rows 5 through 10)	981		981		981		981	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	7,070		7,070		3,498		3,498	
14	Total NPV Lifetime Electric Energy Benefits	7,463		7,463		2,841		2,841	
15	Total NPV Lifetime Electric Capacity Benefits	3,792		3,792		1,438		1,438	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	3,470		3,470		1,286		1,286	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,077		-1,077		-399		-399	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	13,647		13,647		5,166		5,166	
19	TRC Benefit-Cost Ratio ^[8]	1.93		1.93		1.48		1.48	

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

Table 84: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	1,494		1,494		1,494		1,494	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	3,987		3,987		542		542	
4	Incremental Measure Costs (Sum of rows 1 through 3)	5,481		5,481		2,036		2,036	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	80	0	80	0	80	0	80
6	Administration, Management, and Technical Assistance ^[3]	40	158	40	158	40	158	40	158
7	Marketing ^[4]	5	135	5	135	5	135	5	135
8	Program Delivery ^[5]	0	553	0	553	0	553	0	553
9	EDC Evaluation Costs	64		64		64	0	64	0
10	SWE Audit Costs	48		48		48	0	48	0
11	Program Overhead Costs (Sum of rows 5 through 10)	1,084		1,084		1,084		1,084	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	6,565		6,565		3,119		3,119	
14	Total NPV Lifetime Electric Energy Benefits	9,454		9,454		3,289		3,289	
15	Total NPV Lifetime Electric Capacity Benefits	4,515		4,515		1,568		1,568	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	4,790		4,790		1,620		1,620	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-1,843		-1,843		-623		-623	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	16,916		16,916		5,853		5,853	
19	TRC Benefit-Cost Ratio ^[8]	2.58		2.58		1.88		1.88	

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

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

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

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

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

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 85: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	350		350		350		350	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	1,228		1,228		360		360	
4	Incremental Measure Costs (Sum of rows 1 through 3)	1,578		1,578		710		710	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	13	0	13	0	13	0	13
6	Administration, Management, and Technical Assistance ^[3]	-10	25	-10	25	-10	25	-10	25
7	Marketing ^[4]	1	19	1	19	1	19	1	19
8	Program Delivery ^[5]	0	88	0	88	0	88	0	88
9	EDC Evaluation Costs	14		14		14	0	14	0
10	SWE Audit Costs	11		11		11	0	11	0
11	Program Overhead Costs (Sum of rows 5 through 10)	161		161		161		161	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	1,739		1,739		871		871	
14	Total NPV Lifetime Electric Energy Benefits	2,018		2,018		803		803	
15	Total NPV Lifetime Electric Capacity Benefits	594		594		242		242	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	1,043		1,043		405		405	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-222		-222		-86		-86	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	3,432		3,432		1,364		1,364	
19	TRC Benefit-Cost Ratio ^[8]	1.97		1.97		1.57		1.57	
<p>[1] Includes direct install equipment costs and costs for EE&C kits.</p> <p>[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.</p> <p>[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

Table 86: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	1,634		1,634		1,634		1,634	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	4,914		4,914		678		678	
4	Incremental Measure Costs (Sum of rows 1 through 3)	6,548		6,548		2,312		2,312	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	84	0	84	0	84	0	84
6	Administration, Management, and Technical Assistance ^[3]	94	166	94	166	94	166	94	166
7	Marketing ^[4]	6	181	6	181	6	181	6	181
8	Program Delivery ^[5]	0	582	0	582	0	582	0	582
9	EDC Evaluation Costs	64		64		64	0	64	0
10	SWE Audit Costs	50		50		50	0	50	0
11	Program Overhead Costs (Sum of rows 5 through 10)	1,228		1,228		1,228		1,228	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	7,776		7,776		3,540		3,540	
14	Total NPV Lifetime Electric Energy Benefits	8,452		8,452		2,423		2,423	
15	Total NPV Lifetime Electric Capacity Benefits	4,784		4,784		1,356		1,356	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	4,171		4,171		1,108		1,108	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-2,083		-2,083		-553		-553	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	15,324		15,324		4,334		4,334	
19	TRC Benefit-Cost Ratio ^[8]	1.97		1.97		1.22		1.22	

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

3.3.7 Status of Recommendations

The impact and process evaluation activities in PY8 led to the following findings and recommendations from Tetra Tech to the Companies along with a summary of how the Companies plan to address the recommendation in program delivery.

3.3.7.1 HVAC and Appliances

Finding #1: Some customers feel rebates take too long to process. Approximately 10 percent of respondents recalled the rebate took longer than 90 days to process, which is the time frame communicated by the application. This led to lowered satisfaction with the program.

Recommendation #1: Work with the ICSP to monitor rebate payment times, and track applications that are taking longer than expected.

EDC Status Report #1: Recommendation accepted.

Finding #2: Some participants in the Appliance Rebate sub-program reported their income in a range that would qualify for the low-income Appliance Rebate sub-program.

Recommendation #2: Ensure that the low-income rebates are clearly communicated in marketing materials, particularly on the program application.

EDC Status Report #2: Recommendation under consideration.

Finding #3: While overall program satisfaction was high, Appliance participants rated their satisfaction with the amount of the rebate lower than other program aspects.

Recommendation #3: Review appliance rebate amounts in balance with other program metrics such as participation, budget, and satisfaction.

EDC Status Report #3: Recommendation accepted.

Finding #4: Contractors were by far the most common source of program information for HVAC participants. Satisfaction with HVAC contractors was particularly high, averaging 4.7 out of 5.

Recommendation #4: Continue to work with HVAC contractors to maintain their engagement with the program.

EDC Status Report #4: Recommendation accepted

3.3.7.2 Upstream Lighting

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

Finding #1: Awareness of energy-efficient lighting products is high and has increased since Phase II. Almost all customers are at least "somewhat familiar" with CFLs and three-quarters report equal familiarity with LEDs. In contrast, only 55 percent of customers expressed this level of familiarity with LEDs in response to similar survey questions at Phase II. More than one-half understand that LEDs are more energy-efficient than CFLs.

Finding #2: Usage of energy efficient lighting products is high. Over 80 percent of customers have ever used CFLs in their homes and two-thirds have used LEDs.

Finding #3: Customers express a preference for, and greater satisfaction with, LEDs over CFLs. Among customers familiar with both CFLs and LEDs, more than 60 percent prefer LEDs. The quality of lighting from LEDs and greater energy efficiency are most often cited as the reasons for this preference. Two-thirds are "very satisfied" with LEDs, while less than 30 percent express similar satisfaction with CFLs.

Finding #4: Lighting purchases over the past 12 months are predominantly LEDs (57 percent). However, more than one-third of purchases still included incandescent bulbs. About two-thirds of purchases are made to replace an incandescent bulb, usually because the existing bulb is burned out.

Finding #5: Customers consider a wide range of factors when shopping for lighting products. Although price is most often the most important consideration, it is not the overwhelming deciding factor. Almost one in five cite the brightness of the bulb and 15 percent point to bulb life as most important.

Finding #6: Customers who have not used LEDs show declining reluctance to use these products since Phase II. Although 35 percent are "not at all" or "somewhat unlikely" to install and LED in the next 12 months, this is down from over one-half at Phase II. Almost one in five are "very" or "extremely likely" to install LED bulbs in the next year.

Finding #7: Using the Van Westendorp Price Sensitivity Meter, LED bulbs are a "bargain" at \$2.00 to \$2.76 (median, mean, respectively) and "starting to get expensive" at \$4.00 and \$5.04 (median, mean) for those who have not previously used LEDs. However, most customers are not aware of market prices: 60 percent of customers "don't know" if the price of LEDs is higher, lower, or about the same as last year.

Finding #8: Awareness of program-sponsored price discounts is low. Only one in ten customers who purchased a program-eligible lighting product was aware that the price of the bulbs they purchased had been discounted.

Finding #9: Evidence from customer self-reports suggest that most will purchase energy-efficient lighting products regardless of the program-sponsored discount.

Finding #10: Regular interaction with the program implementer is relatively rare among the surveyed retailers. Those who have met with the representative are satisfied with the help they receive, but a request for more contact was among the most frequent suggestion for program improvements

Finding #11: Retailers are very satisfied with the program. Suggestions for ways it could be even more useful to their stores included more contact with program representatives, more and

better signage (larger, bolder), and activities by the program representative that could reinforce the store's education efforts (e.g., displays, in-person interactions with customers)

Recommendation #1: Continue to market the program and conduct outreach efforts to increase awareness of the FirstEnergy programs and LED products.

EDC Status Report #1: Recommendation accepted.

Recommendation #2: Outreach efforts should continue to emphasize the energy and non-energy benefits of program-qualifying LED bulbs. While price is important to customers, it does not overwhelm other considerations and a large proportion of customers are unaware of the overall trend in LED bulb prices. Lighting quality and energy-efficiency are the most important consideration for a substantial proportion of customers.

EDC Status Report #2: Recommendation under consideration.

Recommendation #3: Work with the program implementer to establish greater consistency across participating retail locations in the level and nature of program support that is provided. Continue to incorporate feedback from participating retailers in program design and implementation, and engage the retailers in marketing efforts.

EDC Status Report #3: Recommendation accepted.

3.4 LOW INCOME ENERGY EFFICIENCY PROGRAM

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

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

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

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

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

The *Low Income Kits* (LI Kit) component includes two subcomponents:

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

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

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

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

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

3.4.1 Participation and Reported Savings by Customer Segment

Table 87 presents the participation counts, reported energy and demand savings, and incentive payments for the Appliance Turn-In Program in PY8 by customer segment and EDC. This program serves only the residential customer segment. The EE&C portfolios include separate Appliance Turn-In program components, also administered by ARCA, to serve the low-income residential and the nonresidential customer segments.

Table 87: LIEEP Participation and Reported Impacts

Parameter	Met-Ed LI Residential	Penelec LI Residential	Penn Power LI Residential	WPP LI Residential
PYTD # Participants	26,955	37,329	7,481	31,238
PYRTD MWh/yr	9,107	10,950	3,280	10,388
PYRTD MW/yr	1.15	1.30	0.43	1.39
PY8 Incentives (\$1000)	58.27	79.10	22.84	60.33

3.4.2 Gross Impact Evaluation

The gross impact evaluation of this program is described in detail in Appendix D.1. Table 88 summarizes program verified impacts and realization rates for each EDC.

Table 88: LIEEP Gross Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Appliances	16	0.00	144.4%	91.7%
Met-Ed	Appliance Turn-In	489	0.07	84.3%	85.2%
Met-Ed	Direct Install	1,551	0.18	110.5%	122.3%
Met-Ed	Home Energy Reports	4,041	0.44	108.6%	83.4%
Met-Ed	Kits	3,937	0.45	119.0%	121.0%
Met-Ed	New Homes	72	0.01	88.2%	102.8%
Met-Ed Total		10,105	1.16	111%	101%
Penelec	Appliances	20	0.00	135.5%	93.3%
Penelec	Appliance Turn-In	810	0.11	88.4%	87.1%
Penelec	Direct Install	2,433	0.24	116.5%	118.9%
Penelec	Home Energy Reports	4,273	0.47	129.9%	91.5%
Penelec	Kits	4,823	0.51	103.9%	110.9%
Penelec	New Homes	0	0.00	74.5%	96.5%
PenelecTotal		12,359	1.33	113%	102%
Penn Power	Appliances	7	0.00	172.4%	113.1%
Penn Power	Appliance Turn-In	187	0.02	69.7%	65.4%
Penn Power	Direct Install	842	0.09	121.5%	124.4%
Penn Power	Home Energy Reports	800	0.09	62.1%	42.8%
Penn Power	Kits	1,244	0.14	121.2%	124.8%
Penn Power	New Homes	0	0.00	83.3%	114.3%
Penn PowerTotal		3,080	0.35	94%	80%
WPP	Appliances	15	0.00	169.6%	93.9%
WPP	Appliance Turn-In	616	0.08	88.8%	89.4%
WPP	Direct Install	1,954	0.21	123.1%	119.7%
WPP	Home Energy Reports	3,680	0.41	89.8%	62.6%
WPP	Kits	4,635	0.57	116.3%	118.3%
WPP	New Homes	14	0.00	84.8%	108.1%
WPP Total		10,915	1.26	105%	91%

The gross realization rates for energy savings were driven primarily by Appliance Turn-In part-use factors for refrigerators and freezers as determined through verification surveys, and by the unit energy consumptions for refrigerators and freezers, as determined through measure attributes recorded in the tracking and reporting system. Although verification rates determined through surveys were approximately 100%, the realization rates are generally lower than 100% because the part-use factors are lower than the TRM default values, and the calculated unit energy consumptions were lower than what would expect from application of default parameters in the TRM.

3.4.3 Net Impact Evaluation

Impact evaluation was not conducted for this program in PY8. The NTG for the Low Income Energy Efficiency Program is estimated as 1.0 at this time for the purpose net cost effectiveness calculations.

3.4.4 Verified Savings Estimates

In Table 89 the realization rates and net-to-gross ratios determined by ADM are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for The Low Income Energy Efficiency Program in PY8. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 89: PYTD and P3TD 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	9,107	1.15	10,950	1.30	3,280	0.43	10,388	1.39
PYVTD Gross	10,105	1.16	12,359	1.33	3,080	0.35	10,915	1.26
PYVTD Net	10,105	1.16	12,359	1.33	3,080	0.35	10,915	1.26
RTD	9,107	1.15	10,950	1.30	3,280	0.43	10,388	1.39
VTD Gross	10,105	1.16	12,359	1.33	3,080	0.35	10,915	1.26
VTD Net	10,105	1.16	12,359	1.33	3,080	0.35	10,915	1.26

3.4.5 Process Evaluation

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

Process evaluations for the Appliance Rebate, Behavioral, and Kits sub-programs were conducted with the similar Non-Low Income programs in the Energy Efficient Products and Energy Efficient Homes programs, respectively. Findings and recommendations for those program components are reported in those sections. The sample design is shown in Table 90.

Table 90: LIP Program Process Evaluation Sample Design

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

Key findings and recommendations are listed in Section 3.4.7.

3.4.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 91, Table 92, Table 93, and Table 94 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 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 91: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	58		58		58		58	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	18		18		18		18	
4	Incremental Measure Costs (Sum of rows 1 through 3)	76		76		76		76	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	105	0	105	0	105	0	105
6	Administration, Management, and Technical Assistance ^[3]	174	272	174	272	174	272	174	272
7	Marketing ^[4]	4	67	4	67	4	67	4	67
8	Program Delivery ^[5]	107	2,454	107	2,454	107	2,454	107	2,454
9	EDC Evaluation Costs	57		57		57	0	57	0
10	SWE Audit Costs	93		93		93	0	93	0
11	Program Overhead Costs (Sum of rows 5 through 10)	3,333		3,333		3,333		3,333	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	3,409		3,409		3,409		3,409	
14	Total NPV Lifetime Electric Energy Benefits	1,858		1,858		1,858		1,858	
15	Total NPV Lifetime Electric Capacity Benefits	704		704		704		704	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	2,563		2,563		2,563		2,563	
19	TRC Benefit-Cost Ratio ^[8]	0.75		0.75		0.75		0.75	
<p>[1] Includes direct install equipment costs and costs for EE&C kits.</p> <p>[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.</p> <p>[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

Table 92: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	79		79		79		79	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	7		7		7		7	
4	Incremental Measure Costs (Sum of rows 1 through 3)	86		86		86		86	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	1	127	1	127	1	127	1	127
6	Administration, Management, and Technical Assistance ^[3]	197	334	197	334	197	334	197	334
7	Marketing ^[4]	3	66	3	66	3	66	3	66
8	Program Delivery ^[5]	147	2,381	147	2,381	147	2,381	147	2,381
9	EDC Evaluation Costs	63		63		63	0	63	0
10	SWE Audit Costs	98		98		98	0	98	0
11	Program Overhead Costs (Sum of rows 5 through 10)	3,418		3,418		3,418		3,418	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	3,504		3,504		3,504		3,504	
14	Total NPV Lifetime Electric Energy Benefits	2,252		2,252		2,252		2,252	
15	Total NPV Lifetime Electric Capacity Benefits	797		797		797		797	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	3,048		3,048		3,048		3,048	
19	TRC Benefit-Cost Ratio ^[8]	0.87		0.87		0.87		0.87	

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

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

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

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

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

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 93: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	23		23		23		23	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	2		2		2		2	
4	Incremental Measure Costs (Sum of rows 1 through 3)	25		25		25		25	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	28	0	28	0	28	0	28
6	Administration, Management, and Technical Assistance ^[3]	58	70	58	70	58	70	58	70
7	Marketing ^[4]	1	21	1	21	1	21	1	21
8	Program Delivery ^[5]	55	669	55	669	55	669	55	669
9	EDC Evaluation Costs	19		19		19	0	19	0
10	SWE Audit Costs	28		28		28	0	28	0
11	Program Overhead Costs (Sum of rows 5 through 10)	948		948		948		948	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	973		973		973		973	
14	Total NPV Lifetime Electric Energy Benefits	633		633		633		633	
15	Total NPV Lifetime Electric Capacity Benefits	155		155		155		155	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	788		788		788		788	
19	TRC Benefit-Cost Ratio ^[8]	0.81		0.81		0.81		0.81	

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

Table 94: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	60		60		60		60	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	8		8		8		8	
4	Incremental Measure Costs (Sum of rows 1 through 3)	68		68		68		68	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	110	0	110	0	110	0	110
6	Administration, Management, and Technical Assistance ^[3]	168	281	168	281	168	281	168	281
7	Marketing ^[4]	4	102	4	102	4	102	4	102
8	Program Delivery ^[5]	110	2,589	110	2,589	110	2,589	110	2,589
9	EDC Evaluation Costs	60		60		60	0	60	0
10	SWE Audit Costs	80		80		80	0	80	0
11	Program Overhead Costs (Sum of rows 5 through 10)	3,505		3,505		3,505		3,505	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	3,573		3,573		3,573		3,573	
14	Total NPV Lifetime Electric Energy Benefits	2,053		2,053		2,053		2,053	
15	Total NPV Lifetime Electric Capacity Benefits	546		546		546		546	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	2,599		2,599		2,599		2,599	
19	TRC Benefit-Cost Ratio ^[8]	0.73		0.73		0.73		0.73	

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

3.4.7 Status of Recommendations

The impact and process evaluation activities in PY8 led to the following findings and recommendations from Tetra Tech to the Companies along with a summary of how the Companies plan to address the recommendation in program delivery.

Finding #1: Contractors are required to enter information in the FirstEnergy tracking system as well as a state-run website.

Recommendation #1: Include a web link to the state-run website within FirstEnergy's system for convenience to contractors.

EDC Status Report #1: The Companies periodically update the tracking and reporting system for the low-income programs, and this recommendation will be considered during the next round of coding updates.

Finding #2: While nearly all direct install measures are installed by the contractor, participants still report some are left behind for the homeowner to install. This may result in the measures never being installed and may impact the realization rate. This has improved since Phase II, but participants still report 4 percent of measures are left uninstalled.

Recommendation #2: Continue to work with contractors to ensure direct install measures are installed by the contractor, rather than left for the homeowner to be installed later.

EDC Status Report #2: Recommendation under consideration with the understanding that the gross impact evaluation accounts for and accordingly reduces gross verified impacts for such instances, yet the gross realization rates are generally high.

3.5 C&I ENERGY SOLUTIONS FOR BUSINESS PROGRAM - SMALL

The C&I Solutions for Business Program – Small (referred to as ESB-Small Program) is offered to small commercial and industrial customers and is implemented jointly by Sodexo and ARCA. The Sodexo portion of the program includes downstream incentives for customers that install energy efficient equipment. In PY8, the major program components included lighting (both new construction and retrofits), custom HVAC upgrades, compressed air projects, process improvements, and prescriptive HVAC, refrigeration, and food-service measures. The incentives for most downstream measures are proportional to the reported energy savings. The ARCA portion of the program included refrigerator, freezer, and room air conditioner recycling.

3.5.1 Participation and Reported Savings by Customer Segment

Table 95 and Table 96 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Small Program in PY8 by customer segment and EDC. This program serves the Small C&I and GNI customer segments. Each separate rebate application is counted as one participant.

Table 95: 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	314	34	348	514	94	608
PYRTD MWh/yr	11,412	1,114	12,526	15,331	2,740	18,071
PYRTD MW/yr	1.77	0.15	1.92	2.50	0.50	2.99
PY8 Incentives (\$1000)	660.50	63.78	724.28	980.21	183.24	1,163.44

Table 96: 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	218	31	249	454	52	506
PYRTD MWh/yr	7,810	892	8,703	13,272	1,268	14,540
PYRTD MW/yr	1.28	0.13	1.41	2.00	0.31	2.31
PY8 Incentives (\$1000)	454.58	57.41	511.99	788.12	89.20	877.32

3.5.2 Gross Impact Evaluation

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

described in detail in Appendix P. Prescriptive HVAC and appliance projects were grouped into the Prescriptive Initiative. The evaluation of Prescriptive projects is described in Appendix R. Custom projects include combinations of measures that serve multiple end-uses, as well as custom projects that involve combined heat and power, motors and drives, industrial process improvements, refrigeration, retro-commissioning, compressed air upgrades, data centers, and custom HVAC and chillers. The impact evaluation for the custom initiative is described in Appendix Q. The program has a Direct Install Initiative which started in PY9, although three projects were completed in PY8. The PY8 evaluation activities for the Direct Install Initiative are described in Appendix S. For all EDCs, the Lighting initiative attributed for the majority of program savings, followed by the Custom initiative. The Prescriptive and Appliance Turn-In initiatives accounted for small fractions of overall program impacts. Table 97 summarizes program verified impacts and realization rates for each EDC.

Table 97: ESB-Small Program Gross Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Lighting	10,838	1.94	91%	105%
Met-Ed	Custom	345	0.04	104%	103%
Met-Ed	Prescriptive	203	0.02	85%	78%
Met-Ed	Appliance Turn-In	82	0.01	94%	81%
Met-Ed	Direct Install	0	0.00	100%	100%
Met-Ed Total		11,469	2.01	92%	105%
Penelec	Lighting	15,463	2.73	93%	102%
Penelec	Custom	1,005	0.16	92%	58%
Penelec	Prescriptive	337	0.04	103%	112%
Penelec	Appliance Turn-In	68	0.01	93%	93%
Penelec	Direct Install	2	0.00	100%	100%
Penelec Total		16,874	2.94	93%	98%
Penn Power	Lighting	7,240	1.31	94%	104%
Penn Power	Custom	867	0.15	88%	118%
Penn Power	Prescriptive	30	0.01	81%	84%
Penn Power	Appliance Turn-In	10	0.00	84%	84%
Penn Power	Direct Install	4	0.00	100%	100%
Penn Power Total		8,151	1.48	94%	105%
WPP	Lighting	13,440	2.10	101%	102%
WPP	Custom	548	0.06	97%	90%
WPP	Prescriptive	454	0.05	84%	29%
WPP	Appliance Turn-In	80	0.01	90%	78%
WPP	Direct Install	0	0.00	100%	100%
WPP Total		14,523	2.22	100%	96%

The gross realization rates for energy savings were driven primarily by variances between assumed lighting hours of use in advance of rebate approval and hours of use that were determined through impact evaluation activities.

3.5.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY8. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2. The net impact evaluation of the Prescriptive Initiative is described in Appendix R.2. Net impact evaluation was not conducted for the Appliance Turn-In Initiative or the Direct Install Initiative. The NTG for the Appliance Turn-In Initiative is estimated to be the same as the NTG of the residential Appliance Turn-In Initiative, while the NTG of the Direct Install Initiative is estimated as 1.0 at this time for the purpose net cost effectiveness calculations.

Table 98 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 98: ESB-Small Program Net Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Lighting	10,838	66.3%	7,187
Met-Ed	Custom	345	37.4%	129
Met-Ed	Prescriptive	203	40.9%	83
Met-Ed	Appliance Turn-In	82	50.0%	41
Met-Ed	Direct Install	0	50.0%	0
Met-Ed Total		11,469	64.9%	7,441
Penelec	Lighting	15,463	85.0%	13,147
Penelec	Custom	1,005	56.3%	566
Penelec	Prescriptive	337	43.2%	146
Penelec	Appliance Turn-In	68	43.0%	29
Penelec	Direct Install	2	50.0%	1
Penelec Total		16,874	82.3%	13,889
Penn Power	Lighting	7,240	75.2%	5,448
Penn Power	Custom	867	47.7%	414
Penn Power	Prescriptive	30	37.7%	11
Penn Power	Appliance Turn-In	10	50.0%	5
Penn Power	Direct Install	4	50.0%	2
Penn Power Total		8,151	72.1%	5,880
WPP	Lighting	13,440	82.9%	11,137
WPP	Custom	548	53.0%	291
WPP	Prescriptive	454	100.2%	455
WPP	Appliance Turn-In	80	45.0%	36
WPP	Direct Install	0	50.0%	0
WPP Total		14,523	82.1%	11,919

3.5.3.1 High-Impact Measure Research

The Lighting and Custom Initiatives were identified as High-Impact Measures in PY8. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2.

3.5.4 Verified Savings Estimates

In Table 99 the realization rates and net-to-gross ratios determined by Tetra Tech are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the ESB-Small Program in PY8. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 99: PYTD and P3TD 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	12,526	1.92	18,071	2.99	8,703	1.41	14,540	2.31
PYVTD Gross	11,469	2.01	16,874	2.94	8,151	1.48	14,523	2.22
PYVTD Net	7,441	1.31	13,889	2.43	5,880	1.06	11,919	1.83
RTD	12,526	1.92	18,071	2.99	8,703	1.41	14,540	2.31
VTD Gross	11,469	2.01	16,874	2.94	8,151	1.48	14,523	2.22
VTD Net	7,441	1.31	13,889	2.43	5,880	1.06	11,919	1.83

3.5.5 Process Evaluation

The process evaluation kicked off with interviews with FirstEnergy and ICSP staff. These interviews led to identification of issues that were researched through a participant survey and contractor interviews. The participant survey was conducted over the phone. Researchable issues focused on satisfaction, customer awareness and marketing, incentive levels, program processes, and the transition to a new ICSP in Phase III.

Process evaluation activities were combined for the Large C&I, Small C&I, and Government and Institutional programs given the similarities in program delivery. Survey strata were based on the project type, and were defined as Custom, Lighting, or Other, with the Other category including prescriptive downstream measures (administered by Sodexo) but excluding Appliance Turn-In. The sample design is shown in Table 100, and represents all C&I energy efficiency programs offered by each EDC.

Table 100: ESB-Small Program Process Evaluation Sample Design

Stratum	Population Size	Achieved Sample Size	Response Rate
Met-Ed Lighting	349	63	42%
Met-Ed Custom	40	17	57%
Met-Ed Other	27	2	29%
Penelec Lighting	792	103	44%
Penelec Custom	58	18	51%
Penelec Other	38	2	18%
Penn Power Lighting	416	45	38%
Penn Power Custom	20	7	47%
Penn Power Other	8	1	50%
WPP Lighting	639	70	41%
WPP Custom	47	14	48%
WPP Other	39	1	17%

Key findings and recommendations are listed in Section 3.5.7

3.5.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 101, Table 102, Table 103, and Table 104 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 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 101: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	724		724		724		724	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	2,509		2,509		1,357		1,357	
4	Incremental Measure Costs (Sum of rows 1 through 3)	3,233		3,233		2,082		2,082	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	27	0	27	0	27	0	27
6	Administration, Management, and Technical Assistance ^[3]	55	265	55	265	55	265	55	265
7	Marketing ^[4]	0	124	0	124	0	124	0	124
8	Program Delivery ^[5]	77	228	77	228	77	228	77	228
9	EDC Evaluation Costs	65		65		65	0	65	0
10	SWE Audit Costs	61		61		61	0	61	0
11	Program Overhead Costs (Sum of rows 5 through 10)	903		903		903		903	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	4,136		4,136		2,984		2,984	
14	Total NPV Lifetime Electric Energy Benefits	4,589		4,589		2,981		2,981	
15	Total NPV Lifetime Electric Capacity Benefits	1,812		1,812		1,184		1,184	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-529		-529		-351		-351	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	5,872		5,872		3,814		3,814	
19	TRC Benefit-Cost Ratio ^[8]	1.42		1.42		1.28		1.28	

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

Table 102: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	1,163		1,163		1,163		1,163	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	4,069		4,069		3,074		3,074	
4	Incremental Measure Costs (Sum of rows 1 through 3)	5,232		5,232		4,237		4,237	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	31	0	31	0	31	0	31
6	Administration, Management, and Technical Assistance ^[3]	77	327	77	327	77	327	77	327
7	Marketing ^[4]	0	118	0	118	0	118	0	118
8	Program Delivery ^[5]	98	271	98	271	98	271	98	271
9	EDC Evaluation Costs	71		71		71	0	71	0
10	SWE Audit Costs	64		64		64	0	64	0
11	Program Overhead Costs (Sum of rows 5 through 10)	1,059		1,059		1,059		1,059	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	6,291		6,291		5,296		5,296	
14	Total NPV Lifetime Electric Energy Benefits	6,373		6,373		5,266		5,266	
15	Total NPV Lifetime Electric Capacity Benefits	2,687		2,687		2,234		2,234	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-610		-610		-519		-519	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	8,449		8,449		6,981		6,981	
19	TRC Benefit-Cost Ratio ^[8]	1.34		1.34		1.32		1.32	

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

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

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

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

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

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 103: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	512		512		512		512	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	957		957		472		472	
4	Incremental Measure Costs (Sum of rows 1 through 3)	1,469		1,469		984		984	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	12	0	12	0	12	0	12
6	Administration, Management, and Technical Assistance ^[3]	9	125	9	125	9	125	9	125
7	Marketing ^[4]	0	24	0	24	0	24	0	24
8	Program Delivery ^[5]	21	100	21	100	21	100	21	100
9	EDC Evaluation Costs	18		18		18	0	18	0
10	SWE Audit Costs	16		16		16	0	16	0
11	Program Overhead Costs (Sum of rows 5 through 10)	324		324		324		324	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	1,793		1,793		1,308		1,308	
14	Total NPV Lifetime Electric Energy Benefits	3,132		3,132		2,259		2,259	
15	Total NPV Lifetime Electric Capacity Benefits	1,397		1,397		1,007		1,007	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-319		-319		-240		-240	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	4,210		4,210		3,026		3,026	
19	TRC Benefit-Cost Ratio ^[8]	2.35		2.35		2.31		2.31	
<p>[1] Includes direct install equipment costs and costs for EE&C kits. [2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery. [3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row. [4] Includes the marketing CSP and marketing costs by program CSPs. [5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs. [6] Total TRC Costs includes Total EDC Costs and Participant Costs. [7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III. [8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs. * Rows 1-11 are presented in nominal dollars</p>									

Table 104: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	877		877		877		877	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	4,244		4,244		3,346		3,346	
4	Incremental Measure Costs (Sum of rows 1 through 3)	5,121		5,121		4,224		4,224	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	30	0	30	0	30	0	30
6	Administration, Management, and Technical Assistance ^[3]	73	312	73	312	73	312	73	312
7	Marketing ^[4]	0	172	0	172	0	172	0	172
8	Program Delivery ^[5]	80	258	80	258	80	258	80	258
9	EDC Evaluation Costs	66		66		66	0	66	0
10	SWE Audit Costs	60		60		60	0	60	0
11	Program Overhead Costs (Sum of rows 5 through 10)	1,052		1,052		1,052		1,052	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	6,173		6,173		5,276		5,276	
14	Total NPV Lifetime Electric Energy Benefits	5,484		5,484		4,518		4,518	
15	Total NPV Lifetime Electric Capacity Benefits	2,062		2,062		1,701		1,701	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-571		-571		-473		-473	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	6,974		6,974		5,746		5,746	
19	TRC Benefit-Cost Ratio ^[8]	1.13		1.13		1.09		1.09	
<p>[1] Includes direct install equipment costs and costs for EE&C kits.</p> <p>[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.</p> <p>[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

3.5.7 Status of Recommendations

The impact and process evaluation activities in PY8 led to the following findings and recommendations from Tetra Tech to the Companies along with a summary of how the Companies plan to address the recommendation in program delivery.

Finding #1: Participating customer and trade ally satisfaction remains high. Average customer and trade ally satisfaction ratings across all aspects of the program met or exceeded 4.0 on a 1 to 5 scale with 1 being “not at all satisfied” and 5 being “very satisfied”. Nearly two-thirds of participant customer respondents (64 percent) reported that they have recommended FirstEnergy’s business programs to others and 84 percent said they are “very likely” to participate in FirstEnergy’s programs again in the future, suggesting a strong pipeline for future participation.

Recommendation #1: Continue current processes to maintain high customer and trade ally satisfaction and monitor impacts of program design changes on satisfaction levels.

EDC Status Report #1: Recommendation accepted.

Finding #2: Trade allies continue to be the primary driver of customer awareness and participation in Phase III. While the program has been successful in generating repeat participants through the trade ally relationships, views on the level of general customer awareness of FirstEnergy’s business programs is mixed. Participants report preferring to receive information about FirstEnergy’s programs through email or electronic newsletters, direct mail, and utility bill inserts.

Recommendation #2: Continue to leverage trade ally relationships to help drive participation in the program. Consider additional email and/or direct mailing campaigns to customers.

EDC Status Report #2: Recommendation accepted.

Finding #3: Impressions of the transition to a new ICSP are largely positive; though feedback suggests there may be opportunities to further support to trade allies. Most trade allies interviewed felt well supported by the program and report being in regular communication with their ICSP representative. At the same time, some trade allies noted the loss of some established working relationships and longer response times to requests or questions than observed under the previous ICSP.

Recommendation #3: Continue providing individual support to trade allies and work to ensure inquiries are responded to promptly.

EDC Status Report #3: Recommendation accepted.

Finding #4: While recent efforts to provide additional application support have been recognized, further streamlining the application process remains among the most common recommendations provided by customers and trade allies. Participating trade allies and customers often described the application process as time-consuming and/or cumbersome.

Additionally, several trade allies mentioned not pursuing program incentives for certain projects due to the perceived administrative burden or combination of the required paperwork not being worth the incentives available through the program.

Recommendation #5: Continue to review the application process on an ongoing basis for any additional efficiencies that may be achieved without compromising program implementation or evaluation efforts. In addition, continue to provide application training and support to trade allies and customers.

EDC Status Report #5: Recommendation accepted. The Companies note that applications – particularly for lighting upgrades – will continue to require significant levels of detail to conform with Act 129 measurement and verification requirements.

3.6 C&I ENERGY SOLUTIONS FOR BUSINESS PROGRAM - LARGE

The C&I Solutions for Business Program – Large (referred to as ESB-Large Program) is offered to large commercial and industrial customers and is implemented by Sodexo. The program includes downstream incentives for customers that install energy efficient equipment. In PY8, the major program components included lighting (both new construction and retrofits), custom HVAC upgrades, compressed air projects, process improvements, and prescriptive HVAC, refrigeration, and food-service measures. The incentives for most downstream measures are proportional to the reported energy savings.

3.6.1 Participation and Reported Savings by Customer Segment

Table 105 and Table 106 present the participation counts, reported energy and demand savings, and incentive payments for the ESB-Small Program in PY8 by customer segment and EDC. This program serves the Large C&I and GNI customer segments. Each separate rebate application is counted as one participant.

Table 105: 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	79	37	116	82	28	110
PYRTD MWh/yr	27,435	3,484	30,919	12,873	2,938	15,811
PYRTD MW/yr	3.53	0.58	4.11	1.58	0.28	1.86
PY8 Incentives (\$1000)	1,365.27	176.51	1,541.78	597.90	146.20	744.11

Table 106: 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	16	2	18	31	12	68
PYRTD MWh/yr	3,036	10	3,046	7,433	3,044	10,477
PYRTD MW/yr	0.29	0.00	0.29	0.96	0.57	1.53
PY8 Incentives (\$1000)	167.09	0.61	167.70	372.93	148.78	521.72

3.6.2 Gross Impact Evaluation

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

Initiative. The evaluation of Prescriptive projects is described in Appendix R. Custom projects include combinations of measures that serve multiple end-uses, as well as custom projects that involve combined heat and power, motors and drives, industrial process improvements, refrigeration, retro-commissioning, compressed air upgrades, data centers, and custom HVAC and chillers. The impact evaluation for the Custom Initiative is described in Appendix Q. For all EDCs, the Lighting Initiative attributed for the majority of program savings, followed by the Custom initiative. The Prescriptive and Appliance Turn-In initiatives accounted for small fractions of overall program impacts. Table 107 summarizes program verified impacts and realization rates for each EDC.

Table 107: ESB-Large Program Gross Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Lighting	17,636	2.32	91%	105%
Met-Ed	Custom	11,957	1.94	104%	103%
Met-Ed	Prescriptive	49	0.02	85%	78%
Met-Ed Total		29,643	4.27	95.9%	104.1%
Penelec	Lighting	9,917	1.35	93%	102%
Penelec	Custom	4,745	0.31	92%	58%
Penelec	Prescriptive	4	0.00	103%	112%
Penelec Total		14,666	1.66	92.8%	89.4%
Penn Power	Lighting	1,236	0.17	94%	104%
Penn Power	Custom	1,531	0.15	88%	118%
Penn Power	Prescriptive	0	0.00	81%	84%
Penn Power Total		2,768	0.32	90.9%	109.8%
WPP	Lighting	7,187	0.87	101%	102%
WPP	Custom	3,213	0.60	97%	90%
WPP	Prescriptive	14	0.00	84%	29%
WPP Total		10,414	1.47	99.4%	96.3%

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.

3.6.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY8. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2. The net impact evaluation of the Prescriptive Initiative is described in Appendix R.2. Table 108 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 108: ESB-Large Program Net Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Lighting	17,636	66.3%	11,696
Met-Ed	Custom	11,957	37.4%	4,472
Met-Ed	Prescriptive	49	40.9%	20
Met-Ed Total		29,643	54.6%	16,188
Penelec	Lighting	9,917	85.0%	8,432
Penelec	Custom	4,745	56.3%	2,672
Penelec	Prescriptive	4	43.2%	2
Penelec Total		14,666	75.7%	11,106
Penn Power	Lighting	1,236	75.2%	930
Penn Power	Custom	1,531	47.7%	731
Penn Power	Prescriptive	0	37.7%	0
Penn Power Total		2,768	60.0%	1,661
WPP	Lighting	7,187	82.9%	5,955
WPP	Custom	3,213	53.0%	1,704
WPP	Prescriptive	14	100.2%	14
WPP Total		10,414	73.7%	7,673

3.6.3.1 High-Impact Measure Research

The Lighting and Custom Initiatives were identified as High-Impact Measures in PY8. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2.

3.6.4 Verified Savings Estimates

In Table 109 the realization rates and net-to-gross ratios determined by Tetra Tech are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for ESB-Large Program in PY8. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 109: PYTD and P3TD 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	30,919	4.11	15,811	1.86	3,046	0.29	10,477	1.53
PYVTD Gross	29,643	4.27	14,666	1.66	2,768	0.32	10,414	1.47
PYVTD Net	16,188	2.27	11,106	1.32	1,661	0.20	7,673	1.04
RTD	30,919	4.11	15,811	1.86	3,046	0.29	10,477	1.53
VTD Gross	29,643	4.27	14,666	1.66	2,768	0.32	10,414	1.47
VTD Net	16,188	2.27	11,106	1.32	1,661	0.20	7,673	1.04

3.6.5 Process Evaluation

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

3.6.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 110, Table 111, Table 112, and Table 113 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 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 110: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	1,542		1,542		1,542		1,542	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	8,028		8,028		3,453		3,453	
4	Incremental Measure Costs (Sum of rows 1 through 3)	9,570		9,570		4,995		4,995	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	47	0	47	0	47	0	47
6	Administration, Management, and Technical Assistance ^[3]	43	368	43	368	43	368	43	368
7	Marketing ^[4]	0	80	0	80	0	80	0	80
8	Program Delivery ^[5]	36	506	36	506	36	506	36	506
9	EDC Evaluation Costs	81		81		81	0	81	0
10	SWE Audit Costs	47		47		47	0	47	0
11	Program Overhead Costs (Sum of rows 5 through 10)	1,208		1,208		1,208		1,208	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	10,778		10,778		6,202		6,202	
14	Total NPV Lifetime Electric Energy Benefits	11,989		11,989		6,533		6,533	
15	Total NPV Lifetime Electric Capacity Benefits	3,932		3,932		2,075		2,075	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-861		-861		-571		-571	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	15,060		15,060		8,037		8,037	
19	TRC Benefit-Cost Ratio ^[8]	1.40		1.40		1.30		1.30	
<p>[1] Includes direct install equipment costs and costs for EE&C kits.</p> <p>[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.</p> <p>[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

Table 111: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	744		744		744		744	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	4,999		4,999		3,326		3,326	
4	Incremental Measure Costs (Sum of rows 1 through 3)	5,743		5,743		4,070		4,070	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	29	0	29	0	29	0	29
6	Administration, Management, and Technical Assistance ^[3]	48	229	48	229	48	229	48	229
7	Marketing ^[4]	0	53	0	53	0	53	0	53
8	Program Delivery ^[5]	38	314	38	314	38	314	38	314
9	EDC Evaluation Costs	75		75		75	0	75	0
10	SWE Audit Costs	42		42		42	0	42	0
11	Program Overhead Costs (Sum of rows 5 through 10)	828		828		828		828	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	6,571		6,571		4,898		4,898	
14	Total NPV Lifetime Electric Energy Benefits	5,390		5,390		4,122		4,122	
15	Total NPV Lifetime Electric Capacity Benefits	1,487		1,487		1,198		1,198	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-392		-392		-333		-333	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	6,485		6,485		4,986		4,986	
19	TRC Benefit-Cost Ratio ^[8]	0.99		0.99		1.02		1.02	

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

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

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

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

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

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 112: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	168		168		168		168	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	720		720		305		305	
4	Incremental Measure Costs (Sum of rows 1 through 3)	888		888		473		473	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	6	0	6	0	6	0	6
6	Administration, Management, and Technical Assistance ^[3]	13	50	13	50	13	50	13	50
7	Marketing ^[4]	0	7	0	7	0	7	0	7
8	Program Delivery ^[5]	8	68	8	68	8	68	8	68
9	EDC Evaluation Costs	16		16		16	0	16	0
10	SWE Audit Costs	10		10		10	0	10	0
11	Program Overhead Costs (Sum of rows 5 through 10)	177		177		177		177	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	1,065		1,065		650		650	
14	Total NPV Lifetime Electric Energy Benefits	1,065		1,065		639		639	
15	Total NPV Lifetime Electric Capacity Benefits	307		307		191		191	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-55		-55		-41		-41	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	1,317		1,317		789		789	
19	TRC Benefit-Cost Ratio ^[8]	1.24		1.24		1.21		1.21	
<p>[1] Includes direct install equipment costs and costs for EE&C kits.</p> <p>[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.</p> <p>[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.</p> <p>[4] Includes the marketing CSP and marketing costs by program CSPs.</p> <p>[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.</p> <p>[6] Total TRC Costs includes Total EDC Costs and Participant Costs.</p> <p>[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III.</p> <p>[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.</p> <p>* Rows 1-11 are presented in nominal dollars</p>									

Table 113: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	522		522		522		522	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	2,960		2,960		2,096		2,096	
4	Incremental Measure Costs (Sum of rows 1 through 3)	3,482		3,482		2,617		2,617	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	23	0	23	0	23	0	23
6	Administration, Management, and Technical Assistance ^[3]	43	182	43	182	43	182	43	182
7	Marketing ^[4]	0	63	0	63	0	63	0	63
8	Program Delivery ^[5]	27	250	27	250	27	250	27	250
9	EDC Evaluation Costs	67		67		67	0	67	0
10	SWE Audit Costs	35		35		35	0	35	0
11	Program Overhead Costs (Sum of rows 5 through 10)	691		691		691		691	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	4,173		4,173		3,308		3,308	
14	Total NPV Lifetime Electric Energy Benefits	3,673		3,673		2,772		2,772	
15	Total NPV Lifetime Electric Capacity Benefits	1,214		1,214		889		889	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-305		-305		-253		-253	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	4,582		4,582		3,408		3,408	
19	TRC Benefit-Cost Ratio ^[8]	1.10		1.10		1.03		1.03	
<p>[1] Includes direct install equipment costs and costs for EE&C kits. [2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery. [3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row. [4] Includes the marketing CSP and marketing costs by program CSPs. [5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs. [6] Total TRC Costs includes Total EDC Costs and Participant Costs. [7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Savings carried over from Phase II are not included as a part of Total TRC Benefits for Phase III. [8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs. * Rows 1-11 are presented in nominal dollars</p>									

3.6.7 Status of Recommendations

Recommendations for the nonresidential programs are listed in Section 3.5.7.

3.7 GOVERNMENT AND INSTITUTIONAL TARIFF PROGRAM

The Government and Institutional Tariff Program (referred to as the GAIT Program) is offered to customers with specific rate tariffs such as schools, municipalities, and volunteer fire departments. The impacts from this program are counted toward the Companies' GNI compliance targets, although most of the GNI participation is through the ESB-Small and ESB-Large programs. The program is implemented jointly by Sodexo and ARCA. The Sodexo portion of the program includes downstream incentives for customers that install energy efficient equipment. In PY8, the major program components included lighting (both new construction and retrofits), custom HVAC upgrades, compressed air projects, process improvements, and prescriptive HVAC, refrigeration, and food-service measures. The incentives for most downstream measures are proportional to the reported energy savings. The ARCA portion of the program included refrigerator, freezer, and room air conditioner recycling.

3.7.1 Participation and Reported Savings by Customer Segment

Table 114 presents the participation counts, reported energy and demand savings, and incentive payments for the GAIT Program in PY8 by EDC. This program serves only the GNI customer segment. Each separate rebate application is counted as one participant.

Table 114: GAIT Program Participation and Reported Impacts

Parameter	Met-Ed GNI	Penelec GNI	Penn Power GNI	WPP GNI
PYTD # Participants	32	233	186	229
PYRTD MWh/yr	274	852	1,424	5,489
PYRTD MW/yr	0.01	0.01	0.06	0.16
PY8 Incentives (\$1000)	13.81	42.93	72.48	274.35

3.7.2 Gross Impact Evaluation

The GAIT Program was disaggregated into four sampling initiatives for gross impact evaluation, as described in Appendix C. The Appliance Turn-In program component, administered by ARCA, was evaluated as a separate initiative. The gross impact evaluation for the Appliance Turn-In initiative is described in detail in Appendix T. Lighting improvements were grouped into the C/I Lighting initiative, and evaluated according to PA TRM protocols as described in detail in Appendix P. Prescriptive HVAC and appliance projects were grouped into the Prescriptive Initiative. The evaluation of Prescriptive projects is described in Appendix R. Custom projects include combinations of measures that serve multiple end-uses, as well as custom projects that involve combined heat and power, motors and drives, industrial process improvements, refrigeration, retro-commissioning, compressed air upgrades, data centers, and custom HVAC and chillers. The impact evaluation for the custom initiative is described in Appendix Q, however there were no custom projects in the GAIT programs in PY8. For all EDCs, the Lighting initiative attributed for almost the entirety of program savings. Table 115 summarizes program verified impacts and realization rates for each EDC.

Table 115: GAIT Program Gross Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	Gross Verified MW	MWh Realization Rate	MW Realization Rate
Met-Ed	Lighting	249	0.01	91%	105%
Met-Ed	Prescriptive	0	0.00	85%	78%
Met-Ed	Appliance Turn-In	1	0.00	94%	81%
Met-Ed Total		250	0.01	91.3%	104.4%
Penelec	Lighting	788	0.01	93%	102%
Penelec	Prescriptive	7	0.00	103%	112%
Penelec	Appliance Turn-In	1	0.00	93%	93%
PenelecTotal		796	0.01	93.4%	101.7%
Penn Power	Lighting	1,345	0.07	94%	104%
Penn Power	Prescriptive	0	0.00	81%	84%
Penn Power	Appliance Turn-In	0	0.00	84%	84%
Penn PowerTotal		1,345	0.07	94.4%	103.6%
WPP	Lighting	5,528	0.16	101%	102%
WPP	Prescriptive	0	0.00	84%	29%
WPP	Appliance Turn-In	0	0.00	90%	78%
WPP Total		5,528	0.16	100.7%	102.2%

The gross realization rates for energy savings were driven primarily by variances between assumed operational characteristics in advance of rebate approval and operational characteristics that were determined through impact evaluation activities. Key operational characteristics include lighting hours of use and equivalent full load hours for chillers, air compressors, and motors.

3.7.3 Net Impact Evaluation

Tetra-Tech conducted a Net-to-Gross evaluation for this program in PY8. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2. The net impact evaluation of the Prescriptive Initiative is described in Appendix R.2. Net impact evaluation was not conducted for the Appliance Turn-In Initiative or the Direct Install Initiative. The NTG for the Appliance Turn-In Initiative is estimated to be the same as the NTG of the residential Appliance Turn-In Initiative. Table 116 summarizes program verified gross and net energy impacts and net-to-gross ratios for each EDC.

Table 116: GAIT Program Net Impact Evaluation Summary for PY8

EDC	Sampling Initiative	Gross Verified MWh	NTG	Net Verified MWh
Met-Ed	Lighting	249	66.3%	165
Met-Ed	Prescriptive	0	40.9%	0
Met-Ed	Appliance Turn-In	1	50.0%	0
Met-Ed Total		250	66.3%	166
Penelec	Lighting	788	85.0%	670
Penelec	Prescriptive	7	43.2%	3
Penelec	Appliance Turn-In	1	43.0%	1
Penelec		796	84.6%	673
Penn Power	Lighting	1,345	75.2%	1,012
Penn Power	Prescriptive	0	37.7%	0
Penn Power	Appliance Turn-In	0	50.0%	0
Penn Power		1,345	75.2%	1,012
WPP	Lighting	5,528	82.9%	4,580
WPP	Prescriptive	0	100.2%	0
WPP	Appliance Turn-In	0	45.0%	0
WPP		5,528	82.9%	4,580

3.7.3.1 High-Impact Measure Research

The Lighting and Custom Initiatives were identified as High-Impact Measures in PY8. The net impact evaluation of the Lighting Initiative is described in Appendix P.2. The net impact evaluation of the Custom Initiative is described in Appendix Q.2.

3.7.4 Verified Savings Estimates

In Table 117 the realization rates and net-to-gross ratios determined by Tetra Tech are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for the GAIT Program in PY8. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 117: PYTD and P3TD 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	274	0.01	852	0.01	1,424	0.06	5,489	0.16
PYVTD Gross	250	0.01	796	0.01	1,345	0.07	5,528	0.16
PYVTD Net	166	0.01	673	0.01	1,012	0.05	4,580	0.13
RTD	274	0.01	852	0.01	1,424	0.06	5,489	0.16
VTD Gross	250	0.01	796	0.01	1,345	0.07	5,528	0.16
VTD Net	166	0.01	673	0.01	1,012	0.05	4,580	0.13

3.7.5 Process Evaluation

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

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

3.7.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 118, Table 119, Table 120, and Table 121 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 2016 dollars. NPV costs and benefits for P3TD financials are expressed in the 2016 dollars.

Table 118: Summary of Program Finances – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	14		14		14		14	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	55		55		32		32	
4	Incremental Measure Costs (Sum of rows 1 through 3)	69		69		46		46	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	1	0	1	0	1	0	1
6	Administration, Management, and Technical Assistance ^[3]	-9	18	-9	18	-9	18	-9	18
7	Marketing ^[4]	0	9	0	9	0	9	0	9
8	Program Delivery ^[5]	3	8	3	8	3	8	3	8
9	EDC Evaluation Costs	13		13		13	0	13	0
10	SWE Audit Costs	4		4		4	0	4	0
11	Program Overhead Costs (Sum of rows 5 through 10)	45		45		45		45	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	115		115		91		91	
14	Total NPV Lifetime Electric Energy Benefits	100		100		66		66	
15	Total NPV Lifetime Electric Capacity Benefits	8		8		5		5	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-12		-12		-8		-8	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	96		96		64		64	
19	TRC Benefit-Cost Ratio ^[8]	0.84		0.84		0.70		0.70	

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

Table 119: Summary of Program Finances – Penelec

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	43		43		43		43	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	190		190		155		155	
4	Incremental Measure Costs (Sum of rows 1 through 3)	233		233		197		197	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	2	0	2	0	2	0	2
6	Administration, Management, and Technical Assistance ^[3]	2	41	2	41	2	41	2	41
7	Marketing ^[4]	0	12	0	12	0	12	0	12
8	Program Delivery ^[5]	5	16	5	16	5	16	5	16
9	EDC Evaluation Costs	22		22		22	0	22	0
10	SWE Audit Costs	5		5		5	0	5	0
11	Program Overhead Costs (Sum of rows 5 through 10)	103		103		103		103	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	336		336		301		301	
14	Total NPV Lifetime Electric Energy Benefits	303		303		257		257	
15	Total NPV Lifetime Electric Capacity Benefits	11		11		9		9	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-31		-31		-26		-26	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	283		283		239		239	
19	TRC Benefit-Cost Ratio ^[8]	0.84		0.84		0.79		0.79	

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

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

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

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

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

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

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

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

* Rows 1-11 are presented in nominal dollars

Table 120: Summary of Program Finances – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	72		72		72		72	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	121		121		73		73	
4	Incremental Measure Costs (Sum of rows 1 through 3)	193		193		145		145	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	1	0	1	0	1	0	1
6	Administration, Management, and Technical Assistance ^[3]	0	40	0	40	0	40	0	40
7	Marketing ^[4]	0	3	0	3	0	3	0	3
8	Program Delivery ^[5]	1	4	1	4	1	4	1	4
9	EDC Evaluation Costs	5		5		5	0	5	0
10	SWE Audit Costs	1		1		1	0	1	0
11	Program Overhead Costs (Sum of rows 5 through 10)	54		54		54		54	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	247		247		199		199	
14	Total NPV Lifetime Electric Energy Benefits	517		517		389		389	
15	Total NPV Lifetime Electric Capacity Benefits	63		63		47		47	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-60		-60		-45		-45	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	520		520		392		392	
19	TRC Benefit-Cost Ratio ^[8]	2.10		2.10		1.96		1.96	

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

Table 121: Summary of Program Finances – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	274		274		274		274	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	1,707		1,707		1,367		1,367	
4	Incremental Measure Costs (Sum of rows 1 through 3)	1,981		1,981		1,642		1,642	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	2	0	2	0	2	0	2
6	Administration, Management, and Technical Assistance ^[3]	2	147	2	147	2	147	2	147
7	Marketing ^[4]	0	9	0	9	0	9	0	9
8	Program Delivery ^[5]	3	12	3	12	3	12	3	12
9	EDC Evaluation Costs	17		17		17	0	17	0
10	SWE Audit Costs	4		4		4	0	4	0
11	Program Overhead Costs (Sum of rows 5 through 10)	197		197		197		197	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	2,178		2,178		1,839		1,839	
14	Total NPV Lifetime Electric Energy Benefits	2,117		2,117		1,755		1,755	
15	Total NPV Lifetime Electric Capacity Benefits	152		152		126		126	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-235		-235		-194		-194	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	2,035		2,035		1,686		1,686	
19	TRC Benefit-Cost Ratio ^[8]	0.93		0.93		0.92		0.92	

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

3.7.7 Status of Recommendations

Recommendations for the nonresidential programs are listed in Section 3.5.7.

3.8 C&I DEMAND RESPONSE PROGRAM - SMALL

The C&I Demand Response Program – Large is a load curtailment program that is available to all large C&I customers. The program is implemented by Enernoc in Penn Power, and by both Enernoc and CPower in Met-Ed and WPP. The program offers incentives for load reductions during event hours. Most customers reduce loads by rescheduling industrial processes to off-event hours or by changing operations for the duration of the event.

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

3.8.1 Participation and Reported Savings by Customer Segment

The Demand Response Programs had no participation in PY8. The Companies did incur some start-up costs associated with process development, customer enrollment, administration and evaluation activities prior to the official program launch on June 1, 2017.

3.8.2 Gross Impact Evaluation

A gross impact evaluation was not conducted in PY8 as the programs launched in PY9. Gross impact evaluation activities included development of an evaluation plan and establishing data transfer protocols. The evaluation team ran several baseline estimation protocols for prospective customers to help assess the magnitude and volatility of participants' potential demand reductions.

3.8.3 Process Evaluation

A process evaluation was not conducted in PY8.

3.8.4 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 122, Table 123, and Table 124 for Met-Ed, Penelec, and Penn Power respectively. TRC benefits were calculated using gross verified impacts. PYTD financials are expressed in 2016 dollars and P3TD financials are expressed in the 2016 dollars.

Table 122: Summary of Finances for C&I Demand Response Program – Small – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	0		0		0		0	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	Incremental Measure Costs (Sum of rows 1 through 3)	0		0		0		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	1	0	1	0	1	0	1
6	Administration, Management, and Technical Assistance ^[3]	15	3	15	3	15	3	15	3
7	Marketing ^[4]	0	5	0	5	0	5	0	5
8	Program Delivery ^[5]	1	7	1	7	1	7	1	7
9	EDC Evaluation Costs	4		4		4	0	4	0
10	SWE Audit Costs	5		5		5	0	5	0
11	Program Overhead Costs (Sum of rows 5 through 10)	40		40		40		40	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	40		40		40		40	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	0		0		0		0	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	0		0		0		0	
19	TRC Benefit-Cost Ratio ^[8]	0.00		0.00		0.00		0.00	

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

Table 123: Summary of Finances for C&I Demand Response Program – Small – Penn Power

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

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

Table 124: Summary of Finances for C&I Demand Response Program – Small – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	0		0		0		0	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	Incremental Measure Costs (Sum of rows 1 through 3)	0		0		0		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	1	0	1	0	1	0	1
6	Administration, Management, and Technical Assistance ^[3]	19	5	19	5	19	5	19	5
7	Marketing ^[4]	0	8	0	8	0	8	0	8
8	Program Delivery ^[5]	1	12	1	12	1	12	1	12
9	EDC Evaluation Costs	5		5		5	0	5	0
10	SWE Audit Costs	5		5		5	0	5	0
11	Program Overhead Costs (Sum of rows 5 through 10)	56		56		56		56	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	56		56		56		56	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	0		0		0		0	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	0		0		0		0	
19	TRC Benefit-Cost Ratio ^[8]	0.00		0.00		0.00		0.00	

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

3.8.5 Status of Recommendations

The program started in PY9. There are no recommendations for PY8.

3.9 C&I DEMAND RESPONSE PROGRAM - LARGE

The C&I Demand Response Program – Large is a load curtailment program that is available to all large C&I customers. The program is implemented by Enernoc in Penn Power, and by both Enernoc and CPower in Met-Ed and WPP. The program offers incentives for load reductions during event hours. Most customers reduce loads by rescheduling industrial processes to off-event hours or by changing operations for the duration of the event.

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

3.9.1 Participation and Reported Savings by Customer Segment

The Demand Response Programs had no participation in PY8. The Companies did incur some start-up costs associated with process development, customer enrollment, administration and evaluation activities prior to the official program launch on June 1, 2017.

3.9.2 Gross Impact Evaluation

A gross impact evaluation was not conducted in PY8 as the programs launched in PY9. Gross impact evaluation activities included development of an evaluation plan and establishing data transfer protocols. The evaluation team ran several baseline estimation protocols for prospective customers to help assess the magnitude and volatility of participants' potential demand reductions.

3.9.3 Process Evaluation

A process evaluation was not conducted in PY8.

3.9.4 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 125, Table 126, and Table 127 for Met-Ed, Penelec, and Penn Power respectively. TRC benefits were calculated using gross verified impacts. PYTD financials are expressed in 2016 dollars and P3TD financials are expressed in the 2016 dollars.

Table 125: Summary of Finances for C&I Demand Response Program – Large – Met-Ed

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	0		0		0		0	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	Incremental Measure Costs (Sum of rows 1 through 3)	0		0		0		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	7	0	7	0	7	0	7
6	Administration, Management, and Technical Assistance ^[3]	138	28	138	28	138	28	138	28
7	Marketing ^[4]	0	42	0	42	0	42	0	42
8	Program Delivery ^[5]	6	62	6	62	6	62	6	62
9	EDC Evaluation Costs	36		36		36	0	36	0
10	SWE Audit Costs	41		41		41	0	41	0
11	Program Overhead Costs (Sum of rows 5 through 10)	360		360		360		360	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	360		360		360		360	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	0		0		0		0	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	0		0		0		0	
19	TRC Benefit-Cost Ratio ^[8]	0.00		0.00		0.00		0.00	

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

Table 126: Summary of Finances for C&I Demand Response Program – Large – Penn Power

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	0		0		0		0	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	Incremental Measure Costs (Sum of rows 1 through 3)	0		0		0		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	2	0	2	0	2	0	2
6	Administration, Management, and Technical Assistance ^[3]	51	6	51	6	51	6	51	6
7	Marketing ^[4]	0	9	0	9	0	9	0	9
8	Program Delivery ^[5]	2	14	2	14	2	14	2	14
9	EDC Evaluation Costs	12		12		12	0	12	0
10	SWE Audit Costs	15		15		15	0	15	0
11	Program Overhead Costs (Sum of rows 5 through 10)	111		111		111		111	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	111		111		111		111	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	0		0		0		0	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	0		0		0		0	
19	TRC Benefit-Cost Ratio ^[8]	0.00		0.00		0.00		0.00	

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

Table 127: Summary of Finances for C&I Demand Response Program – Large – WPP

Row #	Cost Category	Gross PYTD (\$1,000)		Gross P3TD (\$1,000)		Net PYTD (\$1,000)		Net P3TD (\$1,000)	
1	EDC Incentives to Participants ^[1]	0		0		0		0	
2	EDC Incentives to Trade Allies	0		0		0		0	
3	Participant Costs (net of incentives/rebates paid by utilities)	0		0		0		0	
4	Incremental Measure Costs (Sum of rows 1 through 3)	0		0		0		0	
		EDC	CSP	EDC	CSP	EDC	CSP	EDC	CSP
5	Design & Development ^[2]	0	12	0	12	0	12	0	12
6	Administration, Management, and Technical Assistance ^[3]	167	47	167	47	167	47	167	47
7	Marketing ^[4]	0	70	0	70	0	70	0	70
8	Program Delivery ^[5]	8	105	8	105	8	105	8	105
9	EDC Evaluation Costs	45		45		45	0	45	0
10	SWE Audit Costs	47		47		47	0	47	0
11	Program Overhead Costs (Sum of rows 5 through 10)	502		502		502		502	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	0		0		0		0	
13	Total NPV TRC Costs ^[6] (Net present value of sum of rows 4, 11, and 12)	502		502		502		502	
14	Total NPV Lifetime Electric Energy Benefits	0		0		0		0	
15	Total NPV Lifetime Electric Capacity Benefits	0		0		0		0	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	0		0		0		0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	0		0		0		0	
18	Total NPV TRC Benefits ^[7] (Sum of rows 14 through 17)	0		0		0		0	
19	TRC Benefit-Cost Ratio ^[8]	0.00		0.00		0.00		0.00	

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

3.9.5 Status of Recommendations

The program started in PY9. There are no recommendations for PY8.

4 Cost Recovery

Act 129 allows Pennsylvania EDCs to recover EE&C plan costs through a cost-recovery mechanism. Each EDCs cost-recovery charges are organized separately by five customer sectors to ensure that the electric rate classes that finance the programs are the rate classes that receive the direct energy and conservation benefits. Cost-recovery is governed by tariffed rate class, so it is necessarily tied to the way customers are metered and charged for electric service. Readers should be mindful of the differences between the tables below and Section 2.4. For example, the low-income customer segments are subsets of the residential tariff(s) and therefore not listed separately. Table 128, Table 129, Table 130, and Table 131.

Table 128: Met-Ed EE&C Expenditures by Cost-Recovery Category⁹ (\$1,000)

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000) ¹	P3TD \$ Spending (\$1,000) ¹
Residential (incl Low Income)	Rate RS	\$12,829	\$12,829
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	\$1,587	\$1,587
Large C&I	Rate GS-Large, Rate GP and Rate TP	\$3,101	\$3,101
Street Lighting	Street Lighting Service, LED Street Lighting Service and Ornamental Street Lighting Service	\$25	\$25
Government & Non-Profit Tariff	Rate GS - Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate and Rate MS	\$34	\$34
Portfolio Total		\$17,576	\$17,576

⁹ Includes SWE costs

Table 129: Penelec EE&C Expenditures by Cost-Recovery Category¹⁰ (\$1,000)

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000) ¹	P3TD \$ Spending (\$1,000) ¹
Residential (incl Low Income)	Rate RS	\$12,899	\$12,899
Small C&I	Rate GS-Small, Rate GS-Medium, and Outdoor Lighting Service	\$2,121	\$2,121
Large C&I	Rate GS-Large, Rate GP, and Rate LP	\$1,567	\$1,567
Street Lighting	Street Lighting Service, LED Street Lighting Service, and Ornamental Street Lighting Service	\$61	\$61
Government & Non-Profit Tariff	Rate GS – Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate and Rate H	\$84	\$84
Portfolio Total		\$16,732	\$16,732

Table 130: Penn Power EE&C Expenditures by Cost-Recovery Category¹¹ (\$1,000)

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000) ¹	P3TD \$ Spending (\$1,000) ¹
Residential (incl Low Income)	Rate RS	\$3,481	\$3,481
Small C&I	Rate GS, GS Special Rider GSDS, Rate GM, Rate GS-Large and POL	\$832	\$832
Large C&I	Rate GP, and Rate GT	\$454	\$454
Street Lighting	Rate Schedules SV, SVD, SM and LED	\$110	\$110
Government & Non-Profit Tariff	Rate GS – Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate and Rate PNP	\$17	\$17
Portfolio Total		\$4,894	\$4,894

¹⁰ Includes SWE costs

¹¹ Includes SWE costs

Table 131: WPP EE&C Expenditures by Cost-Recovery Category¹² (\$1,000)

Cost Recovery Sector	Rate Classes Included	PYTD \$ Spending (\$1,000) ¹	P3TD \$ Spending (\$1,000) ¹
Residential (incl Low Income)	Rate 10	\$12,985	\$12,985
Small C&I	Rate GS 20, Rate GS 30	\$1,902	\$1,902
Large C&I	Rate GS 35, 40, 44, 46, and Tariff No. 38	\$1,700	\$1,700
Street Lighting	Rate Schedules 51 through 58, 71, 72	\$400	\$400
Government & Non-Profit Tariff	Rate GS 20 – Volunteer Fire Company, and Non-Profit Ambulance Service, Rescue Squad and Senior Center Service Rate	\$71	\$71
Portfolio Total		\$17,058	\$17,058

¹² Includes SWE costs

Appendix A Upstream Lighting Cross Sector Sales

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

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

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

Note that the Companies EE&C plans also include distribution of efficient screw-based lamps through conservation kits in their residential and nonresidential sector programs. Based on historical customer surveys, a portion of lighting products distributed to small commercial customers are subsequently redistributed to employees, members, or parishioners for use in their homes. In such cases, the TRM residential lighting protocols are used to evaluate the energy and demand impacts associated with these "reverse-crossover" lamps. The Companies did not have active conservation kit programs in the commercial sector in PY8, therefore adjustments of this kind are not needed for PY8.

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

Survey results indicate that practically all of the efficient lamps that are installed in the nonresidential sector are installed in the small commercial and industrial class. Therefore, the funds transfer needed to avoid cross-subsidization is a net transfer from the ESB-Small Program to the EEP Program. Table 132 shows the overall incentive funding for the Upstream Lighting initiative, and allocates incentives according to the fraction of sales attributed to residential and non-residential sectors. The funding amounts in the last column are transferred from ESB-Small Program to the EEP Program.

Table 132: Upstream Lighting funding allocation between programs.

EDC	Total Upstream Lighting Incentives	Residential EEP Program (91.7%)	SFB-Small Program (8.3%)
Met-Ed	\$ 1,067,434	\$ 978,838	\$ 88,596.18
Penelec	\$ 1,343,537	\$ 1,232,024	\$ 111,512.49
Penn Power	\$ 258,405	\$ 236,958	\$ 21,447.43
West Penn	\$ 1,201,936	\$ 1,102,176	\$ 99,759.72

Appendix B Site Inspection Summary

Table 133: PY8 Site Visit Summary

EDC	Program	Inspection Firm	Number of Inspections Conducted	Number of Sites with Discrepancies from Reported Values	Summary of Common Discrepancies
Met-Ed	Energy Efficient Products Program - HVAC Rebates	Honeywell	277	0	n/a
Penelec		Honeywell	180	0	n/a
Penn Power		Honeywell	46	0	n/a
WPP		Honeywell	201	0	n/a
Met-Ed	Energy Efficient Products Program - New Construction	PSD	6	Discrepancies do not necessarily constitute a lack of verification for this program. Please refer to the gross realization rates as a measure of consistency between reported and verified values.	The most common are due to using REM/Rate defaults for furnace fan energy usage rating rather than looking them up by model #, and estimating the % of lamps that are efficient.
Met-Ed		ADM	8		
Penelec		PSD	1		
Penelec		ADM	5		
Penn Power		PSD	16		
Penn Power		ADM	8		
WPP		PSD	16		
WPP		ADM	6		
Met-Ed	Low Income Direct Install Programs	PSD, Action Housing, Pure Energy LLC	52	3	Measure count discrepancies involve aerators, furnace whistles, lamps, showerheads, and smart power strips.
Penelec			55	2	
Penn Power			50	1	
WPP			46	2	
Met-Ed	C/I Programs	ADM	75	Discrepancies do not necessarily constitute a lack of verification. Please refer to the gross realization rates as a measure of consistency between reported and verified values.	The main discrepancy is lamp fixture counts/types. Other measures are verified essentially 100% of the time.
Penelec	C/I Programs	ADM	77		
Penn Power	C/I Programs	ADM	52		
WPP	C/I Programs	ADM	75		
TOTAL			1,252	n/a	

Appendix C Assignments of Measures to Gross Impact Initiatives

C.1 NONRESIDENTIAL EE PROGRAMS

Sampling for the nonresidential programs is performed on a project by project level. Each project can have multiple measures. If a project is sampled, all (or in rare cases where sampling may be involved, most) measures are sampled. As a first step, projects in the tracking and reporting system are assigned an evaluation initiative. Each entry in FirstEnergy’s tracking and reporting system is assigned to one of seven initiatives: Appliance Recycling, Prescriptive, Lighting, Custom, Direct Install, Conservation Kits, Behavioral, or Null. The Null Initiative is defined solely to strip away items that are not associated with energy savings. These are generally line items to track special promotional bonus incentives, and may include Energy Audits that are not associated with energy savings (if measures are installed as a result of the audit, they appear as separate entries in the tracking system). In PY8, there were no measures associated with the Direct Install, Behavioral, or Conservation Kits Initiatives. These program components are a part of the Companies’ EE&C plans, but were not implemented in PY8. It is possible for projects to include multiple measures, and therefore a project may theoretically map to multiple initiatives. In practice, since rebate applications include equipment and measures that map to a single initiative as defined below, this did not occur in PY8. Measures assigned to the custom evaluation protocol are those that may potentially require custom treatment, but TRM algorithms may be applicable.

Table 134: Assignment of measures to initiatives for Nonresidential Programs

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

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

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

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

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

C.2 RESIDENTIAL PROGRAMS

For the PY8 evaluation effort, sampling initiatives were confined to distinct programs with the exception of the New Homes component of the Low Income Energy Efficiency Program, which was evaluated in the general residential New Homes Initiative. The table below lists (non-low-income) residential measures in the Companies' tracking and reporting system and assigns them to their respective evaluation initiatives. Note that some of the measures are denoted as disabled in the tracking system because they are not offered in PY8. We retain these measures for completeness – if the measures will again be offered in Act 129, they will fall in their corresponding sampling initiatives in the table. Note that the Home Energy Report measure is not listed in the table below, but the measure constitutes its own initiative.

Table 135: Assignment of measures to initiatives for Residential Programs

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

Measure	TRM Section	Initiative
25-30W equivalent CFL	2.1.1	Upstream Lighting
25-30W equivalent LED	2.1.1	Upstream Lighting
25-30W equivalent LED Specialty	2.1.1	Upstream Lighting
25-30W equivalent LEDee	2.1.1	Upstream Lighting
40-45W equivalent CFL	2.1.1	Upstream Lighting
40-45W equivalent LED	2.1.1	Upstream Lighting
40-45W equivalent LED Specialty	2.1.1	Upstream Lighting
40-45W equivalent LEDee	2.1.1	Upstream Lighting
50-60W equivalent CFL	2.1.1	Upstream Lighting
50-60W equivalent LED	2.1.1	Upstream Lighting
50-60W equivalent LED Specialty	2.1.1	Upstream Lighting
50-60W equivalent LEDee	2.1.1	Upstream Lighting
65W equivalent CFL	2.1.1	Upstream Lighting
65W equivalent LED	2.1.1	Upstream Lighting
65W equivalent LED Specialty	2.1.1	Upstream Lighting
65W equivalent LEDee	2.1.1	Upstream Lighting
72-75W equivalent CFL	2.1.1	Upstream Lighting
72-75W equivalent LED	2.1.1	Upstream Lighting
72-75W equivalent LED Specialty	2.1.1	Upstream Lighting
New Construction - Multi Family Low Rise	2.6.3	New Homes
New Construction - Single Family Detached	2.6.3	New Homes
New Construction - Two-on-Two Condos	2.6.3	New Homes
New Construction -Townhouse and Duplexs	2.6.3	New Homes
New Manufactured Housing	2.6.3	New Homes
LI New Construction	2.6.3	New Homes
Dehumidifier Recycling	IMP	Res ATI
Freezer Recycling	2.4.3	Res ATI
Refrigerator Recycling	2.4.3	Res ATI
Room Air Conditioner Recycling	2.2.55	Res ATI
Low Flow Swivel Aerator	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits
LED 12w	Various TRM Sections	Res EE Kits
XXX Disabled LED 6.5w	Various TRM Sections	Res EE Kits
LED 9w	Various TRM Sections	Res EE Kits
LED nightlight	Various TRM Sections	Res EE Kits
XXX Disabled Smart Strip	Various TRM Sections	Res EE Kits
XXXDisabled	Various TRM Sections	Res EE Kits
Low Flow Shower Head 1.6 GPM	Various TRM Sections	Res EE Kits
13/20/25 - 3 way CFL	Various TRM Sections	Res EE Kits
XXX Disabled 9w Globe	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
XXX Disabled Low Flow Swivel Aerator	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits
LED 12w	Various TRM Sections	Res EE Kits
XXX Disabled LED 6.5w	Various TRM Sections	Res EE Kits
LED 9w	Various TRM Sections	Res EE Kits
LED nightlight	Various TRM Sections	Res EE Kits
XXX Disabled Smart Strip	Various TRM Sections	Res EE Kits
XXXDisabled	Various TRM Sections	Res EE Kits

Measure	TRM Section	Initiative
XXX Disabled Low Flow Shower Head 1.6 GPM	Various TRM Sections	Res EE Kits
13/20/25 - 3 way CFL	Various TRM Sections	Res EE Kits
XXX Disabled 9w Globe	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
Low Flow Swivel Aerator	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits
XXX Disabled LED 12w	Various TRM Sections	Res EE Kits
XXX Disabled LED 6.5w	Various TRM Sections	Res EE Kits
LED 9w	Various TRM Sections	Res EE Kits
LED nightlight	Various TRM Sections	Res EE Kits
XXX Disabled Smart Strip	Various TRM Sections	Res EE Kits
XXXDisabled	Various TRM Sections	Res EE Kits
XXX Disabled Low Flow Shower Head 1.6 GPM	Various TRM Sections	Res EE Kits
XXX Disabled 13/20/25 - 3 way CFL	Various TRM Sections	Res EE Kits
XXX Disabled 9w Globe	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
XXX Disabled Low Flow Swivel Aerator	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits
XXX Disabled LED 12w	Various TRM Sections	Res EE Kits
XXX Disabled LED 6.5w	Various TRM Sections	Res EE Kits
LED 9w	Various TRM Sections	Res EE Kits
LED nightlight	Various TRM Sections	Res EE Kits
XXX Disabled Smart Strip	Various TRM Sections	Res EE Kits
XXXDisabled	Various TRM Sections	Res EE Kits
XXX Disabled Low Flow Shower Head 1.6 GPM	Various TRM Sections	Res EE Kits
XXX Disabled 13/20/25 - 3 way CFL	Various TRM Sections	Res EE Kits
XXX Disabled 9w Globe	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
72-75W equivalent LEDee	2.1.1	Upstream Lighting
Clothes Washer - Level 1	2.4.4	Res_Appliances
Clothes Dryer - (Elec w Moisture Sensor)	2.4.5	Res_Appliances
Dehumidifiers	2.4.8	Res_Appliances
Freezers	2.4.2	Res_Appliances
Refrigerators - Level 1	2.4.1	Res_Appliances
Clothes Dryer - (Elec Heat Pump)	2.4.5	Res_Appliances
Refrigerators - Level 2	2.4.1	Res_Appliances
Refrigerators - Level 3	2.4.1	Res_Appliances
Water Heater - Heat Pump	2.3.1	Res_Appliances
Water Heater - Solar	2.3.2	Res_Appliances
TVs	2.5.1	Upstream Electronics
Computers	2.5.2	Upstream Electronics
Imaging	2.5.2	Upstream Electronics
Monitors	2.5.2	Upstream Electronics
Central Air Conditioner - Level 2	2.2.1	Res HVAC
Central Air Conditioner - Level 3	2.2.1	Res HVAC
Ductless Mini-Split Heat Pump - Level 3	2.2.3	Res HVAC
Furnace Fans	2.2.1	Res HVAC
Heat Pump - Level 2	2.2.1	Res HVAC

Measure	TRM Section	Initiative
Heat Pump - Level 3	2.2.1	Res HVAC
Heat Pump - Water & GeoT - ES Tier 3	2.2.1	Res HVAC
PTAC - Level 2 - Multi Family	2.2.10	Res HVAC
PTHP - Level 2 - Multi Family	2.2.10	Res HVAC
HVAC - Maintenance	2.2.1	Res HVAC
Programmable Thermostat - Direct Install	IMP	Res HVAC
Programmable Thermostat - Store Bought	IMP	Res HVAC
3-way CFL (12/23/33)	Various TRM Sections	Res EE Kits
11W LED	Various TRM Sections	Res EE Kits
23w CFL	Various TRM Sections	Res EE Kits
LED Nite Lite	Various TRM Sections	Res EE Kits
9W LED	Various TRM Sections	Res EE Kits
Furnace Whistle	Various TRM Sections	Res EE Kits
Kitchen Swivel Aerator	Various TRM Sections	Res EE Kits
Over 150W equivalent CFL	2.1.1	Upstream Lighting
Over 150W equivalent LED	2.1.1	Upstream Lighting
Over 150W equivalent LED Specialty	2.1.1	Upstream Lighting
Over 150W equivalent LED Specialty	2.1.1	Upstream Lighting
Over 150W equivalent LEDee	2.1.1	Upstream Lighting
Under 25W equivalent CFL	2.1.1	Upstream Lighting
Under 25W equivalent LED	2.1.1	Upstream Lighting
Under 25W equivalent LED Specialty	2.1.1	Upstream Lighting
Under 25W equivalent LEDee	2.1.1	Upstream Lighting
Attic Insulation	2.6.1	Res DI
Air Sealing	2.6.6	Res DI
Showerhead	2.3.9	Res DI
Pipe Wrap	2.3.7	Res DI
CFL - 13W	2.1.1	Res DI
CFL - 18W	2.1.1	Res DI
CFL - 23W	2.1.1	Res DI
CFL - 9W	2.1.1	Res DI
LED - 9W	2.1.1	Res DI
Bath Aerator	2.3.8	Res DI
Kitchen Aerator	2.3.8	Res DI
CFL - 9W Specialty	2.1.1	Res DI
12/22/33 Watt 3-way CFL	2.1.1	Res DI
14W Globe CFL	2.1.1	Res DI
ENERGY STAR Windows	2.6.2	Res DI
Wall Insulation	2.6.1	Res DI
Duct Sealing	2.2.6	Res DI
16W R30 Flood	2.1.1	Res DI
Furnace Whistle	2.2.7	Res DI
LED Night Light	2.1.4	Res DI
Smart Power Strips	2.5.3	Res DI
CFL - 19W	2.1.1	Res DI
CFL - 9W Floodlight	2.1.1	Res DI
CFL - 14W Floodlight	2.1.1	Res DI
CFL - 14W Candelabra	2.1.1	Res DI
CFL - 19W Globe	2.1.1	Res DI
CFL - 9W Candelabra	2.1.1	Res DI

Measure	TRM Section	Initiative
CFL - 9W Globe	2.1.1	Res DI
LED -11W	2.1.1	Res DI
CFL - 23W Floodlight	2.1.1	Res DI
HandHeld Showerhead	2.3.9	Res DI
LED 11/12W	2.1.1	Res DI
LED 5W Candelabra	2.1.1	Res DI
LED 6W Globe	2.1.1	Res DI
LED 14/15	2.1.1	Res DI
LED 11W R30 Flood	2.1.1	Res DI

C.3 RESIDENTIAL LOW-INCOME PROGRAM DIRECT INSTALL

For the PY8 evaluation effort, sampling initiatives were confined to distinct programs with the exception of the New Homes component of the Low Income Energy Efficiency Program, which was evaluated in the general residential New Homes Initiative. The table below lists low-income residential measures in the Companies' tracking and reporting system and assigns them to their respective evaluation initiatives. Note that some of the measures are denoted as disabled in the tracking system because they are not offered in PY8. We retain these measures for completeness – if the measures will again be offered in Act 129, they will fall in their corresponding sampling initiatives in the table. The Home Energy Report measure is not listed in the table below, but the measure constitutes its own initiative.

Measure	TRM Section	Initiative
CREATE INT. ATTIC HATCH > 2 SQ. FT.	2.6.6	LI Direct Install
CREATE EXT. ATTIC HATCH UP TO 2 SQ. FT.	2.6.6	LI Direct Install
CREATE EXT. ATTIC HATCH > 2 SQ. FT.	2.6.6	LI Direct Install
CREATE KNEE WALL ACCESS	2.6.6	LI Direct Install
INSULATE ATTIC ACCESS-PUSH UP	2.6.6	LI Direct Install
INSULATE ATTIC ACC/FOLD. STAIRS	2.6.6	LI Direct Install
INSUL. & WXSTRIP PULL-DOWN ATTIC-PRE-FAB UNIT	2.6.6	LI Direct Install
INSUL. & WXSTRIP HORIZONTAL/PUSH-UP ATTIC HTCH-PRE-FAB UNIT	2.6.6	LI Direct Install
INSULATE & WXSTRIP WHOLE ATTIC DOOR	2.6.6	LI Direct Install
INSUL. & WXSTRIP WHOLE ATTIC DOOR (STAIRWAY)-PRE-FAB UNIT	2.6.6	LI Direct Install
ATTIC RECESSED LIGHTING BOXING	2.6.6	LI Direct Install
INSULATE ATTIC KNEE WALL	2.6.1	LI Direct Install
INSULATE ATTIC KNEE WALL PRE-FAB	2.6.1	LI Direct Install
FRAME SETS-ENERGY GUARD. OR EQUIVALENT ATTIC BOX	2.6.6	LI Direct Install
ENERGY GUARDIAN ACCESSORY PACK	2.6.6	LI Direct Install
FLOOR-FACED BAT FBGL R-11 16" ON CENTER	2.6.1	LI Direct Install
FLOOR-FACD BAT FBGL R-19 16" ON CENTER	2.6.1	LI Direct Install
FLOOR-FACD BAT FBGL R-19 24" ON CENTER	2.6.1	LI Direct Install
FLR. UNCOD. SP- VAPOR BARRIER-CRAWLSPACE	2.6.6	LI Direct Install
BREATHABLE MATERIAL-TYPAR/TYVEK -MOISTURE CONTROL	2.6.6	LI Direct Install
PERIMETER INSULATION-FACD FBGL R-11	2.6.1	LI Direct Install
PERIMETER INSULATION-FACD FBGL R-19	2.6.1	LI Direct Install

GARAGE- RIGID BOARD	2.6.6	LI Direct Install
GARAGE-FACD BAT FBGL R-19	2.6.1	LI Direct Install
MISC REPAIRS-CHIMNEY, FLUE, ETC.	2.6.6	LI Direct Install
INT. REPAIRS-FLOOR/WALL/CEILING..	2.6.6	LI Direct Install
EXHAUST FANS	2.6.6	LI Direct Install
VENT AN EXISTING EXHAUST TO OUTSIDE	2.6.6	LI Direct Install
DRYER VENT REPLACEMENT	2.6.6	LI Direct Install
DRYER VENT REPAIR	2.6.6	LI Direct Install
HEAT SYST./FURN. REPR. & RETROFIT	2.2.1	LI Direct Install
DUCT SEALING & REPAIR	2.2.6	LI Direct Install
DUCT INSULATION LESS THAN 6" IN DIAMETER	2.2.6	LI Direct Install
DUCT INSULATION GREATER THAN 6" DIAMETER	2.2.6	LI Direct Install
DUCT INSULATION SQUARE DUCTS	2.2.6	LI Direct Install
FURN./HEAT. SYSTEM REPLACEMENT	2.2.1	LI Direct Install
BASEBOARD REPAIR/REPLACE	2.6.6	LI Direct Install
FURNACE MAINT./TUNE-UP	2.2.1	LI Direct Install
REPLACE FURNACE FILTER	2.2.1	LI Direct Install
HEAT PUMP FILTER CLEANING/REPLACEMENT	2.2.1	LI Direct Install
HEAT PUMP COIL CLEANING-COIL ACCESSIBLE	2.2.1	LI Direct Install
HEAT PUMP COIL CLEANING-COIL NOT ACCESSIBLE	2.2.1	LI Direct Install
INSTALL AIR COND/APPLIANCE TIMER	2.2.1	LI Direct Install
EFFICIENT LIGHTING FIXTURES/COMPACT FLUORESCENT	2.1.1	LI Direct Install
DIMMABLE COMPACT FLUORESCENT LIGHTS	2.1.1	LI Direct Install
THREE-WAY COMPACT FLUORESCENT LIGHTS	2.1.1	LI Direct Install
R-30 AND R-40 COMPACT FLUORESCENT LIGHTS	2.1.1	LI Direct Install
3W AND 7W COMPACT FLUORESCENT LIGHTS	2.1.1	LI Direct Install
LIGHT FIXTURE OR SPECIALTY BULB REPLACEMENT	2.1.1	LI Direct Install
REPLACE AIR CONDITIONING FILTER	2.2.1	LI Direct Install
WINDOW/WALL A/C FILTER CLEANING/REPLACEMENT	2.2.1	LI Direct Install
CENTRAL AIR CONDITIONING TUNE-UP	2.2.1	LI Direct Install
CENTRAL A/C COIL CLEAN-COIL NOT ACCESSIBLE	2.2.1	LI Direct Install
COOLING SYSTEM REPLACEMENT- CENTRAL A/C	2.2.1	LI Direct Install
THERMOSTAT (REG.) RECALB./RELOCT/REPLAC.	2.2.8	LI Direct Install
LINE VOLTAGE THERMOSTAT	2.2.8	LI Direct Install
INSTALL SETBACK THERMOSTAT	2.2.8	LI Direct Install
CHANGEOUT AIR CONDITIONER--5000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--8000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--10000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--12000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--14000 BTU	2.2.1	LI Direct Install
CHANGEOUT AIR CONDITIONER--18000 BTU	2.2.1	LI Direct Install
WINDOW FILM	2.6.6	LI Direct Install
GRAVITY FILM EXCHANGE (GFX)	2.6.6	LI Direct Install
5 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
7 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
9 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
15 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
20 CU FT FREEZER CHEST/MANUAL	2.4.2	LI Direct Install
12 CU FT FREEZER UPRIGHT	2.4.2	LI Direct Install
14 CU FT FREEZER UPRIGHT FROST-FREE	2.4.2	LI Direct Install
14 CU FT FREEZER UPRIGHT MANUAL	2.4.2	LI Direct Install
17 CU FT FREEZER UPRIGHT FROST-FREE	2.4.2	LI Direct Install

17 CU FT FREEZER UPRIGHT/MANUAL	2.4.2	LI Direct Install
15 CUBIC FT. TOP MOUNT REFRIGERATOR	2.4.1	LI Direct Install
15 CUBIC FT. TOP MOUNT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
18 CUBIC FT. TOP MOUNT REFRIGERATOR	2.4.1	LI Direct Install
18 CU FT TOP MOUNT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
21 CUBIC FT. TOP MOUNT REFRIGERATOR	2.4.1	LI Direct Install
21 CU FT. TOP MOUNT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
22 CU FT. SIDE/SIDE REFRIGERATOR (ICE)	2.4.1	LI Direct Install
22 CU FT TOP MOUNT REFRIGERATOR (NO ICE)	2.4.1	LI Direct Install
25 CU FT REFRIG SIDE/SIDE ICE	2.4.1	LI Direct Install
ADDITIONAL REFRIGERATOR/FREEZER REMOVAL	2.4.3	LI Direct Install
DRYER REPLACEMENT	2.4.5	LI Direct Install
TORCHERE LAMP	2.1.1	LI Direct Install
SMART STRIP POWER PLUG	2.5.3	LI Direct Install
FAUCET AERATOR-BATH	2.3.8	LI Direct Install
FAUCET AERATOR-KITCH	2.3.8	LI Direct Install
FAUCET AERATOR-WITH SWIVEL HEAD	2.3.8	LI Direct Install
ENERGY SAVING SHOWERHEAD W/O SHUTOFF	2.3.9	LI Direct Install
ENERGY SAVING SHOWERHEAD W/SHUTOFF	2.3.9	LI Direct Install
SHOWERHEAD - HANDHELD	2.3.9	LI Direct Install
WATER HEATER JACKET R-11	2.3.5	LI Direct Install
WATER HEATER JACKET TANK GREATER THAN 52 GALLONS	2.3.5	LI Direct Install
WATER HEATER INSULATION - LOW E OR EQUIVALENT	2.3.5	LI Direct Install
PIPE INSULATION - 3/4"	2.3.7	LI Direct Install
PIPE INSULATION - 1/2"	2.3.7	LI Direct Install
TANK TEMPERATURE SETBACK	2.3.6	LI Direct Install
30 GAL ELEC HOT WATER TANK REMOVE/REPLACE	Null Measure	LI Direct Install
40 GAL ELEC. HOT WATER TANK REMOVE/REPLACE	2.3.1	LI Direct Install
52 GAL ELEC HOT WATER TANK REMOVE/REPLACE	2.3.1	LI Direct Install
80 GAL ELEC HOT WATER TANK REMOVE/REPLACE	2.3.1	LI Direct Install
INFILTRATION WORK INCLUDING BLOWER DOOR	2.6.6	LI Direct Install
RIGID BOARD HOLE REPAIR/AIR SEALING	2.6.6	LI Direct Install
TWO-PART FOAM PERIMETER INSULATION	2.6.6	LI Direct Install
FIBERGLASS PERIMETER INSULATION (R19)	2.6.1	LI Direct Install
RIGID BOARD PERIMETER INSULATION (1')	2.6.6	LI Direct Install
DRYWALL PATCH W/TAPED JOINTS & TOP COAT	2.6.6	LI Direct Install
DRYWALL FULL SHEET W/TAPED JOINTS & TOP COAT	2.6.6	LI Direct Install
KITCHEN VENT COVER	2.6.6	LI Direct Install
INTERIOR ATTIC STAIR COVER	2.6.6	LI Direct Install
WHOLE HOUSE FAN COVER	2.6.6	LI Direct Install
INFILTRATION WORK EXCLUDING BLOWER DOOR	2.6.6	LI Direct Install
CAULK	2.6.6	LI Direct Install
CAULK - HIGH TEMPERATURE	2.6.6	LI Direct Install
AEROSOL FOAM SEALANT	2.6.6	LI Direct Install
AEROSOL FOAM SEALANT-HIGH TEMPERATURE	2.6.6	LI Direct Install
AIR TIGHT INSERT KIT OR EQUIVALENT FOR RECESSED LIGHTS	2.6.6	LI Direct Install
AIR CONDITIONER COVER-RIGID	2.6.6	LI Direct Install
AIR CONDITIONER COVER-SOFT	2.6.6	LI Direct Install
WINDOW QUILT	2.6.6	LI Direct Install
BLOWN SIDEWALL INSULATION - ASBESTOS	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION - WOOD / ASPHALT	2.6.1	LI Direct Install

BLOWN SIDEWALL INSULATION - STUCCO/BRICK	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION - ALUMINUM SIDING	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION - VINYL SIDING	2.6.1	LI Direct Install
FIBERGLASS UNFINISHED WALL INSULATION (R13)	2.6.1	LI Direct Install
FIBERGLASS UNFINISHED WALL INSULATION-R19	2.6.1	LI Direct Install
WET SPRAY CELLULOSE INSULATION	2.6.1	LI Direct Install
EXT. DOOR - SWEEP	2.6.6	LI Direct Install
EXT. DOOR - WEATHER-STRIP	2.6.6	LI Direct Install
EXT. DOOR - FIX LOCK	2.6.6	LI Direct Install
EXT. DOOR - REPLACE LOCK	2.6.6	LI Direct Install
EXT. DOOR - REPAIR	2.6.6	LI Direct Install
EXT. DOOR - REPLACE	2.6.6	LI Direct Install
EXTERIOR DOOR - CONSTRUCT	2.6.6	LI Direct Install
EXT. DOOR - STORM DOOR	2.6.6	LI Direct Install
INT. DOOR - WEATHER-STRIP	2.6.6	LI Direct Install
EXT./INT. DOOR - INSULATE W/RIGID BD	2.6.6	LI Direct Install
WINDOW-REPL GLASS W/ GLAZE	2.6.6	LI Direct Install
WINDOW-REGLAZE ONLY	2.6.6	LI Direct Install
WINDOW-REPAIR/REPLACE SASH	2.6.6	LI Direct Install
WINDOW WEATHER-STRIP	2.6.6	LI Direct Install
WINDOW-REPLACE SASH LOCK	2.6.6	LI Direct Install
WINDOW-ADD PULLEY SEALS	2.6.6	LI Direct Install
REPLACEMENT WINDOW	2.6.6	LI Direct Install
INTERIOR STORM WINDOW W/CLIPS	2.6.6	LI Direct Install
INTERIOR STORM WINDOW W/O CLIPS	2.6.6	LI Direct Install
EXTERIOR STORM WINDOW/DOOR REPAIR	2.6.6	LI Direct Install
INSTALL EXTERIOR STORM DOOR/WINDOW	2.6.6	LI Direct Install
MOBILE HOME-INSTALL DOOR/STORM COMBO	2.6.6	LI Direct Install
MOBILE HOME-REPL. EXT PRIME DOOR	2.6.6	LI Direct Install
MOBILE HOME--INTERIOR STORM WINDOWS	2.6.6	LI Direct Install
MOBILE HOME--REPLACE PRIME WINDOWS	2.6.6	LI Direct Install
MOBILE HOME-SKIRTING	2.6.6	LI Direct Install
REFLECTIVE ROOF COAT	2.6.6	LI Direct Install
MOB. HOME-CEILING INSULATION - CELLULOSE	2.6.1	LI Direct Install
MOB. HOME-CEILING INSULATION - FIBERGLASS	2.6.1	LI Direct Install
MOB. HOME- FLOOR INSULATION (BELLY) CELLULOSE	2.6.1	LI Direct Install
MOBILE HOME FLOOR INSULATION--FIBERGLASS	2.6.1	LI Direct Install
TYPAR/TYVEK BELLY BOARD MOBILE HOME REPAIR	2.6.6	LI Direct Install
PLYWOOD OR RIGID BOARD BELLY BOARD MOBILE HOME REPAIR	2.6.6	LI Direct Install
CLEAN/SEAL/SECURE MOBILE HOME ELECTRIC HEAT REG. RISER	2.6.6	LI Direct Install
MOBILE HOME ROOF PATCH	2.6.6	LI Direct Install
R11 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R13 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R-19 ATTIC-NON FACD BATT FBGLS	2.6.1	LI Direct Install
R25 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R30 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R38 ATTIC FIBERGLASS BATTS	2.6.1	LI Direct Install
R19 PINK PLUS	2.6.1	LI Direct Install
BLOWN CELLULOSE UNFLOORED ATTIC INSULATION R19 OR LESS	2.6.1	LI Direct Install
BLOWN CELLULOSE UNFLOORED ATTIC INSULATION R20 OR GREATER	2.6.1	LI Direct Install

BLOWN CELLULOSE FLOORED (DENSE PACKED) ATTIC INSULATION R19 OR LESS	2.6.1	LI Direct Install
BLOWN CELLULOSE FLOORED (DENSE PACKED) ATTIC INSULATION R20 OR GREATER	2.6.1	LI Direct Install
PREP OR FOLLOW-UP TO AIR SEAL OR INSULATING	2.6.6	LI Direct Install
BOXING/DAMMING OF ATTIC HATCHES	2.6.6	LI Direct Install
BOXING/DAMMING OF CHIMNEYS	2.6.6	LI Direct Install
BOXING/DAMMING OF STORAGE AREAS	2.6.6	LI Direct Install
BOXING/DAMMING OF SOFFIT VENTS	2.6.6	LI Direct Install
BOXING/DAMMING FIXTURES-SEALED-END DUCT	2.6.6	LI Direct Install
BOXING/DAMMING FIXTURES (PRE-FAB 16" DAM)	2.6.6	LI Direct Install
BOXING/DAMMING FIXTURES (PRE-FAB 24" DAM)	2.6.6	LI Direct Install
CREATE INT. ATTIC HATCH UP TO 2 SQ.FT	2.6.6	LI Direct Install
CF1 9-13 watt CFL	2.1.1	LI Direct Install
CF2 14-16 watt CFL	2.1.1	LI Direct Install
CF3 17-20 watt CFL	2.1.1	LI Direct Install
CF4 21-25 watt CFL	2.1.1	LI Direct Install
SP 1 Smart Power Strip 6-9 outlets	2.5.3	LI Direct Install
SP 2 Smart Power Strip 10+ outlets	2.5.3	LI Direct Install
FLOOD/RECESSED CFL - 10-13 WATTS	2.1.1	LI Direct Install
FLOOD/RECESSED CFL - 14-16 WATTS	2.1.1	LI Direct Install
FLOOD/RECESSED CFL - 17-20 WATTS	2.1.1	LI Direct Install
FLOOD/RECESSED CFL - 21-25 WATTS	2.1.1	LI Direct Install
SPEC CFL - 2-9 WATTS	2.1.1	LI Direct Install
SPEC CFL - 10-13 WATTS	2.1.1	LI Direct Install
SPEC CFL - 14-16 WATTS	2.1.1	LI Direct Install
SPEC CFL - 17-20 WATTS	2.1.1	LI Direct Install
SPEC CFL - 21-25 WATTS	2.1.1	LI Direct Install
Furnace Whistle	2.2.7	LI Direct Install
LED Night Light	2.1.4	LI Direct Install
12 CU FT FREEZER UPRIGHT/MANUAL	2.4.2	LI Direct Install
13 CU FT FREEZER UPRIGHT MANUAL	2.4.2	LI Direct Install
14 CU FT FREEZER CHEST/FROSTFREE	2.4.2	LI Direct Install
15 CU FT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
16 CU FT FREEZER UPRIGHT/FROSTFREE	2.4.2	LI Direct Install
16 CU FT FREEZER UPRIGHT/MANUAL	2.4.2	LI Direct Install
16 CU FT REFRIGERATOR	2.4.1	LI Direct Install
16 CU FT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
17 CU FT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
17 CUBIC FT. REFRIGERATOR	2.4.1	LI Direct Install
21 CU FT FREEZER UPRIGHT FROST FREE	2.4.2	LI Direct Install
22 CU FT REFRIGERATOR (ICE)	2.4.1	LI Direct Install
23 CU FT SIDE/SIDE REFRIGERATOR(ICE)	2.4.1	LI Direct Install
7 CU FT UPRIGHT FREEZER	2.4.2	LI Direct Install
A/C WINDOW UNIT - NO PRIOR UNIT	2.2.4	LI Direct Install
AIR CONDITIONER WINDOW/WALL GASKET	2.6.6	LI Direct Install
ATTIC BATT FBGLS R-38	2.6.1	LI Direct Install
ATTIC-BLN INSL R-10	2.6.1	LI Direct Install
ATTIC-BLN INSL R-19	2.6.1	LI Direct Install
ATTIC-BLN INSL R-20	2.6.1	LI Direct Install
ATTIC-BLN INSL R-25	2.6.1	LI Direct Install
ATTIC-BLN INSL R-27	2.6.1	LI Direct Install
ATTIC-BLN INSL R-30	2.6.1	LI Direct Install

ATTIC-BLN INSL R-38	2.6.1	LI Direct Install
ATTIC-BLN INSL R-8	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION-BIBS	2.6.1	LI Direct Install
BLOWN SIDEWALL INSULATION-PLASTER/DRYW.	2.6.1	LI Direct Install
BOXING/DAMMING ATTIC HATCH - FIBERGLASS	2.6.6	LI Direct Install
CLEAN/SEAL/SECURE MOBILE HOME REG. RISER	2.6.6	LI Direct Install
DEHUMIDIFIER REPLACEMENT	2.4.8	LI Direct Install
DENSE PACK CANTILEVER	2.6.1	LI Direct Install
DISPOSAL AND INSTALLTION OF NEW AIR COND	2.2.1	LI Direct Install
ENERGY SAVING SHOWERHEAD	2.3.9	LI Direct Install
FLOOR-FACED BAT FBGL R-11 24 CTR	2.6.1	LI Direct Install
FLR. UNCOD. SP-FACD FBGL R11 16	2.6.1	LI Direct Install
GARAGE RIGID BOARD - 2 INCH	2.6.6	LI Direct Install
HEAT EXCHANGER REPLACEMENT	2.2.1	LI Direct Install
HEAT REFLECTOR	2.6.6	LI Direct Install
INSTALL CEILING FAN	2.4.10	LI Direct Install
INSTALL WHOLE HOUSE FAN	2.2.9	LI Direct Install
MOB. HOME-REPLACE FLOOR REG. 8X10	2.6.6	LI Direct Install
RIGID BOARD INSULATION 2 INCH	2.6.6	LI Direct Install
SPRAY FOAM-THERMAL/IGNITION BARRIER REQ	2.6.6	LI Direct Install
WATER HEATER T-STAT. - TEST/REPLACE	2.3.6	LI Direct Install
CHANGEOUT AIR CONDITIONER-15000 BTU	2.2.4	LI Direct Install
78A - Dimmable CFL	2.1.1	LI Direct Install
78F - Specialty CFL - Flood/Recessed	2.1.1	LI Direct Install
HPW-A - Install Heat Pump Water Heater 2.0 EF	2.3.1	LI Direct Install
HPW-B - Install Heat Pump Water Heater 2.3 EF	2.3.1	LI Direct Install
22 cu. Ft. SxS fridge (no ice)	2.4.1	LI Direct Install
25 cu. Ft. freezer chest/manual	2.4.2	LI Direct Install
Install heat pump water heater 2.0 EF	2.3.1	LI Direct Install
Install heat pump water heater 2.3 EF	2.3.1	LI Direct Install
Mobile home replace floor reg 4x10	2.6.6	LI Direct Install
Mobile home replace floor reg 4x12	2.6.6	LI Direct Install
Mobile home replace floor reg. 4x8	2.6.6	LI Direct Install
Safety test - atmospheric draft	2.6.6	LI Direct Install
25 cu ft refrigerator (side by side)	2.4.1	LI Direct Install
30 Gallon - .93 EF	Null Measure	LI Direct Install
30 Gallon - .94 EF	Null Measure	LI Direct Install
30 Gallon - .95 EF	Null Measure	LI Direct Install
40 Gallon - .93 EF	Null Measure	LI Direct Install
40 Gallon - .94 EF	Null Measure	LI Direct Install
40 Gallon - .95 EF	Null Measure	LI Direct Install
50 Gallon - .93 EF	Null Measure	LI Direct Install
50 Gallon - .94 EF	Null Measure	LI Direct Install
50 Gallon - .95 EF	Null Measure	LI Direct Install
80 Gallon - .93 EF	Null Measure	LI Direct Install
80 Gallon - .94 EF	Null Measure	LI Direct Install
80 Gallon - .95 EF	Null Measure	LI Direct Install
FW1 - Met-Ed	2.2.7	LI Direct Install
FW2 - Penelec	2.2.7	LI Direct Install
FW3 - Penn Power	2.2.7	LI Direct Install
FW4 - West Penn Power	2.2.7	LI Direct Install
Met-Ed - B2A	2.2.8	LI Direct Install
Penelec - B2B	2.2.8	LI Direct Install

Penn Power - B2C	2.2.8	LI Direct Install
West Penn Power - B2D	2.2.8	LI Direct Install
Removal of Additional Freezer	2.4.3	LI Direct Install
Energy Saving Showerhead with Shut Off	2.3.9	LI Direct Install
Faucet Aerator - Bath	2.3.8	LI Direct Install
Faucet Aerator - Kitchen	2.3.8	LI Direct Install
Faucet Aerator with Swivel Head	2.3.8	LI Direct Install
Pipe Ins. 1/2 inch from EHWH	2.3.7	LI Direct Install
Pipe Ins. 3/4 inch from EHWH	2.3.7	LI Direct Install
PIPE INSULATION - 3/4"	2.3.7	LI Direct Install
50 Gal .93EF Elec HWH Replace	Null Measure	LI Direct Install
50 Gal .94EF Elec HWH Replace	Null Measure	LI Direct Install
50 Gal .95EF Elec HWH Replace	Null Measure	LI Direct Install
50 Gal Elec. Hot Water Tank Remove/Replace	2.3.1	LI Direct Install
50 Gal Elec. Hot Water Tank Remove/Replace	Null Measure	LI Direct Install
Attic-BLN INSL R14	2.6.1	LI Direct Install
Attic-BLN INSL R33	2.6.1	LI Direct Install
Attic-BLN INSL R44	2.6.1	LI Direct Install
Ductless Mini-Split Heat Pump	2.2.3	LI Direct Install
LED - 13-14 WATT Flood	2.1.1	LI Direct Install
LED - 17 WATT Flood	2.1.1	LI Direct Install
LED - 2.3 WATT Globe	2.1.1	LI Direct Install
LED - 3.5 WATT Medium Base Torpedo	2.1.1	LI Direct Install
LED - 3.7-4.8 WATT Candelabra	2.1.1	LI Direct Install
LED - 6-8 WATT Standard Bulb	2.1.1	LI Direct Install
LED - 8 WATT Flood	2.1.1	LI Direct Install
LED - 9-13 WATT Standard Bulb	2.1.1	LI Direct Install
Ground Cover	2.6.6	LI Direct Install
Heat Pump Clean and Tune	2.2.1	LI Direct Install
LI Dehumidifier Recycling	IMP	LI ATI
LI Freezer Recycling	2.4.3	LI ATI
LI Refrigerator Recycling	2.4.3	LI ATI
LI Room Air Conditioner Recycling	2.2.5	LI ATI
Low Flow Swivel Aerator	Various TRM Sections	LI Kits
Furnace Whistle	Various TRM Sections	LI Kits
LED 12w	Various TRM Sections	LI Kits
LED 6.5w	Various TRM Sections	LI Kits
LED 9w	Various TRM Sections	LI Kits
LED nightlight	Various TRM Sections	LI Kits
XXX Disabled Smart Strip	Various TRM Sections	LI Kits
XXXDisabled	Various TRM Sections	LI Kits
Low Flow Shower Head 1.6 GPM	Various TRM Sections	LI Kits
13/20/25 - 3 way CFL	Various TRM Sections	LI Kits
XXX Disabled 9w Globe	Various TRM	LI Kits

	Sections	
23w CFL	Various TRM Sections	LI Kits
XXX Disabled Low Flow Swivel Aerator	Various TRM Sections	LI Kits
XXX Disabled Low Flow Shower Head 1.6 GPM	Various TRM Sections	LI Kits
LI Clothes Washers	2.4.4	LI Appliances
LI Clothes Dryer	2.4.5	LI Appliances
LI Dehumidifiers	2.4.8	LI Appliances
LI Freezers	2.4.2	LI Appliances
LI Refrigerators	2.4.1	LI Appliances
3-way CFL (12/23/33)	Various TRM Sections	LI Kits
11W LED	Various TRM Sections	LI Kits
LED Nite Lite	Various TRM Sections	LI Kits
9W LED	Various TRM Sections	LI Kits
Kitchen Swivel Aerator	Various TRM Sections	LI Kits
6W LED	Various TRM Sections	LI Kits
SILL BOX INSUL PRE CUT PRODUCT	2.6.6	LI Direct Install
LE9 - Retrofit Kit - 13-14 Watt Flood	2.1.1	LI Direct Install

Appendix D Evaluation Detail – Residential Appliance Turn-In Initiative

D.1 GROSS IMPACT EVALUATION

Gross impact evaluation for the Appliance Turn-In (ATI) Initiative involved customer verification surveys and TRM calculations of measure-level impacts. There are four distinct measures offered by the program: refrigerator recycling, freezer recycling, room AC (RAC) recycling, and dehumidifier recycling.

D.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical for all four EDCs. A TRM-based calculation was performed for each entry in the tracking and reporting system. The parameter values from the TRM (or for dehumidifiers, IMP) algorithms were taken from project-specific data from the tracking and reporting system when applicable, from TRM defaults, or from customer verification surveys. For refrigerators and freezers, measure attributes that participants would readily recall were determined from participant surveys, and the average parameter values were applied to all measures. Apart from measure verification, these attributes include the part-use factor, the location in the home where the appliance was used, and for refrigerators, whether the appliance was a primary or secondary unit. Technical attributes of the appliances, such as the age, capacity, and configuration, as collected by ARCA, were taken from program tracking and reporting data. TRM or IMP default parameters were used for room air conditioners (RACs) and dehumidifiers. Table 136 lists the data sources for gross impact calculation algorithms.

Table 136: Data Sources for the ATI Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
Refrigerator, Freezer	Appliance Age	Tracking and Reporting System
Refrigerator, Freezer	Pre-1990	Tracking and Reporting System
Refrigerator, Freezer	Appliance Size / Capacity	Tracking and Reporting System
Refrigerator, Freezer	Configuration/Type	Tracking and Reporting System
Refrigerator	Primary Usage	Participant Surveys
Refrigerator, Freezer	Part Use Factor	Participant Surveys
Refrigerator, Freezer	In Unconditioned Space?	Participant Surveys
Refrigerator, Freezer	CDD and HDD	TRM - Zip Code Lookup
RAC	Capacity	TRM Default
RAC	EER	TRM Default
RAC	RAC EFLH	TRM - Zip Code Lookup
RAC	CF	TRM Default
Dehumidifier	Capacity	IMP Default
Dehumidifier	Region (to determine kWh)	TRM - Zip Code Lookup
All Measures	Verification Rate	Participant Surveys

Both telephone and online surveys were conducted in PY8. The two modes yielded compatible results, so each survey response for a given stratum was given equal weight. The number of completed surveys, response rates, and energy realization rates, as averaged over all four EDCs are listed in Table 137.

Table 137: ATI Initiative Gross Impact Evaluation Survey Mode Comparison

Survey Mode	N Appliances Surveyed	Verification Rate
Telephone	97	95.9%
Online	493	94.1%
Total	590	94.4%

The gross realization rates for energy savings were driven primarily by part-use factors for refrigerators and freezers as determined through verification surveys, and by the unit energy consumptions for refrigerators and freezers, as determined through measure attributes recorded in the tracking and reporting system. Although verification rates determined through surveys were approximately 100%, the realization rates are generally lower than 100% because the part-use factors are lower than the TRM default values, and the calculated unit energy consumptions were lower than what would expect from application of default parameters in the TRM.

D.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 138, Table 139, Table 140, and Table 141. The population sizes and sample sizes represent individual appliances rather than individual customers.

Table 138: ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	3,410	66	Survey (phone + online)
Freezers	835	37	
Dehumidifiers	215	24	
RACs	383	26	
Program Total	4,843	153	

Table 139: ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	2,877	83	Survey (phone + online)
Freezers	1,000	37	
Dehumidifiers	1,000	25	
RACs	1,000	21	
Program Total	5,877	166	

Table 140: ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	932	60	Survey (phone + online)
Freezers	1,000	38	
Dehumidifiers	1,000	14	
RACs	1,000	7	
Program Total	3,932	119	

Table 141: ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	3,838	66	Survey (phone + online)
Freezers	1,000	33	
Dehumidifiers	1,000	21	
RACs	1,000	32	
Program Total	6,838	152	

D.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 142, Table 143, Table 144, and Table 145 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 142: ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	3,219	103.1%	0.5	8.9%
Freezers	694	77.8%	0.5	11.8%
Dehumidifiers	54	218.2%	0.5	14.7%
RACs	44	92.0%	0.5	14.1%
Program Total	4,009	100.1%	0.5	7.5%

Table 143: ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	3,048	85.6%	0.5	7.9%
Freezers	27	85.8%	0.5	11.8%
Dehumidifiers	58	178.2%	0.5	14.4%
RACs	693	97.1%	0.5	15.7%
Program Total	3,826	89.0%	0.5	6.1%

Table 144: ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	1,007	79.4%	0.5	9.3%
Freezers	260	65.8%	0.5	11.7%
Dehumidifiers	15	202.6%	0.5	19.2%
RACs	6	99.4%	0.5	27.2%
Program Total	1,288	78.1%	0.5	6.0%

Table 145: ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	3,935	92.9%	0.5	8.9%
Freezers	983	79.4%	0.5	12.5%
Dehumidifiers	26	255.5%	0.5	15.7%
RACs	55	109.4%	0.5	12.7%
Program Total	4,999	91.3%	0.5	6.8%

D.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 146, Table 147, Table 148, and Table 149 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 146: ATI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.36	102.7%	0.5	8.9%
Freezers	0.08	77.7%	0.5	11.8%
Dehumidifiers	0.02	111.8%	0.5	14.7%
RACs	0.10	74.3%	0.5	14.1%
Program Total	0.56	94.5%	0.5	6.3%

Table 147: ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.34	85.3%	0.5	7.9%
Freezers	0.06	86.0%	0.5	11.8%
Dehumidifiers	0.02	107.7%	0.5	14.4%
RACs	0.08	95.4%	0.5	15.7%
Program Total	0.50	87.9%	0.5	5.3%

Table 148: ATI Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.11	79.3%	0.5	9.3%
Freezers	0.03	65.8%	0.5	11.7%
Dehumidifiers	0.01	116.8%	0.5	19.2%
RACs	0.01	100.1%	0.5	27.2%
Program Total	0.16	80.2%	0.5	5.9%

Table 149: ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.44	92.7%	0.5	8.9%
Freezers	0.11	79.8%	0.5	12.5%
Dehumidifiers	0.06	147.1%	0.5	15.7%
RACs	0.02	106.8%	0.5	12.7%
Program Total	0.63	96.1%	0.5	6.4%

D.2 NET IMPACT EVALUATION

D.2.1 Net Impact Evaluation Methodology

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

The participant self-report methodology was implemented following the common approach outlined in Appendix B of the evaluation framework. Tetra Tech added a question to identify customers who would have kept the recycled unit at least a year longer, since program results represent first-year annual savings. This clarifies that customers who respond they would have removed the unit, but at some point in the future, are really more appropriately characterized as keeping the unit for at least the program year in question. Individual free-ridership rates from the participant survey were weighted to adjust for sampling differences, non-response, and claimed energy savings to calculate overall estimates.

The Appliance Turn-in program is not designed to promote spillover since it does not push customers to implement energy efficiency projects outside of FirstEnergy's programs. Because the participant survey is already lengthy, containing both gross and net impact questions, the evaluation team did not collect spillover information from customers. Moreover, because the Companies offer incentives for efficient new refrigerators and freezers, it is possible that the most likely spillover may overlap with gross impacts for the Efficient Products program and lead to undesired double-counting of net impacts.

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

D.2.2 Sampling

The sample designs for the four EDCs are shown in Table 150, Table 151, Table 152, and Table 153 for Met-Ed, Penelec, Penn Power, and WPP respectively. The focus of the NTG surveys was on refrigerators and freezers because these two measures accounted for 98% of reported savings.

Table 150: ATI Initiative Net to Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All	4,843	184	29.0%
Program Total	4,843	184	29.0%

Table 151: ATI Initiative Net to Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Refrigerators	5,877	197	39.0%
Program Total	5,877	197	39.0%

Table 152: ATI Initiative Net to Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Refrigerators	3,932	152	30.6%
Program Total	3,932	152	30.6%

Table 153: ATI Initiative Net to Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Refrigerators	6,838	173	30.3%
Program Total	6,838	173	30.3%

D.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 154, Table 155, Table 156, and Table 157 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 154: ATI Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	4,014	50.0%	0.0%	50.0%	8.0%
Program Total	4,014	50.0%	0.0%	50.0%	8.0%

Table 155: ATI Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Refrigerators	3,407	57.0%	0.0%	43.0%	7.7%
Program Total	3,407	57.0%	0.0%	43.0%	7.7%

Table 156: ATI Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Refrigerators	1,007	50.0%	0.0%	50.0%	8.8%
Program Total	1,007	50.0%	0.0%	50.0%	8.8%

Table 157: ATI Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Refrigerators	4,565	55.0%	0.0%	45.0%	8.2%
Program Total	4,565	55.0%	0.0%	45.0%	8.2%

Appendix E Evaluation Detail – EE Kits Initiative

E.1 GROSS IMPACT EVALUATION

The Energy Efficiency Kits (EE Kits) initiative has three sub-components. The first two subcomponents, EE Kits and Online Audit Kits are administered by PowerDirect. Both components involve delivery of conservation kits to program participants, but the Online Audit component requires that customers participate in an online home energy audit, while the main program component, EE Kits, distributes kits to customers that submit an online or telephonic request for conservation kits. The third subcomponent, the School Education program, is administered by AM Conservation Group (AMCG), and distributes conservation kits to students at participating schools. The program also distributes kits by mail, but collaborates with local schools to develop an energy efficiency oriented educational component for children.

E.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical for all four EDCs and for all kit types, although separate samples and realization rates are developed for each kit type (School Kits, Online Audit Kits, and EE Kits). In the EE Kit and Online Audit Kit subprograms, two separate types of energy conservation kits were sent to customers depending on their hot water fuel source. The kits provided to customers with electric water heating included LED lamps, CFLs, LED night lights, energy saving aerators, a furnace whistle, and an energy saving showerhead. The kits provided to customers with non-electric water heating consists of LED lamps, CFLs, LED night lights, and a furnace whistle. School kits included LED lamps, CFLs, LED night lights, an energy saving faucet aerator, and a furnace whistle.

In evaluating the gross impact analysis for the energy conservation kits in PY8, 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 PY8;
3. The installation rate or in-service rate (ISR) for the various kit elements;
4. The delivery rate, or percentage of reported kits sent to customers that were not received by customers, either because of shipping problems, customers moving, or other such scenarios.

The first item has been determined through application of the partially deemed savings protocols in the 2016 TRM. The second item, the total number and type of kits mailed to customers in PY8, 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 CFLs which are given "deemed" installation rates of 0.92 (later multiplied by the kit receipt rate as determined through surveys), consistent with the TRM.

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

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

The final item, the delivery rate is determined through the online and phone survey instrument. Online and phone survey respondents are asked to indicate whether they received the conservation kit that was mailed to them. The reported in-service rates reflect the kit non-receipt rate as they are calculated as the ratio of the number of items installed to the number of items claimed to be delivered.

The survey instrument that was used to verify that the shipped energy conservation kits were installed asks a series of questions that determine how many of each item was installed and where each item was installed. As with the Low-Income kits and the Schools kits, the average kit receipt rates and measure-level in service rates are closely correlated across all four FirstEnergy PA EDCs. EDC-specific variations are explicable primarily due to statistical variation in survey responses, which may account for a $\pm 10\%$ uncertainty in final verified impacts at the EDC-level. Due to this, average statewide in-service rates are used for all four FirstEnergy EDCs. This reduces the likelihood that one particular EDC will receive an unusually high or low realization rate due solely to statistical fluctuations, and is generally consistent with the PA TRM’s treatment of in-service rates, which are uniform across the state. The statistical precision for this program component is based on the EDC-specific number of customers that completed survey responses.

The ISRs for kit components are expected to be dynamic quantities. Previous evaluations have shown that the ISR for residential lighting approaches 100%, but over a period of several years. This is in part the reason behind relating the ISR to the kit receipt rate, rather than to ISRs reported by customers, as survey ISRs represent a snapshot in time. While it is expected that the ISR for lighting may gradually increase as lamps installed in a home burn out and are replaced by lamps in the kit, the ISRs for other kit items may be relatively stable since the number of potential replacement scenarios are limited (e.g. a home may have dozens of general service lamps, but only one furnace filter, kitchen aerator, or showerhead). In Figure 24, we plot the ISR vs. survey lag (defined as the time between kit receipt and verification surveys) for various kit components. In this figure, the ISR for lamps is estimated through general questions (installed some, none, or all of the supplied lamps), while other ISRs are constructed according to the methods described above. The figure suggests that ISRs for lighting do tend to grow with time, while ISRs for other items are relatively static after a brief ramp-up period.

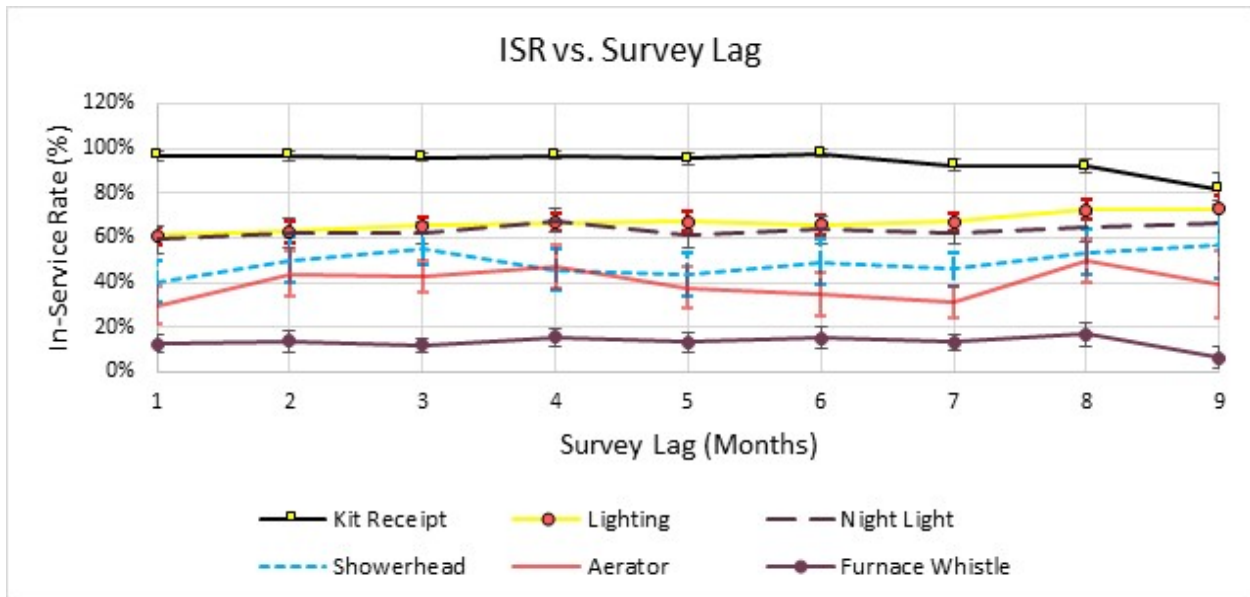


Figure 24: ISR vs. Survey Lag for Kit Components

Both telephone and online surveys were conducted in PY8. The two modes yielded compatible results, so each survey response for a given stratum was given equal weight. The overall realization rates by kit type and survey mode, as averaged over all four EDCs are shown in Figure 25. School kits are not included in the figure because the kit contents and quantities differ. Although Low-Income kits are treated as a separate initiative for PY8, the following two Figures show results for both Low-Income and non-Low-Income kits.

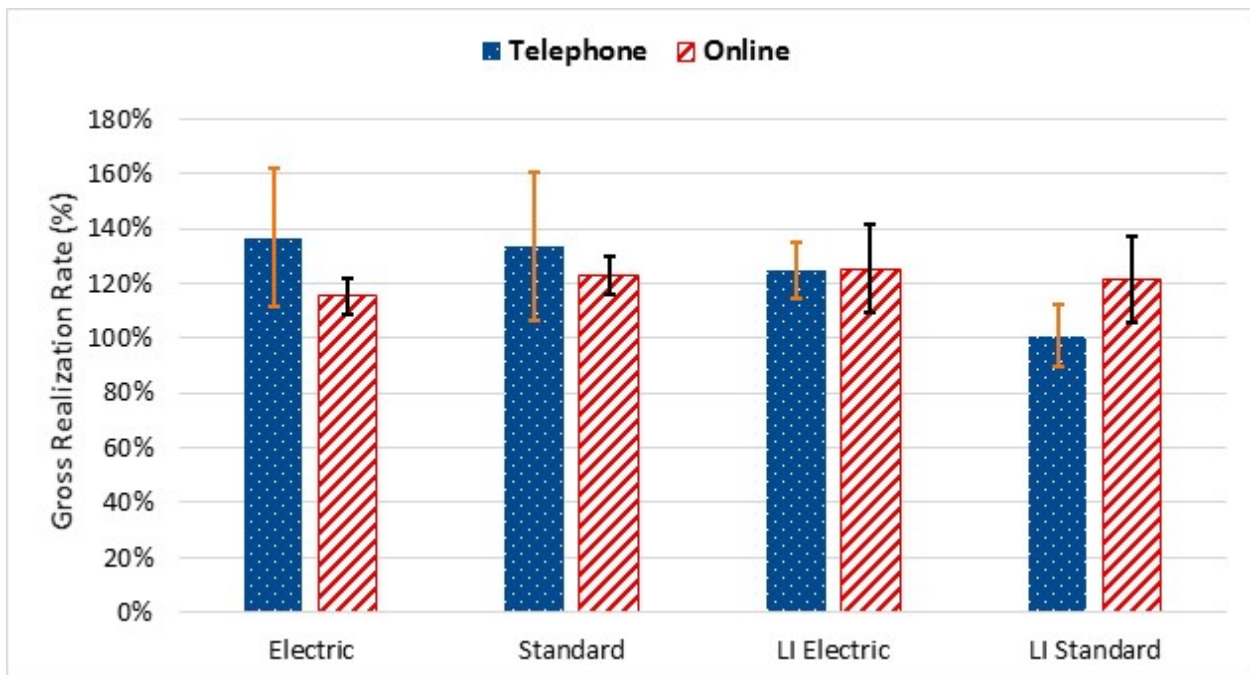


Figure 25 – Realization Rates vs. Kit Type and Survey Mode

Response rates for telephone surveys were about twice as high as response rates for online surveys. For a given survey mode, the response rates for income-qualified customers were about half as high as the response rates for non income-qualified customers. Response rates were relatively low, but we did not find significant correlations between response rates and key performance indicators, such as the kit receipt rate. Figure 26 shows response rates and kit non-receipt rates (which are closely related to overall realization rates), as averaged for all four EDCs, by survey mode and income status.

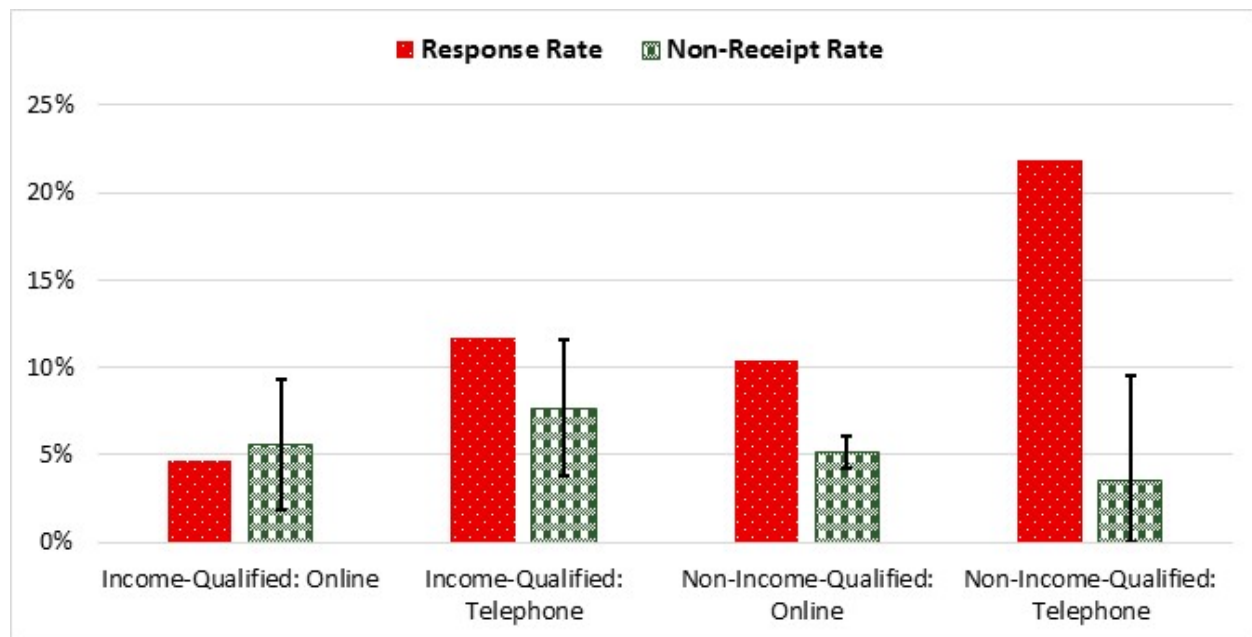


Figure 26: Survey response rates and reported kit non-receipt rates by income qualification and survey mode.

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

E.1.2 Sampling

The low-income kits are treated as a separate initiative in PY8, and are discussed in Appendix O. Each kit type was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 158, Table 159, Table 160, and Table 161.

Table 158: EE Kits Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	20,168	94	Survey (phone + online)
EE Kits - Standard	30,003	96	
Online Kits - Electric	2,044	23	
Online Kits - Standard	1,190	30	
School Education kits	1,788	28	
Program Total	55,193	271	

Table 159: EE Kits Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	19,356	82	Survey (phone + online)
EE Kits - Standard	33,349	88	
Online Kits - Electric	1,515	19	
Online Kits - Standard	1,169	28	
School Education kits	2,087	41	
Program Total	57,476	258	

Table 160: EE Kits Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	4,316	100	Survey (phone + online)
EE Kits - Standard	7,611	113	
Online Kits - Electric	470	23	
Online Kits - Standard	352	13	
School Education kits	972	30	
Program Total	13,721	279	

Table 161: EE Kits Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
EE Kits - Electric	11,928	126	Survey (phone + online)
EE Kits - Standard	16,568	111	
Online Kits - Electric	3,083	21	
Online Kits - Standard	1,674	31	
School Education kits	2,559	39	
Program Total	35,812	328	

E.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 162, Table 163, Table 164, and Table 165 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 162: EE Kits Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	7,737	124.515%	0.5	7.4%
EE Kits - Standard	8,033	119.770%	0.5	7.3%
Online Kits - Electric	327	134.5%	0.5	14.9%
Online Kits - Standard	145	126.5%	0.5	13.0%
School Education kits	583	104.0%	0.5	13.5%
Program Total	16,825	121.7%	0.5	4.9%

Table 163: EE Kits Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	7,844	139.1%	0.5	7.9%
EE Kits - Standard	9,671	121.9%	0.5	7.7%
Online Kits - Electric	255	119.2%	0.5	16.4%
Online Kits - Standard	153	122.5%	0.5	13.4%
School Education kits	732	102.3%	0.5	11.1%
Program Total	18,655	128.3%	0.5	5.2%

Table 164: EE Kits Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	1,745	123.1%	0.5	7.1%
EE Kits - Standard	2,195	126.0%	0.5	6.7%
Online Kits - Electric	79	103.3%	0.5	14.6%
Online Kits - Standard	46	152.0%	0.5	19.6%
School Education kits	339	100.6%	0.5	12.9%
Program Total	4,404	122.7%	0.5	4.5%

Table 165: EE Kits Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	4,761	115.3%	0.5	6.4%
EE Kits - Standard	4,692	122.7%	0.5	6.8%
Online Kits - Electric	513	127.5%	0.5	15.7%
Online Kits - Standard	215	126.6%	0.5	12.8%
School Education kits	878	108.6%	0.5	11.4%
Program Total	11,059	118.7%	0.5	4.2%

E.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 166, Table 167, Table 168, Table 169 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 166: EE Kits Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.84	122.9%	0.5	7%
EE Kits - Standard	0.90	126.3%	0.5	7%
Online Kits - Electric	0.04	141.4%	0.5	15%
Online Kits - Standard	0.02	141.6%	0.5	13%
School Education kits	0.07	106.0%	0.5	13%
Program Total	1.86	124.5%	0.5	4.9%

Table 167: EE Kits Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.77	144.0%	0.5	8%
EE Kits - Standard	0.95	134.3%	0.5	8%
Online Kits - Electric	0.03	120.2%	0.5	16%
Online Kits - Standard	0.01	135.1%	0.5	13%
School Education kits	0.07	108.0%	0.5	11%
Program Total	1.83	137.1%	0.5	5.2%

Table 168: EE Kits Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.19	124.2%	0.5	7%
EE Kits - Standard	0.24	138.0%	0.5	7%
Online Kits - Electric	0.01	103.6%	0.5	15%
Online Kits - Standard	0.01	183.4%	0.5	20%
School Education kits	0.04	107.6%	0.5	13%
Program Total	0.48	130.0%	0.5	4.5%

Table 169: EE Kits Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
EE Kits - Electric	0.54	116.4%	0.5	6%
EE Kits - Standard	0.57	131.4%	0.5	7%
Online Kits - Electric	0.06	134.9%	0.5	16%
Online Kits - Standard	0.03	140.8%	0.5	13%
School Education kits	0.11	117.8%	0.5	11%
Program Total	1.31	124.4%	0.5	4.2%

E.2 NET IMPACT EVALUATION

E.2.1 Net Impact Evaluation Methodology

The net-to-gross evaluation for the Energy Efficiency Kits measures was based on self-report data from program participants. This followed the self-report methodologies for free-ridership and spillover from the PA Evaluation Framework. Kits contribute a significant portion of FirstEnergy’s residential portfolio savings and several sub-programs operate with this delivery method. The evaluation sampled and analyzed kits as a high-impact measure (HIM) based on the definition in the evaluation framework. This analysis included the Opt-In Kits, School Kits, and Online Audit kits provided by FirstEnergy, since there are minimal differences in the delivery of these 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 are approximately 20 percent higher than estimates from Phase II evaluation. The previous evaluation did not correctly assess the program influence portion of the common approach to free ridership, so the analysis assumed a mid-point of 25 percent. The program influence scores for Phase III are around 5 percent, which reflects the difference of approximately 20 percent between Phase II and III results. The intention portion was also analyzed and weighted based on the measures the customer received; this additional analysis detail did not produce major differences in results than Phase II analysis.

E.2.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown Table 170.

Table 170: EE Kits Initiative Net to Gross Sampling for Met-Ed

EDC	Population Size	Achieved Sample Size	Response Rate
Met-Ed	55,193	136	15.0%
Penelec	57,476	132	15.0%
Penn Power	13,721	143	16.0%
WPP	35,812	154	17.0%

E.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 171.

Table 171: EE Kits Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	20,484	21.0%	3.0%	82.0%	9.3%
Penelec	23,936	20.0%	3.0%	83.0%	9.4%
Penn Power	5,406	20.0%	2.0%	82.0%	9.0%
WPP	13,125	20.0%	2.0%	82.0%	8.7%

Appendix F Home Energy Reports Impact Evaluation Detail

F.1 GROSS IMPACT EVALUATION

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

F.1.1 Data Preparation and Analysis Procedure

F.1.1.1 Data Gathering

Monthly billing data dating back to 12 months prior to each experimental cohort's treatment start date through May 2017 was requested from FirstEnergy for all participants. Monthly billing data was provided with indicators identifying whether the monthly bill was estimated or based on an actual meter read. Control vs. treatment indicators were also provided in the billing data set. Demographic information such as participant account number, etc. were masked in the billing data set. ADM utilized a map of customer IDs to utility account numbers for use in dual participation analysis.

F.1.1.2 Data Preparation

Much of FirstEnergy's service territories currently rely on traditional meter reads, which require a technician to record a customer's metered usage. Due to environmental and resource restrictions, it is not feasible for actual meter data to be obtained on a monthly basis. In order to accommodate these restrictions, FirstEnergy generates an estimated metered read based on load shapes and customer's historical usage. The customer's subsequent metered bill then features an adjustment factor to accommodate for any differences between the estimated read and the actual read.

As part of the data preparation process, ADM corrected for estimated reads and adjusted actual reads by using a "true-up" process. For each metered read and all estimated reads immediately preceding it, ADM totaled the billed usage and number of days spanning those bills. The total billed usage for that cumulative period was then divided by the total number of days to generate an average usage per day value. This average usage per day value was then multiplied by the number of days in each individual bill in order to generate a corrected usage value. Because

the number of estimated reads per actual read is inconsistent, the number of estimated reads prior to the first actual read in the provided dataset could not be assumed. Therefore, the first metered read and all estimated reads preceding it were excluded from the dataset. Similarly, estimated reads that did not have a corresponding actual read (generally towards the tail end of provided billing data) were also excluded from analysis. Equation 1 and Table 172 provide the algorithm and inputs for calculating the adjusted usage for billing data after the first metered read and all prior estimated reads have been excluded.

$$Adjusted\ usage = \sum_i^n Billed\ usage \times \frac{Billing\ days_m}{\sum_i^n Billing\ days}$$

Equation 1: Adjusted usage calculation for billing usage true-up.

Table 172: Definition of inputs for adjusted usage calculation.

Variable	Definition
i	First estimated bill in a sequence of estimated bills leading to a metered bill.
n	A metered bill providing an adjustment factor for preceding estimated bills.
m	The billing month of interest.
Billed usage	The total kWh billed in a monthly bill.
Billing days	The total number of days in a monthly bill's billing period.

Billing periods for customers do not fall on consistent dates between participants. For example, one customer’s June bill may run from May 16th to June 17th while another’s may run from May 20th to June 20th. Furthermore, the billing periods do not correspond to calendar months. In order to make the monthly billing data consistent between participants, ADM calendarized the data. Calendarization is the process of correcting monthly billing data to match calendar dates. For example, if 15 days in a billing period belonged to June and 15 days belonged to July, 50% of the billed usage would be attributed to June and 50% attributed to July. The proportionated usage and number of days that fall under a given calendar month are then summed to generate a calendarized usage value and a number of billed days for that month.

Equation 2 and Table 173 provide the algorithm for calculating the monthly usage for a given calendar month.

$$\text{Monthly usage}_m = \sum_i^n \left(\text{Adjusted usage}_i \times \frac{\text{Month days}_i}{\text{Billing days}_i} \right)$$

Equation 2: Monthly usage calculation.

Table 173: Definition of inputs for monthly usage calculation.

Variable	Definition
i	First bill containing the month of interest.
n	Last bill containing the month of interest.
m	Month of interest.
Monthly usage	The calendarized monthly usage for a given month.
Month days	The number of days belonging to the month of interest in a given billing period.
Billing days	The total number of days in a given billing period

In addition to calculating the monthly usage, the number of billed days per month was also calculated by summing together the number of billed days in a corresponding month. Equation 3 provides the algorithm for calculating the number of days billed in a given month.

$$Billed\ days_m = \sum_i^n Month\ days_i$$

Equation 3: Billed days calculation.

After calendarization was completed, an average daily usage value was calculated by dividing the monthly usage by the number of billed days in a month. Customer months that had less than one billed day or exceeded the total number of days in that calendar month for that year were excluded from analysis—months that meet these criteria have overlapping bills and are unreliable for analysis. Months that were present after a customer’s move out date were also be excluded from analysis. Customer months in which average daily usage exceeded 300 kWh or was less than -300 kWh were considered outliers and were excluded from analysis. Partial-month data for the most recent available billing period was removed from the data set. Furthermore, only the billing data from the past 12 months prior to the wave enrollment start date were used for analysis.

F.1.1.3 Billing Analysis

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

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

Equation 4: Formula specifying the lagged seasonal regression model.

The variables above are defined in Table 174 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 174: Definition of variables in the lagged seasonal regression model.

Variable	Definition
kWh_{imy}	Customer <i>i</i> 's average daily energy usage in bill month <i>m</i> in year <i>y</i> .
β_0	Intercept of the regression equation.
I_{my}	Equal to one for each monthly bill month <i>m</i> , year <i>y</i> , and zero otherwise.
β_{mys}	The coefficient on the bill month <i>m</i> , year <i>y</i> indicator variable interacted with season <i>s</i> .
$AvgPre_i$	Average daily usage for customer <i>i</i> in the pre-treatment period.
$AvePreSummer_i$	Average daily usage for customer <i>i</i> in the pre-treatment period during June through September.
$AvePreWinter_i$	Average daily usage for customer <i>i</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 term.

F.1.1.4 Dual Participation Analysis

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

Adjustment for Downstream Measures

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

1. The measures for the treatment group and control group were assigned to an appropriate month based on the reported date of installation for measures installed after the treatment start date.

2. For each month of the program year, the annual savings for all measures installed prior to the month of interest dating back to the treatment start date that had not yet reached the end of their effective useful life were summed for all active participants for each group. For measures installed prior to Program Year 8, ADM used verified savings for dual participation analysis. For measures installed during Program Year 8, ADM utilized reported savings as verification activities occurred concurrently to the evaluation of the Behavioral Modification subprogram.
3. The totaled savings for each group was then divided by 365.25 and then divided by the number of active customers in each group to create a daily average dual participation savings value per home.
4. For each month, the daily average dual participation savings value per home for the control group was then subtracted from the daily average dual participation savings value per home from the treatment group. This resulted in an adjustment factor which was then subtracted from the daily savings value extrapolated from the billing analysis prior to using these values to calculate gross verified energy savings.

Adjustment for Upstream Measures

Adjustments for upstream measures was conducted in accordance to the Phase III Evaluation Framework. The adjustment was cast as a multiplier and applied after the correction for the downstream energy efficiency programs and the initial calculation of annual savings for the program year for a given participant wave. The multiplier values depended on the number of years since program enrollment for a given participation wave and are summarized in Table 5 10 below.

Table 175: Adjustment factors for dual participation in upstream programs.

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

F.1.1.5 Gross Energy Savings Calculation

Gross energy savings can be calculated by taking the treatment effect in a given month (the negative of the regression coefficient of the treatment effect for a given month minus the downstream dual participation adjustment factor for that month), multiplying it by the number of days in the month, the number of active treatment group participants in that month, and the upstream adjustment multiplier. Equation 5 demonstrates the algorithm for calculating verified savings for the model for each month in the program year.

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

Equation 5: kWh savings calculation.

The variables in the above equation are defined in Table 176 below.

Table 176: 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 EDC. Monthly savings were added together to generate annual savings.

Table 177: Dual participation correction results by EDC and participation wave.

Wave	Treat	Control	Delta	Wave	Treat	Control	Delta
ME-1	22,223	21,331	893	PN-1	22,223	21,331	893
ME-1-LI	3,462	3,543	-81	PN-1-LI	3,462	3,543	-81
ME-2	8,939	8,147	792	PN-2	8,939	8,147	792
ME-2-LI	481	483	-2	PN-2-LI	481	483	-2
ME-3	1,469	1,261	207	PN-3	1,469	1,261	207
WP-1	16,014	14,854	1,160	PN-3-LI	16,014	14,854	1,160
WP-1-LI	1,864	1,889	-25	PP-1	1,864	1,889	-25
WP-2	1,640	1,609	30	PP-1-LI	1,640	1,609	30
WP-2-LI	530	497	32	PP-2	530	497	32
WP-3	1,424	1,099	325	PP-2-LI	1,424	1,099	325

F.1.1.6 Gross Demand Savings Calculation

ADM developed a model for predicting gross demand savings using the monthly gross energy savings calculated above and 8,760 load profiles for three residential end uses (heat pumps, interior lighting, and flat).

Step 1: Normalize kWh Usage

ADM normalized the kWh savings value predicted by the impact evaluation regression model into a percent savings value by dividing each month's savings by the total annual savings as follows:

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

Equation 6: Monthly savings normalization calculation.

Step 2: Calculate Monthly Load Factors for Component Variables

The model assumes a linear relationship between the end uses of interest and the percent savings calculated above. Because load shape information is available for multiple residential end uses at an 8,760 resolution, ADM can estimate the relationship between end use load shapes and percent savings in order to estimate total demand savings. In order to make sure that the model is interpretable, hourly load factors must be aggregated to a monthly resolution, providing a monthly load shape with 12 data points. To calculate monthly load shapes, ADM will take the sum of all hourly loads in a given month for each end use of interest.

Step 3: Multivariate Regression

In order to determine the relationship between the percent savings and the residential end uses, ADM used a multivariate regression approach. Because the model was used to assign weights to each end use, ADM held the intercept constant at 0 to ensure that the model produced percent weights for each end use. The following equation provides the model specification used in Program Year 8:

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

Equation 7: End use weight regression model.

The regression coefficients for the above regression equation represent the relationship of each of the component variables to percent savings. Because both independent and dependent variables are calculated in units of months, the numerator of the regression weights are time invariant and can be used to estimate the percent contribution across any unit of time.

Step 4: Demand Savings Calculation

After obtaining the percent weight of each of the three end uses, the 8,760 end use load profiles are then scaled by applying the percent weight to the normalized end use load profile. The total normalized whole house load can then be assumed to be the sum of the weighted load of the three end uses at a given hour. Averaging this value for all hours of the peak demand window will provide an average peak demand whole building load. Multiplying this value by the total annual kWh savings will then predict the kW savings for the program year.

As with gross energy savings, ADM anticipates that some participants in the treatment group will also participate in other FirstEnergy programs. Because the peak demand savings is

predicted from the dual participation adjusted monthly savings, an additional adjustment does not be made.

F.1.2 Program Year 8 Participation Levels

Table 178 provides a table of the participation levels for PY8. The nomenclature in the table includes a prefix to denote the EDC, a suffix of “-LI” for low-income groups, and a number that identifies waves of participants sequentially. The first wave started in July 2012, the second wave in January 2014, and the third wave in December 2014.

Table 178 – PY8 Participation Bill Counts by Month and Cohort.

Wave	Jun-16	Jul-16	Aug-16	Sep-16	Oct-16	Nov-16	Dec-16	Jan-17	Feb-17	Mar-17	Apr-17	May-17
ME-1	77,939	77,726	77,481	77,155	76,772	80,118	79,763	79,266	79,013	78,715	78,415	78,154
ME-1-LI	11,151	11,086	11,040	10,957	10,846	11,730	11,617	11,494	11,429	11,358	11,269	11,201
ME-2	52,152	51,934	51,716	51,460	51,163	54,095	53,745	53,317	53,115	52,868	52,583	52,348
ME-2-LI	2,555	2,531	2,504	2,468	2,419	2,815	2,763	2,704	2,677	2,643	2,603	2,580
ME-3	12,393	12,326	12,240	12,139	12,013	13,158	13,016	12,830	12,751	12,655	12,556	12,467
PN-1	50,002	49,884	49,758	49,593	49,437	51,183	50,998	50,738	50,594	50,433	50,260	50,125
PN-1-LI	6,963	6,937	6,897	6,845	6,783	7,289	7,230	7,152	7,113	7,058	7,022	6,995
PN-2	66,746	66,516	66,288	66,032	65,697	69,000	68,611	68,109	67,833	67,518	67,191	66,952
PN-2-LI	1,833	1,820	1,802	1,775	1,753	1,985	1,958	1,929	1,905	1,883	1,861	1,846
PN-3	29,736	29,581	29,426	29,257	29,012	31,346	31,048	30,653	30,461	30,250	30,032	29,864
PN-3-LI	10,144	10,044	9,949	9,828	9,676	11,130	10,948	10,724	10,607	10,470	10,312	10,226
PP-1	17,999	17,944	17,886	17,829	17,749	18,526	18,433	18,312	18,239	18,166	18,085	18,036
PP-1-LI	2,277	2,267	2,252	2,232	2,213	2,380	2,360	2,343	2,327	2,316	2,296	2,288
PP-2	7,432	7,415	7,384	7,358	7,317	7,702	7,651	7,595	7,566	7,524	7,485	7,459
PP-2-LI	931	922	916	905	894	1,008	994	976	966	953	941	935
WP-1	118,926	118,609	118,259	117,840	117,431	121,819	121,332	120,651	120,328	119,949	119,517	119,205
WP-1-LI	12,150	12,091	12,021	11,916	11,809	12,783	12,674	12,503	12,432	12,348	12,269	12,209
WP-2	18,657	18,602	18,541	18,455	18,377	19,288	19,177	19,031	18,956	18,871	18,787	18,712
WP-2-LI	4,638	4,601	4,573	4,511	4,443	5,017	4,945	4,865	4,813	4,755	4,696	4,663
WP-3	29,426	29,281	29,125	28,928	28,743	30,913	30,591	30,195	30,019	29,859	29,690	29,558

F.1.3 Adjustment for 2012 Low Income vs. Standard Residential Savings

During the initial wave of participants in 2012, separate Low Income and standard residential groups were not established as part of program implementation. As part of the Phase III implementation, Low Income treatment and control participants were identified and treated as a separate cohort from their standard residential counterparts. In accordance with Phase III efficiency goals, a number of treatment group homes were dropped from the standard residential cohorts while fewer to no homes were dropped from the corresponding Low Income group.

Equivalence testing done as part of Program Year 8 Evaluation Plan development showed initial imbalances between treatment and control groups for some of the Low Income cohorts when looking at annual pre-treatment energy usage. Simultaneously, unlike the standard residential cohorts, the Low Income cohorts showed high levels of volatility in predicting program year savings. This volatility could be due to the imbalance in treatment vs. control groups, high level

of variability in billing data due to breaking of the randomized control trial in creating the Low Income group, or overall smaller cohort sizes for the Low Income groups.

To compensate for this volatility, the program year savings for the 2012 Low Income and standard residential cohorts were corrected by taking the sum of the Low Income group savings and its corresponding standard residential cohort. For each EDC, the summed savings was then proportioned back to the Low Income group and the standard residential group by taking the proportion of pre-treatment annual energy consumption belonging to each group (i.e., the proportion of pre-treatment annual energy usage for all Low Income treatment customers over the sum of the annual energy usage for all Low Income and standard residential treatment customers). This adjustment took place after calculating cohort-level savings as modeled through the lagged seasonal model regression but prior to dual participation adjustment. Demand savings, similarly, were modeled after all adjustments to energy savings took place and therefore do not require additional adjustments.

F.1.4 Results

The reported and verified energy savings are shown in Table 179 below. The values below include dual participation adjustments. The last column of the table shows model absolute precisions for each cohort, and also combined for each distinct initiative. Table 180 shows the reported and verified demand reduction for each EDC and initiative.

Table 179: Verified Energy Savings and Absolute Precisions by EDC and Wave

Operating Company	Experimental Cohort	PYRTD (MWh)	PYVTD (MWh)	Relative Savings (%)	Absolute Precision at 95% CL
Met Ed	ME-1	20,379	21,658	2.03%	0.13%
Met Ed	ME-2	7,198	7,650	1.10%	0.16%
Met Ed	ME-3	2,732	2,903	1.76%	0.32%
Met Ed	Total for EEH Program	30,310	32,212	1.78%	0.10%
Met Ed	ME-1-LI	3,062	3,324	2.11%	0.43%
Met Ed	ME-2-LI	660	717	1.71%	0.56%
Met Ed	Total for LI Program	3,722	4,041	2.04%	0.36%
Penelec	PN-1	9,610	10,267	1.66%	0.16%
Penelec	PN-2	7,242	7,737	1.29%	0.18%
Penelec	PN-3	2,824	3,017	1.39%	0.28%
Penelec	Total for EEH Program	19,675	21,020	1.48%	0.11%
Penelec	PN-1-LI	1,185	1,539	1.75%	0.44%
Penelec	PN-2-LI	508	660	2.71%	0.64%
Penelec	PN-3-LI	1,597	2,074	2.57%	0.45%
Penelec	Total for LI Program	3,290	4,273	2.29%	0.30%
Penn Power	PP-1	3,317	3,968	1.82%	0.22%
Penn Power	PP-2	2,356	2,819	2.26%	0.29%
Penn Power	Total for EEH Program	5,673	6,787	2.00%	0.18%
Penn Power	PP-1-LI	842	523	1.89%	0.71%
Penn Power	PP-2-LI	447	278	1.82%	0.90%
Penn Power	Total for LI Program	1,289	800	1.86%	0.56%
WPP	WP-1	24,631	25,551	1.44%	0.14%
WPP	WP-2	4,472	4,639	1.40%	0.22%
WPP	WP-3	3,631	3,766	0.94%	0.23%
WPP	Total for EEH Program	32,734	33,957	1.38%	0.11%
WPP	WP-1-LI	3,066	2,754	1.47%	0.55%
WPP	WP-2-LI	1,031	926	1.48%	0.47%
WPP	Total for LI Program	4,096	3,680	1.48%	0.43%

Table 180: Demand reported and verified demand reductions for the HER Initiative

Operating Company	Initiative	PYRTD MW/yr	PYVTD MW/yr	Demand Realization Rate
Met Ed	Non-LI	4.34	3.55	82%
Met Ed	LI	0.53	0.44	83%
Penelec	Non-LI	3.06	2.32	76%
Penelec	LI	0.51	0.47	91%
Penn Power	Non-LI	0.91	0.75	82%
Penn Power	LI	0.21	0.09	43%
WPP	Non-LI	5.19	3.75	72%
WPP	LI	0.65	0.41	63%

Appendix G Evaluation Detail – Residential Direct Install Initiative

The Residential Direct Install Initiative is comprised of the Home Energy Assessment program implemented by GoodCents. A participant in this program is defined as a unique address in the program, multiple projects can be installed at one address.

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

The initial audit cost the customer \$350. The customer can receive \$200 worth of energy savings products installed during the day of the audit. Customer can apply for a rebate of \$250 after the initial audit. The implementer and the customer also discuss major measure installation possibilities. A major measure typically requires a significant investment from the customer. Customer, which installed major measures, can receive an additional \$100 for saving more than 2,000 kWh and \$150 for saving more than 3,000 kWh.

G.1 GROSS IMPACT EVALUATION

G.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Res DI Initiative involved stratified sampling with specific measurement and verification processes for each sampling stratum. The program tracking and reporting system is at the measure level, but also identifies the rebate application and participant address associated with each measure. In general, there can be multiple measures per application and even multiple applications per household. An example of the latter scenario is when a household first undergoes an initial audit with direct installation of low-cost measures, but later has major measures installed as identified in the audit report. The subsequent retrofits would be captured in a separate rebate application. Major measures are considered attic insulation, wall insulation, air sealing, and windows measures.

ADM aggregated all measures by unique address and then placed each household in one of three strata: Participants that had one or more major measures, participants without major measures and with high energy savings, and participants without major measures and with low energy savings. Evaluation activities for each stratum are described below.

G.1.1.1 Participants with 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.

G.1.1.2 Non-Weatherization Participants with High Energy Savings

A sample of customers in this stratum were contacted to determine stratum level in-service rates. Furthermore, a document review to verify HVAC equipment and water heating equipment was performed.

G.1.1.3 Non-Weatherization Participants with Low Energy Savings

Reviews consisted of a document review to verify HVAC equipment and water heating equipment. Default TRM in-service rates were used for this stratum.

The impacts for all equipment are determined through TRM algorithms.

For lighting measures, efficient wattage ranges and bulb type are stated in equipment name column of the customer tracking data. ADM used data from the PY8 upstream lighting program to determine average baseline watts and average energy efficient watts for each unique lighting equipment name. The hours of use are assumed to be 3 hours because the bulb installation location is not known. TRM defaults were used for other portions of the calculation.

TRM defaults were used for the LED Nights Lights saving calculations.

For domestic hot water measures, first the water heater type was verified with a document review. The housing type was assumed to be single family homes. TRM defaults are assumed when specific values are not known.

Rebate forms were used to verify heating and cooling equipment types for accounts which received attic insulation. Insulation areas, baseline and post-installation insulation R-values were provided in the rebate forms or an accompanying project documentation. The heating and cooling degree days and equivalent full-load hours were found using the TRM's zip code lookup table to the project's reference city.

Residential air sealing measures used CFM50_{post} and CFM50_{pre} values found in the project rebate forms. The heating equipment type cooling equipment type were also found on the rebate forms. The reference city was found using the TRM's zip code look up table.

The default savings values were used for the smart strip plug outlets. All smart strips were assumed tier-1 smart strips unspecified use 5-plug power strips.

TRM section 2.6.2 was to verify energy savings for window installations. The reference city was found using the TRM's zip code look up table. Heating and cooling types were found in rebate forms. No supporting documentation (invoices, specs sheet) was given for the windows installations; therefore, this measure was found to have zero savings

Table 181 lists the data sources for gross impact calculation algorithms.

Table 181: Data Sources for the ATI Initiative Gross Impact Evaluation

Measure	TRM Parameter	Value	Units	Data Source
All Measures	ISR	Varies	percent	email surveys
Lighting, LED Night Lights	Wbase	Varies	W	PY8 upstream lighting program
Lighting	Wee	Varies	W	PY8 upstream lighting program
Lighting, LED Night Lights	HOU	Varies	hours	TRM default
Lighting, Attic Insulation	CF	Varies	fraction	TRM default
Lighting	IEkWh	Varies	percent	based on EDC
Lighting	IEkW	Varies	percent	based on EDC
LED Night Light	Wnl	1	W	TRM default
Attic Insulation	Rbase	Varies	°F·ft ² ·h/Btu	Project audit forms
Attic Insulation	Ree	Varies	°F·ft ² ·h/Btu	Project audit forms
Attic Insulation	HDD, CDD	Varies	Varies	TRM - Zip Code Lookup
Attic Insulation	Area	Varies	ft ²	Project audit forms
Attic Insulation	EER, SEER, HSPF, COP, GSHPDF, GSER	Varies	number	TRM default
Attic Insulation	DUA	0.75	fraction	TRM default
Attic Insulation	AHF	1.056	fraction	TRM default
Air Sealing	CFM50base	Varies	cfm	Project audit forms
Air Sealing	CFM50ee	Varies	cfm	Project audit forms
Air Sealing	UEScitysystem	Varies	text	TRM - Zip Code Lookup
Air Sealing	UDScitysystem	Varies	text	TRM - Zip Code Lookup
Air Sealing, Windows	Equipment Type	Varies	text	customer tracking data, project audit forms
Pipe Insulation, Aerators, Showers	Water heater type	Varies	text	customer tracking data
Pipe Insulation	unit energy savings	9.43	kWh/ft	TRM default
Pipe Insulation	unit peak demand reduction	0.000759	kW/ft	TRM default
Smart Power Strip	# of plug	Varies	number	customer tracking data
Smart Power Strip	Entertainment Center	Varies	text	customer tracking data
Aerators, Showerhead	Housing Type	Varies	text	customer tracking data
Aerators, Showerhead	Flow Rate (gpm)	1.5	gpm	TRM default
Aerators	Faucet Location	Varies	text	customer tracking data
Windows	Esav	Varies	kWh/ft ²	based on equipment type
Windows	Dsav	Varies	kW/ft ²	based on equipment type

G.1.2 Sampling

The sampling strategy for gross impact evaluation is summarized in Table 182, Table 183, Table 184, and Table 185 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 182: Res DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Weatherization	n/a	6	6	Desk Review
High Savings	650 kWh	12	2	
Low Savings	n/a	28	28	
Program Total		46	36	

Table 183: Res DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Weatherization	n/a	0	0	Desk Review
High Savings	650 kWh	7	4	
Low Savings	n/a	21	21	
Program Total		28	25	

Table 184: Res DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Weatherization	n/a	1	1	Desk Review
High Savings	700 kWh	4	1	
Low Savings	n/a	10	10	
Program Total		15	12	

Table 185: Res DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Weatherization	n/a	5	5	Desk Review
High Savings	670 kWh	21	7	
Low Savings	n/a	43	43	
Program Total		69	55	

G.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 186, Table 187, Table 188, and Table 189 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 186: 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.
Weatherization	n/a	24	70.9%	0.5	0%
High Savings	650 kWh	9	109.1%	0.5	46%
Low Savings	n/a	13	97.4%	0.5	0%
Program Total		46	85.9%	0.5	11.5%

Table 187: 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.
Weatherization	n/a	0	100.0%	0.5	0%
High Savings	650 kWh	6	97.1%	0.5	24%
Low Savings	n/a	11	113.7%	0.5	0%
Program Total		17	107.6%	0.5	7.8%

Table 188: 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.
Weatherization	n/a	4	106.7%	0.5	0%
High Savings	700 kWh	3	110.6%	0.5	62%
Low Savings	n/a	5	104.0%	0.5	0%
Program Total		12	106.7%	0.5	18.3%

Table 189: 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.
Weatherization	n/a	37	44.6%	0.5	0%
High Savings	670 kWh	19	127.0%	0.5	22%
Low Savings	n/a	25	116.3%	0.5	0%
Program Total		81	85.7%	0.5	7.6%

G.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 190, Table 191, Table 192, and Table 193 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 190: 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.
Weatherization	n/a	0.00	71.5%	0.5	0%
High Savings	650 kWh	0.00	100.9%	0.5	46%
Low Savings	n/a	0.00	91.5%	0.5	0%
Program Total		0.00	86.2%	0.5	13.4%

Table 191: 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.
Weatherization	n/a	0.00	100.0%	0.5	0%
High Savings	650 kWh	0.00	82.0%	0.5	24%
Low Savings	n/a	0.00	97.1%	0.5	0%
Program Total		0.00	91.6%	0.5	7.8%

Table 192: Res DI Initiative Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Weatherization	n/a	0.00	104.2%	0.5	0%
High Savings	700 kWh	0.00	106.0%	0.5	62%
Low Savings	n/a	0.00	98.5%	0.5	0%
Program Total		0.00	101.9%	0.5	21.4%

Table 193: 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.
Weatherization	n/a	0.00	46.0%	0.5	0%
High Savings	670 kWh	0.00	116.4%	0.5	22%
Low Savings	n/a	0.00	110.9%	0.5	0%
Program Total		0.01	97.9%	0.5	8.6%

G.2 NET IMPACT EVALUATION

G.2.1 Net Impact Evaluation Methodology

An independent net impact evaluation was not conducted for this initiative because the initiative accounts for less than 0.1% of portfolio impacts, as averaged for the four PA Companies. The program impacts are distributed between a small number of high-savings whole-house retrofit projects, and a larger number of projects that involve measures that are also offered in the EE Kits initiative. We use the NTG from EE Kits as a proxy for this Res DI program's NTG for PY8.

Appendix H – Residential New Construction Initiative

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

All submitted projects in PY8 used REM/Rate to generate reported energy and demand impacts.

H.1 GROSS IMPACT EVALUATION

H.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Residential New Construction (Res NC) Initiative involved reviewing the software models submitted with each sampled project, performing on-site verification of model inputs, and re-running modified models through the same software used by program HERS raters. Models were modified based on site-inspection information obtained by the implementer (PSD) during their quality control inspections, or ADM. Models were also modified to zero out the savings calculated for lighting improvements, appliances, and water heaters. Modified models were then run against the reference home to obtain ex post energy savings and demand reductions for weather sensitive measures. Ex post savings for lighting, appliances, and water heaters were obtained from corresponding TRM algorithms. Additional algorithm parameters required by the TRM but not required by software inputs were obtained through the on-site verification efforts.

H.1.1.1 On-Site Inspections

Two types of on-site inspections were performed in PY8:

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

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

Visual inspection includes the following:

- Building Characteristics
 - Orientation (N, NE, E, SE, etc.)
 - Housing type (SF detached, Townhouse inside unit, Townhouse end unit, etc.)
 - Number of floors on or above grade
 - Conditioned sq. ft.
 - Number of bedrooms
 - Window type, size and orientation
 - Ceiling heights
- Envelope
 - Foundation type (slab, conditioned basement, unconditioned basement, etc.)

- Wall and ceiling insulation R-values
- Slab and framed floor insulation
- Rim/band joist insulation
- Number of exterior doors
- HVAC
 - Make and model
 - SEER, capacity, and HSPF
 - For gas furnaces, electric auxiliary energy usage (EAE) as obtained from the AHRI database
 - Programmable thermostat is installed
 - Duct location (conditioned space, attic)
 - Type of mechanical ventilation if necessary
- Water heating
 - Type (storage, instantaneous)
 - Fuel (gas, electric resistance, heat pump)
 - Size in gallons
 - Energy factor as obtained from the AHRI database
- Lighting
 - Percent efficient installed interior, exterior, and in the garage. In cases of discrepancies, lighting counts were reported in the notes section of the checklist. ADM visual inspections reported lighting counts in each of these three areas.
 - Identification of source (incandescent, LED, or CFL)
- Appliances
 - An Energy Star appliance was installed at the time of inspection
 - kWh/yr for refrigerators and dishwashers
 - Fuel for ranges and cooktops
 - ADM visual inspections included make and model of each installed appliance

H.1.1.2 Engineering Model Reviews

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

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

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

H.1.1.3 TRM Impact Evaluation

The PA TRM requires that impacts from lighting and appliances are evaluated with relevant TRM protocols rather than within engineering simulation models. The REM/Rate models submitted by participating HERS raters reflect that building as-found, and therefore include the

impacts of efficient lighting and appliances. ADM recalculates energy and demand impacts for sampled projects by altering the REM/Rate models to remove any impacts associated with lighting and appliances, and then adds back the associated impacts as calculated with TRM protocols.

H.1.2 Sampling

Sampling for the New Homes initiative requires close coordination with the implementation team. Projects are typically sampled prior to rebate approval. As such, the sampling is not strictly a simple random sample drawn from the tracking and reporting system. Rather, ADM samples randomly from projects that were part of PSD’s quality assurance sample, and supplements with randomly selecting homes that are eligible for QA/QC visits (but before the rebates are approved and the homes are sold). The only exception is Penelec, where ADM reviewed a census of the homes that were inspected by PSD. Our sampling approach is essentially unaltered since Phase I, and allows us to leverage data gathered during QA/QC inspections, much like the process used for the low-income program evaluation. Furthermore, but sampling “ahead” of the tracking and reporting system, we are able to observe homes in near-final stages of construction, so that it is generally easier to verify building envelope characteristics. The sampling strategy for gross impact evaluation is summarized in Table 295, Table 296, Table 297, and Table 298 for Met-Ed, Penelec, Penn Power, and WPP respectively. We use an error ratio of 0.26 for calculating achieved precision levels. This error ratio is derived from evaluated sample points from all four EDCs in PY8. Our 15% relative precision targets were met for all EDCs except for Penelec. There were only 55 homes in Penelec’s program in PY8, so a much larger sample than that achieved in PY8 was impractical.

Table 194: RES NC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	363	10	Model Review
Program Total	363	10	/ On-Site

Table 195: RES NC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	55	6	Model Review
Program Total	55	6	/ On-Site

Table 196: RES NC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	440	10	Model Review
Program Total	440	10	/ On-Site

Table 197: RES NC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
All	524	11	Model Review
Program Total	524	11	/ On-Site

H.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 299, Table 300, Table 301, and Table 302 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 198: RES NC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
All	1,027	88.2%	0.257	12%
Program Total	1,027	88.2%	0.257	12%

Table 199: RES NC Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
All	176	74.5%	0.257	14%
Program Total	176	74.5%	0.257	14%

Table 200: RES NC Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
All	813	83.3%	0.257	12%
Program Total	813	83.3%	0.257	12%

Table 201: Res DI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
All	1,362	84.8%	0.257	11%
Program Total	1,362	84.8%	0.257	11%

H.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 303, Table 304, Table 305, and Table 306 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 202: RES NC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
All	0.36	102.8%	0.257	12%
Program Total	0.36	102.8%	0.257	12%

Table 203: RES NC Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
All	0.07	96.5%	0.257	14%
Program Total	0.07	96.5%	0.257	14%

Table 204: RES NC Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
All	0.33	114.3%	0.257	12%
Program Total	0.33	114.3%	0.257	12%

Table 205: RES NC Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
All	0.51	108.1%	0.257	11%
Program Total	0.51	108.1%	0.257	11%

H.2 NET IMPACT EVALUATION

H.2.1 Net Impact Evaluation Methodology

An independent net impact evaluation was not conducted for this initiative in PY8. A proxy 50% net to gross ratio was applied for calculation of portfolio-level net verified impacts and for net-level TRC calculations

Appendix I Evaluation Detail – Residential Upstream Lighting Initiative

I.1 GROSS IMPACT EVALUATION

The Upstream Lighting initiative provides point of sale incentives on energy efficient lighting products at participating retailers. The program also provides for the promotion of energy efficient lighting at retailers, including product placement, signage, and staff training. Contact information for downstream participants is not collected, as this is an upstream program. The number of participants is estimated as the number of packs of lamps. The average pack size is approximately three, the lamps to participants ratio is approximately three.

I.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Upstream Lighting Initiative involved a database review to reconcile invoices with tracking and reporting data and to calculate lamp-specific impacts according to the 2016 PA TRM, and a general population telephone survey to determine cross-sector sales. The impact evaluation process is described below.

I.1.1.1 Review of Sales Invoices and Determination of ISR

ADM conducted a review and obtained invoices for the CFLs and LEDs sold by participating retailers. These invoices are matched to the tracking and reporting (tracking and reporting) system to confirm proper counts and characteristics of the lamps and packages. The information regarding lamp types and quantities in the tracking and reporting system was found to be consistent with the reviewed invoices. Given this finding, the default 92% ISR is applied in the impact calculations. In the event that discrepancies are found between invoiced and tracked quantities.

I.1.1.2 Determination of Baseline and Efficient Lamp Watts

ADM developed an ex-ante wattage equivalency map for use by the ICSP. The wattage equivalency was not make/model specific, but was rather designed to facilitate accurate if somewhat conservative, reporting of energy and demand impacts.

To calculate verified impacts, ADM developed a make/model specific wattage equivalency map. For each unique stock keeping unit (SKU) description, ADM determined the lamp type as one of the following:

- General Service
- Reflector (with subcategories having different lumen to baseline wattage mappings)
- Globe
- Decorative
- 3-Way

For each category, the baseline wattage was determined according to the TRM as a function of the efficient lamp's lumen output. With the baseline and efficient watts determined, the impacts for all lamps are determined through TRM algorithms.

I.1.1.1 Treatment of Non ENERGY STAR® LED Lamps

In PY8, approximately 21% of rebated LED lamps were not ENERGY STAR® qualified at the start of PY8. However, approximately 43% of those LED models have since qualified for ENERGY STAR®. The non-qualifying lamps have similar light output and color rendition, but often have shorter measure lives (at the beginning of PY8, the ENERGY STAR® lifetime requirement was 25,000 hours, but the requirement has since been relaxed to 15,000 hours). The non-qualifying “value” LEDs had considerable price advantages last year, and were offered as a transitional measure given the changes in ENERGY STAR® standards. The price advantage is now minimal, however, and the Companies have stopped rebating non-qualifying LEDs in PY9.

ADM applied the same gross impact evaluation protocols to these lamps as to ENERGY STAR® LEDs and CFLs. The annual energy savings are based on the actual lamp wattages and baseline wattages as determined through application of the PA TRM protocols described above. However, as the TRM section 2.1.1 uses the term ENERGY STAR® throughout in reference to efficient lighting, ADM's application of the TRM protocols to value LEDs is an off-TRM approach. As the main difference between the two sets of lamps is measure life, ADM is applying a measure life of ten years instead of 15 years for all LEDs that are marked as ‘value LEDs’ in the Companies’ tracking and reporting system. This approach has been vetted by SWE prior to the publication of this report.

I.1.1.2 Determination of Cross Sector Sales

Since upstream program tracking data do not contain customer information, a general population survey was conducted in PY8 to identify program participants and to determine the fraction of lamps that are installed in various nonresidential settings. The online survey targeted up to 1,000 residential customers combined over the four FirstEnergy PA EDCs. ADM and Tetra Tech monitored interim results and reduced the target to about 600. A total of 573 surveys were completed. The survey instrument included initial questions to positively identify program participants, and then asked how many lamps they purchased and where the lamps were installed.

The weight for each facility type is taken to be the number of lamps purchased by the respondent, divided by the total number of lamps purchased by all respondents. If customers reported that they installed lamps in both residences and businesses, a follow up call asked for the proportion of lamps installed in each location. Not all customers could be contacted for a follow-up call, but the majority of such customers did respond. Based on these responses, 50.2% of the purchased lamps were installed in businesses. This proportion was then applied to cases where a customer reported having installed lamps in both a business and a residence, but could not be reached for follow up.

The instrument included seven facility types that have previously been identified as likely places of lamp installation, along with an open-ended response for other facility types. The responses were then mapped to TRM building types for determination of hours of use, coincidence factors, and GNI status according to the assignment scheme shown in Table 206. If a precise determination of business type is not possible after a review all responses in the “Other” category (last line of Table 206), the building is mapped to the “Miscellaneous” TRM building type, and the GNI status is set to non-GNI.

Table 206: Mapping of cross sector sales survey responses to TRM building types and GNI status.

Nonresidential Facility Type	TRM Building Type	GNI
Office	Office	No
Retail store	Retail	No
Health care facility	Health	Yes
Hotel / motel / lodging	Lodging	No
Restaurant	Restaurant	No
School	Education	Yes
Place of worship	Institutional	Yes
Other	Determined from response	

Out of 571 completed survey responses (5,409 efficient lamps purchased in the last 12 months), 9 customers reported installing a total of 120 lamps in businesses. Another 32 customers reported installing a total of 655 lamps both in homes and businesses, and of the 655, 329 were determined to be installed in businesses (228 by direct confirmation and 101 by proportionating as discussed above). The fraction of efficient lamps that are installed in non-residential settings is $449/5,409=8.3\%$. Of the 449 lamps, total of 35 were determined to be installed in GNI facilities, so that the GNI cross sector rate is $35/5,409=0.65\%$. The cross sector rate is higher than determined in PY4 or PY6 (the rate has climbed from 4.9% to 5.8% to 8.3%). Although a definite cause for the increase is not known, a possible explanation is that small businesses are more willing to install efficient screw-based lamps than before due to the increased availability and reduced costs of LEDs.

I.1.1.3 Determination of Hours of Use and Coincidence Factor

The daily hours of use and peak coincidence factor for lamps installed in the residential sector are taken as the corresponding values for efficient lamps as installed in the overall household in the 2016 PA TRM. Nonresidential hours of use and coincidence factors are calculated by building type according to Table 3-5 of the TRM. Weighted average HOU and CF are developed for the total nonresidential cross-sector lamps, and separately for the subset of cross-sector lamps that are installed in GNI facilities. The TRM parameters, their associated weights according to the cross-sector sales survey, and overall weighted averaged results are shown in Table 207.

Table 207: HOU, CF, IF, and overall weighting for cross-sector sales.

Building Type	HOU	CF	IF_kWh	IF_kW	Weight	% GNI
Education	2,944	0.39	0.00	0.192		4% 100%
Exterior	3,833	0.00	0.00	0		0% 0%
Grocery	7,798	0.99	0.00	0.192		0% 0%
Health	2,476	0.47	0.00	0.192		0% 100%
Industrial Manufacturing – 1 Shift	2,857	0.57	0.00	0.192		1% 0%
Industrial Manufacturing – 2 Shift	4,730	0.57	0.00	0.192		0% 0%
Industrial Manufacturing – 3 Shift	6,631	0.57	0.00	0.192		0% 0%
Institutional/Public Service	1,456	0.23	0.00	0.192		4% 100%
Lodging	2,925	0.38	0.00	0.192		0% 0%
Miscellaneous/Other	2,001	0.33	0.00	0.192		18% 0%
Multi-Family Common Areas	5,950	0.62	0.00	0.192		3% 0%
Office	1,420	0.26	0.00	0.192		60% 0%
Parking Garages	6,552	0.62	0.00	0		0% 0%
Restaurant	3,054	0.55	0.00	0.192		0% 0%
Retail	2,383	0.56	0.00	0.192		10% 0%
Warehouse	2,815	0.50	0.00	0.192		0% 0%
Weighted Average - All C&I	1,821	0.32	0.00	0.192		100%
Weighted Average - GNI	2,222	0.31	0.00	0.192		

I.1.1.4 Determination of HVAC Interactive Effects

Residential HVAC interactive effects factors are determined separately for each EDC in a two-step process. As a first step, we use data from the 2014 Act 129 Residential Baseline Study to estimate the fraction of lamps that are installed in conditioned space. The fraction of lamps in conditioned space is the ratio of the number of eligible interior sockets to the total number of eligible sockets for each EDC. This fraction is presented in Table 208.

Table 208: Determination of the fraction of lamps in conditioned space by EDC.

EDC	Number of Interior Lamps	Number of Exterior Lamps	Interior lamps as a % of total lamps
Met-Ed	45	6	88%
Penelec	35	4	90%
Penn Power	49	5	91%
West Penn	49	6	89%

As a second step the residential interactive factors from the PA TRM are adjusted through multiplication by the percentages in the last column of Table 208. The adjusted interactive effects are shown in Table 209.

The interactive effects for nonresidential lighting are taken from Table 3-9 from the 2016 PA TRM. The default values of 0 and 0.192 for unknown space conditioning are appropriate for this calculation effort.

Table 209: Original and adjusted energy and demand interactive effects by EDC.

EDC	IE_kWh	ADJ_IE_kW	IE_kW	ADJ_IE_kW
Met-Ed	-8%	-7%	13%	11%
Penelec	1%	1%	10%	9%
Penn Power	0%	0%	20%	18%
WPP	-2%	-2%	30%	27%

Table 210 lists the data sources for gross impact calculation algorithms.

Table 210: Data Sources for the ATI Initiative Gross Impact Evaluation

Evaluation Parameter	Data Source	Value
Verification of Quantity	Invoice to SSRS comparison	Varies
Baseline Watts	Lookup based on lumens, type	Varies
Watts	Lookup from EnergyStar DB and online searches	Varies
Lumens	Lookup from EnergyStar DB and online searches	Varies
Lamp Type	Lookup from EnergyStar DB and online searches	Varies
Residential Daily Hour of Use	TRM Table 2-5 HOU for Efficient Lamps in Household	3
Residential Coincidence Factor	TRM Table 2-5 CF for Efficient Lamps in Household	0.106
Residential IF_kWh	TRM Table 2-6, per EDC, for lamps installed indoors	Varies
Residential IF_kW	TRM Table 2-6, per EDC, for lamps installed indoors	Varies
Residential % Installed Indoors	2014 Baseline Study Figure 5-12 and Table 5-50	Varies
Percent Nonresidential	Cross Sector Sales Survey*	5.00%
Percent GNI	Cross Sector Sales Survey*	1.00%
Nonresidential Hour of Use	Cross Sector Sales Survey* and TRM Table 3-5	1,821
Nonresidential CF	Cross Sector Sales Survey* and TRM Table 3-5	0.32
GNI Hours of Use	Cross Sector Sales Survey* and TRM Table 3-5	2,222
GNI CF	Cross Sector Sales Survey* and TRM Table 3-5	0.31
Nonesidential IF_kWh	TRM Table 2-6, per EDC, for lamps installed indoors	0
Nonesidential IF_kW	TRM Table 2-6, per EDC, for lamps installed indoors	0.192

*Cross sector sales survey results are applied to all four EDCs

I.1.2 Sampling

Of the three gross impact evaluation activities conducted for this initiative, only the invoice review component involved sampling. The sampling was conducted on a simple random basis. The relative precision on the cross-sector rate is estimated to be 30%, but this translates to approximately 3% at the initiative level. The sample design for this initiative is summarized in Table 211 below.

Table 211: Gross Impact Sample Design for the Upstream Lighting Initiative

EDC	Population Size	Achieved Sample Size	Evaluation Activity
Met-Ed	294,513	Census	Database Review
		50	Invoice Review
		211	X-Sector Sales Survey
Met-Ed Total	294,513	261	
Penelec	360,025	Census	Database Review
		50	Invoice Review
		211	X-Sector Sales Survey
Penelec Total	360,025	261	
Penn Power	60,029	Census	Database Review
		50	Invoice Review
		211	X-Sector Sales Survey
Penn Power Total	60,029	261	
WPP	328,833	Census	Database Review
		50	Invoice Review
		211	X-Sector Sales Survey
WPP Total	328,833	261	

I.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 212.

Table 212: Upstream Lighting Initiative Energy Gross Realization Rates

EDC	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Met-Ed	23,715	121.3%	0.5	10%
Penelec	32,402	116.4%	0.5	10%
Penn Power	5,726	128.3%	0.5	10%
WPP	29,003	118.8%	0.5	10%

I.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 213.

Table 213: Upstream Lighting Initiative Demand Gross Realization

EDC	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Met-Ed	2.85	130.3%	0.5	10%
Penelec	3.35	133.0%	0.5	10%
Penn Power	0.66	140.2%	0.5	10%
WPP	3.71	126.3%	0.5	10%

I.2 NET IMPACT EVALUATION

I.2.1 Net Impact Evaluation Methodology

Upstream lighting net-to-gross was based on both customer and retailer survey responses. The retailer analysis was conducted on retailers' estimates of the increased sales, or sales lift, of ENERGY STAR® LEDs and CFLs that was attributable to the program incentives during PY8. This analysis very likely underestimates the program's net-to-gross since the program includes other components that may increase sales, such as customer awareness and education and retailer stocking practices. These other components are not captured by the sales lift analysis. The sales lift results were weighted by the retailer's gross energy savings.

Lighting net-to-gross results are presented across all four FirstEnergy EDCs because of the low number of responses for individual EDCs. Net-to-gross was noticeably lower for West Penn Power than for the other three EDCs, however this is based on fewer than 20 interviews. The average net-to-gross based on sales lift is 36 percent for LEDs and 27 percent for CFLs.

The survey also asked retailers to rate the overall influence of the program on their sales of program-eligible products. The responses on a 1 to 5 scale were converted to a percent, with 1 (little or no influence) being 0 percent and 5 (extremely influential) being 100 percent influence. This metric attempts to capture the influence of the incentive as well as the other program components. The average influence rating was 80 percent for LEDs, suggesting the program is still very influential in stores' sales of these products, and 57 percent for CFLs, suggesting the influence on sales of these products is more moderate. These results indicate that the program's influence is likely higher than what is captured by the sales lift methodology.

The Customer NTG score is adapted from the self-report methodology described in the evaluation framework. This data acquisition mode is not ideal since participants are often unaware that they participated in the program (that is, they may not notice or recall that the efficient lamps are rebated by their utility company), but the survey instrument was modified to enable a discussion of customers' purchasing preferences even if they were not aware of the upstream discounts at the time of purchase. The program is not designed to induce spillover, so the customer NTG is only based on free ridership analysis. The customer NTG was analyzed per EDC.

The results from the retailer and customer surveys were averaged to arrive at a blended estimate of net-to-gross for the program. Overall, the customer NTG was lower than the retailer estimates for LEDs and higher than the retailer estimate for CFLs.

The net-to-gross results for these measures are lower than reported during Phase II, however the Phase III analysis implemented a completely different methodology. Phase II results were based on the influence ratings noted above, and the results of that analysis were very similar to the influence ratings reported in Phase III. This suggests the program's influence has been relatively stable over the past several years.

Two other net impact and process evaluation methodologies were specified in our PY8 evaluation framework. These efforts are still planned for Phase III and some are in progress, but not yet completed. An econometric price elasticity analysis was also planned for PY8. This

analysis will require pricing information for lamps at participating stores. We expect the pricing data to become available during PY9, and therefore this net impact evaluation activity is postponed to PY10. If it becomes apparent that the information will not be available during PY9, ADM and Tetra Tech will work with FirstEnergy and its ICSP, Honeywell, to experiment with incentive levels in a manner that will enable econometric analysis even with the absence of lamp pricing data. A planned shelf study has been delayed to PY9. One reason to delay the study is that ENERGY STAR® specifications changed mid-year, and consequently many non ENERGY STAR® LEDs began to qualify in late PY8. The shelf stocking research will start in mid-PY9, after the market has had time to react to the new specifications.

I.2.2 Sampling

Both retailers and participants were contacted for net impact evaluation purposes. The sample designs for the four EDCs are shown in Table 214.

Table 214: Upstream Lighting Initiative Net to Gross Sampling

EDC	Stratum	Population Size	Achieved Sample Size	Response Rate
Met-Ed	Retailers	33	12	36%
	Customers	294,513	176	6%
Met-Ed Total		n/a	n/a	n/a
Penelec	Retailers	44	16	36%
	Customers	360,025	169	6%
Penelec Total		n/a	n/a	n/a
Penn Power	Retailers	14	9	64%
	Customers	60,029	183	6%
Penn Power Total		n/a	n/a	n/a
WPP	Retailers	39	19	49%
	Customers	328,833	143	5%
WPP Total		n/a	n/a	n/a

I.2.3 Net Impact Evaluation Results

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

Table 215: Upstream Lighting Initiative Net-to-Gross Results for Met-Ed

EDC	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Met-Ed	28,761	63.0%	0.0%	37.0%	17.4%
Penelec	37,706	66.2%	0.0%	33.8%	15.4%
Penn Power	7,346	61.2%	0.0%	38.8%	15.3%
WPP	34,457	73.4%	0.0%	26.6%	13.3%

Appendix J Evaluation Detail – Residential Upstream Electronics Initiative

J.1 GROSS IMPACT EVALUATION

The Upstream Electronic initiative provides retailers incentives for the promotion of energy efficient computers, monitors, televisions, and imaging equipment. Each rebated item is counted as one participant for reporting purposes.

J.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the Upstream Electronics Initiative involved a database review to reconcile invoices with tracking and reporting data and to calculate lamp-specific impacts according to the 2016 PA TRM. The impact evaluation process is described below.

J.1.1.1 Review of Sales Invoices and Determination of Product Eligibility

ADM conducted a review and obtained invoices for the computers, monitors, televisions, and imaging equipment sold by participating retailers. These invoices are matched to the tracking and reporting (T&R) system to confirm proper counts and characteristics of rebated items. The information regarding item types and quantities in the T&R system was found to be consistent with the reviewed invoices. In the event that discrepancies are found between invoiced and tracked quantities, a verification rate is generated by dividing the invoiced quantity by the tracked quantity and applied to calculated energy and demand savings.

J.1.1.2 Determination of ENERGY STAR® Status

To calculate verified impacts, ADM developed a make/model specific equipment map. For each unique stock keeping unit (SKU) description, ADM categorized the equipment type as one of the following:

- Computer
- Monitor
- Television
- Imaging Equipment

Imaging equipment was further sub-divided based on imaging equipment technology (multifunction device, printer, or scanner) and ink-type (inkjet, laser, or thermal transfer/impact). ADM utilized ENERGY STAR® databases for the program year to determine equipment eligibility. Impacts for all equipment are determined using deemed savings tables from the TRM. Upon detailed review of the tracking and reporting system, a small fraction of the rebated equipment (on average, about 10 MWh per EDC or 2% of program savings) were found to be ineligible for savings under the PA TRM. Zero verified savings were assigned in these cases, and the Companies were notified and have since stopped rebating the equipment.

J.1.2 Sampling

Of the two gross impact evaluation activities conducted for this initiative, only the invoice review component involved sampling. The sampling was conducted on a simple random basis. The sample design for this initiative is summarized in Table 216 below.

Table 216: Upstream Electronics Initiative Sample Design

EDC	Population Size	Achieved Sample Size	Evaluation Activity
Met-Ed	15,403	Census	Database Review
		Census	Invoice Review
Met-Ed Total	15,403	15403	
Penelec	7,990	Census	Database Review
		Census	Invoice Review
Penelec Total	7,990	7990	
Penn Power	5,657	Census	Database Review
		Census	Invoice Review
Penn Power Total	5,657	5657	
WPP	28,621	Census	Database Review
		Census	Invoice Review
WPP Total	28,621	28,621	

J.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 217, Table 218, Table 219, and Table 220 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 217: Upstream Electronics Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
TV	363	93.3%	0.5	0.0%
Imaging	80	70.7%	0.5	0.0%
Computer	65	88.5%	0.5	0.0%
Monitor	36	100.0%	0.5	0.0%
Program Total	545	89.9%	0.5	0.0%

Table 218: Upstream Electronics Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
TV	203	90.7%	0.5	0.0%
Imaging	42	88.6%	0.5	0.0%
Computer	25	83.2%	0.5	0.0%
Monitor	12	100.0%	0.5	0.0%
Program Total	282	90.1%	0.5	0.0%

Table 219: Upstream Electronics Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
TV	126	94.2%	0.5	0.0%
Imaging	29	96.7%	0.5	0.0%
Computer	32	89.4%	0.5	0.0%
Monitor	16	100.0%	0.5	0.0%
Program Total	202	94.3%	0.5	0.0%

Table 220: Upstream Electronics Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
TV	693	96.0%	0.5	0.0%
Imaging	148	82.5%	0.5	0.0%
Computer	111	85.9%	0.5	0.0%
Monitor	61	100.0%	0.5	0.0%
Program Total	1,013	93.1%	0.5	0.0%

J.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 221, Table 222, Table 223, and Table 224 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 221: Upstream Electronics Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
TV	0.03	99.8%	0.5	0.0%
Imaging	0.02	46.5%	0.5	0.0%
Computer	0.01	89.1%	0.5	0.0%
Monitor	0.00	106.7%	0.5	0.0%
Program Total	0.06	84.6%	0.5	0.0%

Table 222: Upstream Electronics Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
TV	0.02	97.0%	0.5	0.0%
Imaging	0.01	58.3%	0.5	0.0%
Computer	0.00	83.7%	0.5	0.0%
Monitor	0.00	106.7%	0.5	0.0%
Program Total	0.03	85.4%	0.5	0.0%

Table 223: Upstream Electronics Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
TV	0.01	100.9%	0.5	0.0%
Imaging	0.01	63.7%	0.5	0.0%
Computer	0.00	90.0%	0.5	0.0%
Monitor	0.00	106.7%	0.5	0.0%
Program Total	0.02	89.7%	0.5	0.0%

Table 224: Upstream Electronics Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
TV	0.06	102.7%	0.5	0.0%
Imaging	0.03	54.3%	0.5	0.0%
Computer	0.01	86.4%	0.5	0.0%
Monitor	0.01	106.7%	0.5	0.0%
Program Total	0.11	87.9%	0.5	0.0%

J.2 NET IMPACT EVALUATION

J.2.1 Net Impact Evaluation Methodology

A net impact evaluation was not conducted for the upstream electronics program in PY8, but will be conducted in PY9. The net-to-gross ratio from the Phase II evaluation of this program component, 49.5%, was applied for calculation of portfolio-level net verified impacts and for net-level TRC calculations

Appendix K Evaluation Detail – Residential HVAC Initiative

The Residential HVAC initiative provides rebates to customers who purchase high efficiency HVAC equipment, Tune-Up an existing HVAC system, install a new programmable thermostat, or replace an existing furnace fan with a new high-efficiency one. Enhanced rebates are provided for CEE tier 2 and tier 3 HVAC systems.

Participants are defined as each separate measure rebated. Thus, the rebate application, rather than the customer is the sampling unit for gross impact evaluation.

K.1 GROSS IMPACT EVALUATION

K.1.1 Gross Impact Evaluation Methodology

Each component of gross impact evaluation is described below.

Mini-Splits

Ductless mini-splits (ACs and heat pumps) were also looked up on AHRI similar to the other HVAC system types, but several additional steps were taken to determine gross impacts. EFLHs were determined through the TRM classification of “primary zone” or “secondary zone”. Participant survey responses were used to determine the TRM classification based on which room the systems were installed in as rebate applications do not include this information. The TRM default value was used for CF. The baseline system type was determined from participant surveys. Several response fields were taken into account to determine the baseline including whether the mini-split installation supplemented an existing HVAC system. In cases where there was no existing heating or cooling, or the respondent did not know what type of existing system they had, the baseline was taken to be an ASHP or ducted mini-split (both have SEERbase = 14 and HSPFbase = 8.2). Baseline efficiencies were taken from TRM table 2-21 according to the type of baseline system.

Thermostats

Programmable thermostats were classified by the features they possess according to the IMP: conventional programmable, basic smart, or advanced smart. The corresponding features are: programmable schedule, remote access, and occupancy sensing. These features were looked up on manufacturer websites and compiled into a database. For each sampled thermostat measure, the IMP classification was looked up in the database based on its features. The IMP classification was used to determine the Energy Saving Factors (ESFcool and ESFheat) used in the IMP algorithm. The baseline thermostat was determined based on the rebate application. In cases where the existing thermostat was broken or non-existing, a manual baseline was assumed.

Furnace Fans

High-efficiency furnace fan energy savings relied on the deemed values in the TRM. ADM used the results of participant surveys to determine the verification rate.

HVAC Maintenance

Default TRM parameters were used for HVAC Tune-Up calculations. Heating and cooling capacities were determined from the rebate application for sampled units. For tune-ups performed on AC units, the kWh heat term in the TRM algorithm was taken to be zero.

PTACs and PTHPs

As there were only three PTACs and zero PTHPs reported, ADM elected to pass these measures through the evaluation process with no activity.

Table 225 lists the data sources for gross impact calculation algorithms.

Table 225: Data Sources for the Res HVAC Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
All Measures	Appliance Age	Tracking and Reporting System
All HVAC Equipment	AHRI # (to get other TRM parameters)	Invoice Inspections and Tracking Data
All HVAC Equipment	Heating Capacity	Tracking and Reporting System
All HVAC Equipment	Cooling Capacity	Tracking and Reporting System
HVAC Maintenance	Heating Capacity	Invoice Inspections
HVAC Maintenance	Cooling Capacity	Invoice Inspections
All	SEER/EER/HSPF/COP	AHRI database reference
Minisplits	EFLH	ZIP lookup and survey for room type
Minisplits	Baseline Type	Customer Surveys
Programmable Thermostats	Install Type	Application Review
Programmable Thermostats	Thermostat Type	Application Review
Programmable Thermostats	Heating System Type	Application Review
Programmable Thermostats	Cooling System Type	Application Review
Programmable Thermostats	Baseline Thermostat Type	Application Review

K.1.1.1 Determination of Verification Rate

ADM performed telephone and online surveys on a random sample of customers selected from the tracking and reporting data. Nearly all contacted customers verified that they have purchased and installed the stated HVAC measures. The verification rates are used to inform measure-level realization rates. The two modes yielded compatible results, so each survey response for a given stratum was given equal weight. The number of completed surveys, response rates, and energy realization rates, as averaged over all four EDCs are listed in Table 226.

Table 226: Res HVAC Initiative Gross Impact Evaluation Survey Mode Comparison

Survey Mode	N Completes	Response Rate	Measure Verification Rate
Telephone	39	21%	97%
Online	257	27%	98%
Total	296	26%	98%

K.1.1.2 Invoice and Application Review

ADM obtained invoices and applications from Honeywell. For each application, ADM verified that the manufacturer name and model number in the tracking and reporting system matches those on the invoice and rebate application. In general, all sampled measures were matched to qualifying product lists. ADM independently retrieved the attributes necessary for TRM and IMP calculations from various supporting databases which were compiled for this purpose. These include the AHRI database and manufacturer websites. In certain cases, the make or model numbers were entered in with minor typographic errors or with missing or inserted dashes, spaces, or other delimiting characters. In such cases, straightforward manual correction of the make or model numbers results in positive identification of the involved equipment in the supporting databases.

K.1.1.3 Calculation Review using TRM algorithm and parameters

For HVAC measures with partially deemed TRM (or IMP) protocols, the T&R system reported impacts with one savings scenario rather than with specific scenarios that occur in measure implementation. For example, values from planning assumptions for capacity and efficiency are used rather than HVAC system-specific values. In general, the per-unit savings reported by the ICSP are rather conservative (the assumed average efficiency levels or capacities are lower than actual average values). For all reviewed records, ADM used project-specific attributes to calculate “On-TRM” impacts.

The average per-unit gross verified impact for a given measure is the product of the measure-specific verification rate as determined from customer surveys, and the average calculated impacts as described above.

The following provide additional details into the calculation review procedure:

CACs and ASHPs

Central HVAC systems were looked up on the AHRI database to determine individual measure attributes for use in the TRM algorithms. These attributes include heating and cooling capacities, and seasonal efficiency ratios (SEER and HSPF). EFLHs were taken from TRM table 2-12 based on the reported zip code or zip code obtained through participant surveys if the reported zip code was overridden by the respondent. The TRM default value was used for CF.

Baseline efficiencies were taken as TRM defaults assuming a replace on burnout scenario rather than early retirement¹³.

GSHPs

Ground-source heat pump make and model numbers, or AHRI certificate numbers, are cross-referenced on the AHRI database to determine equipment parameters for use in the TRM algorithm. EFLHs were determined through zip code lookups as provided in the T&R data or with zip codes from survey data if overridden by respondents. The TRM default value for CF was used. Other TRM default values used include GSHPDF, GSER, GSOP, and GSPK. Baseline efficiencies were also taken as TRM defaults for a replace on burnout scenario with an ASHP as the baseline system.

For GSHP units larger than 65 kBtuh, the commercial algorithm in section 3.2.3 of the TRM was used to calculate impacts. Here the baseline efficiencies were taken from TRM table 3-36. In these cases, the replace on burnout scenario assumes kWh_{pump} and kW_{pump} for the baseline ASHP are zero.

Mini-Splits

Ductless mini-splits (ACs and heat pumps) were also looked up on AHRI similar to the other HVAC system types, but several additional steps were taken to determine gross impacts. EFLHs were determined through the TRM classification of “primary zone” or “secondary zone”. Participant survey responses were used to determine the TRM classification based on which room the systems were installed in as rebate applications do not include this information. The TRM default value was used for CF. The baseline system type was determined from participant surveys. Several response fields were taken into account to determine the baseline including whether the mini-split installation supplemented an existing HVAC system. In cases where there was no existing heating or cooling, or the respondent did not know what type of existing system they had, the baseline was taken to be an ASHP or *ducted* mini-split (both have $SEER_{base} = 14$ and $HSPF_{base} = 8.2$). Baseline efficiencies were taken from TRM table 2-21 according to the type of baseline system.

Thermostats

Programmable thermostats were classified by the features they possess according to the IMP: conventional programmable, basic smart, or advanced smart. The corresponding features are: programmable schedule, remote access, and occupancy sensing. These features were looked up on manufacturer websites and compiled into a database. For each sampled thermostat measure, the IMP classification was looked up in the database based on its features. The IMP classification was used to determine the Energy Saving Factors (ESF_{cool} and ESF_{heat}) used in the IMP algorithm. The baseline thermostat was determined based on the rebate application.

¹³ Although early retirements are eligible and do occur in the program, the downstream rebate program does not have any special provisions, such as mandatory pre-inspections, to accommodate early retirement. For this program, early retirement is viewed by ADM as a phenomenon that may increase net impacts, but not gross impacts.

In cases where the existing thermostat was broken or non-existing, a manual baseline was assumed.

Furnace Fans

High-efficiency furnace fan energy savings relied on the deemed values in the TRM. ADM used the results of participant surveys to determine the verification rate.

HVAC Maintenance

Default TRM parameters were used for HVAC Tune-Up calculations. Heating and cooling capacities were determined from the rebate application for sampled units. For tune-ups performed on AC units, the kWh_{heat} term in the TRM algorithm was taken to be zero.

PTACs and PTHPs

As there were only three PTACs and zero PTHPs reported, ADM elected to pass these measures through the evaluation process with no activity.

K.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 227, Table 228, Table 229, and Table 230.

Table 227: Res HVAC Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	257	24	24
Mini-Split HP	187	20	18
GSHP	96	5	14
CAC	336	22	15
Furnace Fan	103	12	8
Thermostat	638	15	22
HVAC Tune-Up	69	10	3
PTAC	1	0	0
Program Total	1,687	108	104

Table 228: Res HVAC Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	62	8	13
Mini-Split HP	337	22	26
GSHP	21	1	7
CAC	71	2	5
Furnace Fan	36	1	5
Thermostat	343	23	20
HVAC Tune-Up	151	3	10
PTAC	1	0	0
Program Total	1,022	60	86

Table 229: Res HVAC Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	61	7	31
Mini-Split HP	17	2	1
GSHP	17	1	10
CAC	47	3	10
Furnace Fan	81	9	16
Thermostat	226	19	39
HVAC Tune-Up	17	4	3
PTAC	0	0	0
Program Total	466	45	110

Table 230: Res HVAC Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
ASHP	289	18	28
Mini-Split HP	212	14	12
GSHP	69	3	9
CAC	182	11	6
Furnace Fan	284	15	11
Thermostat	715	22	21
HVAC Tune-Up	353	16	10
PTAC	1	0	0
Program Total	2,105	99	97

K.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 231, Table 232, Table 233, and Table 234 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 231: Res HVAC Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	197	109.9%	0.5	14.0%
Mini-Split HP	156	162.8%	0.5	16.1%
GSHP	153	115.0%	0.5	17.8%
CAC	71	128.4%	0.5	18.2%
Furnace Fan	46	100.0%	0.5	24.4%
Thermostat	38	209.5%	0.5	15.1%
HVAC Tune-Up	12	57.9%	0.5	41.3%
PTAC	0	100.0%	0.5	100.0%
Program Total	672	129.4%	0.5	7.38%

Table 232: Res HVAC Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	54	108.9%	0.5	17.8%
Mini-Split HP	281	211.3%	0.5	13.6%
GSHP	33	123.8%	0.5	22.2%
CAC	15	100.5%	0.5	31.0%
Furnace Fan	16	100.0%	0.5	29.9%
Thermostat	21	386.1%	0.5	15.6%
HVAC Tune-Up	26	38.6%	0.5	22.0%
PTAC	0	100.0%	0.5	100.0%
Program Total	446	182.5%	0.5	10.20%

Table 233: Res HVAC Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	49	126.2%	0.5	9.1%
Mini-Split HP	14	122.9%	0.5	69.9%
GSHP	27	112.6%	0.5	14.6%
CAC	10	126.1%	0.5	20.2%
Furnace Fan	36	88.9%	0.5	16.3%
Thermostat	14	140.9%	0.5	10.5%
HVAC Tune-Up	3	101.1%	0.5	37.7%
PTAC	0	100.0%	0.5	0.0%
Program Total	153	115.5%	0.5	8.73%

Table 234: Res HVAC Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	230	119.4%	0.5	12.9%
Mini-Split HP	177	178.8%	0.5	20.2%
GSHP	110	113.2%	0.5	22.4%
CAC	39	120.7%	0.5	28.9%
Furnace Fan	127	53.3%	0.5	21.6%
Thermostat	43	101.3%	0.5	15.5%
HVAC Tune-Up	61	87.3%	0.5	22.6%
PTAC	0	100.0%	0.5	100.0%
Program Total	786	117.8%	0.5	8.83%

K.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 235, Table 236, Table 237, and Table 238 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 235: Res HVAC Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	0.05	159.5%	0.5	14.0%
Mini-Split HP	0.06	103.2%	0.5	16.1%
GSHP	0.02	188.6%	0.5	17.8%
CAC	0.05	224.1%	0.5	18.2%
Furnace Fan	0.01	100.0%	0.5	24.4%
Thermostat	0.00	100.0%	0.5	15.1%
HVAC Tune-Up	0.01	62.0%	0.5	41.3%
PTAC	0.00	100.0%	0.5	100.0%
Program Total	0.21	155.7%	0.5	8.65%

Table 236: Res HVAC Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	0.01	205.6%	0.5	17.8%
Mini-Split HP	0.11	103.1%	0.5	13.6%
GSHP	0.00	158.0%	0.5	22.2%
CAC	0.01	239.3%	0.5	31.0%
Furnace Fan	0.00	100.0%	0.5	29.9%
Thermostat	0.00	100.0%	0.5	15.6%
HVAC Tune-Up	0.02	60.7%	0.5	22.0%
PTAC	0.00	100.0%	0.5	100.0%
Program Total	0.16	117.8%	0.5	9.83%

Table 237: Res HVAC Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	0.01	183.1%	0.5	9.1%
Mini-Split HP	0.01	13.1%	0.5	69.9%
GSHP	0.00	196.9%	0.5	14.6%
CAC	0.01	274.2%	0.5	20.2%
Furnace Fan	0.01	88.9%	0.5	16.3%
Thermostat	0.00	100.0%	0.5	10.5%
HVAC Tune-Up	0.00	116.5%	0.5	37.7%
PTAC	0.00	100.0%	0.5	0.0%
Program Total	0.04	154.6%	0.5	8.31%

Table 238: Res HVAC Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
ASHP	0.06	174.7%	0.5	12.9%
Mini-Split HP	0.07	41.1%	0.5	20.2%
GSHP	0.02	205.0%	0.5	22.4%
CAC	0.03	254.8%	0.5	28.9%
Furnace Fan	0.03	53.3%	0.5	21.6%
Thermostat	0.00	100.0%	0.5	15.5%
HVAC Tune-Up	0.04	98.6%	0.5	22.6%
PTAC	0.00	100.0%	0.5	100.0%
Program Total	0.24	120.1%	0.5	9.81%

K.2 NET IMPACT EVALUATION

K.2.1 Net Impact Evaluation Methodology

The net-to-gross evaluation for the downstream HVAC measures was based on self-report data from program participants. This followed the self-report methodologies for free-ridership and spillover from the PA Evaluation Framework. Participants were randomly sampled since the savings for these sub-programs are relatively small and do not qualify for the higher level of rigor of high-impact measures. Individual free-ridership and spillover rates from the participant survey were weighted to adjust for sampling differences, non-response, and claimed energy savings to calculate overall estimates.

Overall NTG ratios were slightly lower than those determined in the Phase II evaluation, as customers reported higher levels of free ridership.

K.2.2 Sampling

Tetra Tech sampled randomly from all participants on record in the Companies' tracking and reporting systems in early PY8Q4. The sample designs for the four EDCs are shown in Table 239, Table 240, Table 241, and Table 242 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 239: Res HVAC Initiative Net to Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,687	74	26.0%
Program Total	1,687	74	26.0%

Table 240: Res HVAC Initiative Net to Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,022	72	26.0%
Program Total	1,022	72	26.0%

Table 241: Res HVAC Initiative Net to Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	466	46	29.0%
Program Total	466	46	29.0%

Table 242: Res HVAC Initiative Net to Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,105	74	26.0%
Program Total	2,105	74	26.0%

K.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 243, Table 244, Table 245, and Table 246 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 243: Res HVAC Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	870	55.0%	0.0%	45.0%	12.6%
Program Total	870	55.0%	0.0%	45.0%	12.6%

Table 244: Res HVAC Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	814	49.0%	1.0%	52.0%	12.7%
Program Total	814	49.0%	1.0%	52.0%	12.7%

Table 245 Res HVAC Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	177	47.0%	3.0%	56.0%	15.1%
Program Total	177	47.0%	3.0%	56.0%	15.1%

Table 246 Res HVAC Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	926	52.0%	1.0%	49.0%	12.6%
Program Total	926	52.0%	1.0%	49.0%	12.6%

Appendix L Evaluation Detail – Residential Appliances and LI Residential Appliances Initiatives

Residential Appliances and LI Appliances are two separate initiatives in ADM's PY8 evaluation plan. While the program process is the same between the two, the measures and rebate levels differ. Refrigerators, Freezers, Clothes Washers, Clothes Dryers, and Dehumidifiers are rebated under both initiatives, but under the LI Appliance initiative, the rebates are increased by \$25. Income eligibility is attested to by the customer on the rebate application by providing "Number of Household Residents" and "Gross Household Income". Heat Pump Water Heaters are rebated under the Residential Appliances initiative, but not under the LI Appliances initiative. Enhanced rebates are available to the Residential Appliance initiative participants for purchasing a CEE Tier 2 or Tier 3 Refrigerator.

Participants are defined as each separate appliance rebated. Additional rebates provided to LI customers are not included in participation counts. Thus, the rebate application, rather than the customer is the sampling unit for gross impact evaluation.

Gross impact evaluation activities are identical for the two initiatives. Separate survey samples were maintained in PY8 to assess whether demographic differences would affect the realization rates for the measures. No significant differences were found, however, and in PY9 we may treat residential appliance rebates as one initiative.

L.1 GROSS IMPACT EVALUATION

L.1.1 Gross Impact Evaluation Methodology

Each component of gross impact is described below.

L.1.1.1 Verification Surveys

ADM performed telephone and online surveys on a random sample of customers selected from the tracking and reporting data. Nearly all contacted customers verified that they have purchased and installed the stated appliances. The verification rates are used to inform measure-level realization rates

L.1.1.2 Invoice and Application Review

ADM obtained invoices and applications from the Honeywell. For each application, ADM verified that the manufacturer name and model number in the tracking and reporting system matches those on the invoice and rebate application. In general, all sampled appliances were matched to the qualifying ENERGY STAR® product lists. ADM independently retrieved the attributes necessary for TRM calculations from the ENERGY STAR® database. In certain cases, the make or model numbers were entered in with minor typographic errors or with missing or inserted dashes, spaces, or other delimiting characters. In such cases, straightforward manual correction of the make or model numbers results in positive identification of the involved equipment in the supporting databases.

L.1.1.3 Saving Calculations with TRM Algorithms and Parameters

For measures with partially deemed TRM (or IMP) protocols, the T&R system reported impacts with one savings scenario rather than with specific scenarios that occur in measure implementation. For example, values from planning assumptions for capacity and efficiency are used rather than rebate-specific values. In general, the per-unit savings reported by the ICSP are rather conservative (the assumed average efficiency levels or capacities are lower than actual average values). For all reviewed records, ADM used project-specific attributes to calculate “On-TRM” impacts.

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.

Table 247 lists the data sources for gross impact calculation algorithms.

Table 247: Data Sources for the Res Appliances Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
All Measures	Capacity	Invoice and Application Review
Refrigerator, Freezer	Pre-1990	Tracking and Reporting System
Refrigerator, Freezer	Appliance Size / Capacity	Tracking and Reporting System
Refrigerator, Freezer	Configuration/Type	Tracking and Reporting System
Refrigerator	Primary Usage	Participant Surveys
Refrigerator, Freezer	Part Use Factor	Participant Surveys
Refrigerator, Freezer	In Unconditioned Space?	Participant Surveys
Refrigerator, Freezer	CDD and HDD	TRM - Zip Code Lookup
RAC	Capacity	TRM Default
RAC	EER	TRM Default
RAC	RAC EFLH	TRM - Zip Code Lookup
RAC	CF	TRM Default
Dehumidifier	Region (to determine kWh)	TRM - Zip Code Lookup
All Measures	Verification Rate	Participant Surveys

Both telephone and online surveys were conducted in PY8. The two modes yielded compatible results, so each survey response for a given stratum was given equal weight. The number of completed surveys, response rates, and energy realization rates, as averaged over all four EDCs are listed in Table 248.

Table 248: Res Appliances Initiative Gross Impact Evaluation Survey Mode Comparison

Survey Mode	N Completes	Response Rate	Measure Verification Rate
Telephone	104	22%	98%
Online	359	24%	100%
Total	463	24%	100%

The gross realization rates for energy savings were driven primarily by the reported energy savings in the tracking and reporting system. In general, the reported energy and demand impacts are calculated with conservative assumptions of market-average efficiencies and capacities.

L.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 249, Table 250, Table 251, and Table 252.

Table 249: Res Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Heat Pump Water Heater	148	10	15
Clothes Washer	1,231	29	17
Dehumidifier	754	27	31
Refrigerator	1,325	22	18
Clothes Dryer	433	8	5
Freezer	187	7	2
Program Total	4,078	103	88

Table 250: Res Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Heat Pump Water Heater	50	9	12
Clothes Washer	883	25	15
Dehumidifier	996	25	34
Refrigerator	1,064	17	14
Clothes Dryer	254	5	5
Freezer	191	8	3
Program Total	3,438	89	83

Table 251: Res Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Heat Pump Water Heater	13	5	10
Clothes Washer	366	23	21
Dehumidifier	268	30	27
Refrigerator	382	19	19
Clothes Dryer	141	7	8
Freezer	60	7	1
Program Total	1,230	91	86

Table 252: Res Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Heat Pump Water Heater	111	20	14
Clothes Washer	1,371	20	20
Dehumidifier	1,092	38	29
Refrigerator	1,413	17	24
Clothes Dryer	514	3	8
Freezer	260	11	1
Program Total	4,761	109	96

The sample designs for the Res LI Appliance Initiative are shown in Table 253, Table 254, Table 255, and Table 256.

Table 253: Res LI Appliances Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Clothes Washer	48	7	14
Dehumidifier	22	2	6
Refrigerator	46	6	9
Clothes Dryer	16	0	6
Freezer	5	0	2
Program Total	137	15	37

Table 254: Res LI Appliances Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Clothes Washer	62	12	15
Dehumidifier	32	11	9
Refrigerator	59	9	14
Clothes Dryer	17	0	3
Freezer	8	0	2
Program Total	178	32	43

Table 255: Res LI Appliances Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Clothes Washer	15	4	9
Dehumidifier	6	1	2
Refrigerator	24	3	11
Clothes Dryer	6	0	3
Freezer	2	0	1
Program Total	53	8	26

Table 256: Res LI Appliances Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size (Survey)	Achieved Sample Size (Desk Review)
Clothes Washer	40	6	12
Dehumidifier	17	3	8
Refrigerator	36	8	8
Clothes Dryer	18	0	6
Freezer	4	0	1
Program Total	115	17	35

L.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 257, Table 258, Table 259, and Table 260 for Met-Ed, Penelec, Penn Power, and WPP respectively. In general, gross realization rates were far above 100% for both energy and demand. The primary reason for the high realization rates are generally conservative ex ante values for clothes washers (93 kWh per unit) and heat pump water heaters (1,389 kWh per unit).

Table 257: Res Appliances Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	206	132.2%	0.5	17.6%
Clothes Washer	114	212.3%	0.5	17.3%
Dehumidifier	105	96.2%	0.5	12.7%
Refrigerator	88	79.2%	0.5	16.9%
Clothes Dryer	11	110.6%	0.5	32.0%
Freezer	4	164.8%	0.5	50.6%
Program Total	528	133.4%	0.5	9.4%

Table 258: Res Appliances Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	69	134.0%	0.5	18.1%
Clothes Washer	82	183.7%	0.5	18.4%
Dehumidifier	138	100.8%	0.5	12.1%
Refrigerator	71	95.6%	0.5	19.1%
Clothes Dryer	6	111.6%	0.5	31.9%
Freezer	4	182.4%	0.5	41.2%
Program Total	372	125.5%	0.5	8.4%

Table 259: Res Appliances Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	18	116.9%	0.5	10.9%
Clothes Washer	34	268.0%	0.5	15.3%
Dehumidifier	37	98.3%	0.5	13.1%
Refrigerator	25	103.3%	0.5	16.1%
Clothes Dryer	4	111.5%	0.5	24.7%
Freezer	1	208.7%	0.5	71.4%
Program Total	120	152.1%	0.5	8.6%

Table 260: Res Appliances Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	154	142.9%	0.5	18.0%
Clothes Washer	128	222.7%	0.5	16.0%
Dehumidifier	152	97.0%	0.5	13.2%
Refrigerator	94	94.3%	0.5	14.6%
Clothes Dryer	13	113.4%	0.5	25.3%
Freezer	6	208.7%	0.5	71.9%
Program Total	546	140.5%	0.5	8.5%

The gross realization rates for energy and relative precisions for the Res LI Appliances Initiative are shown in Table 261, Table 262, Table 263, and Table 264 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 261: Res LI Appliances Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	5	206.5%	0.5	16.2%
Dehumidifier	3	98.8%	0.5	25.1%
Refrigerator	3	100.4%	0.5	21.5%
Clothes Dryer	0	93.9%	0.5	32.9%
Freezer	0	157.5%	0.5	55.8%
Program Total	11	144.4%	0.5	11.5%

Table 262: Res LI Appliances Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	6	191.2%	0.5	16.2%
Dehumidifier	4	101.9%	0.5	20.3%
Refrigerator	4	84.9%	0.5	16.8%
Clothes Dryer	0	113.0%	0.5	53.3%
Freezer	0	232.2%	0.5	62.4%
Program Total	15	135.5%	0.5	10.8%

Table 263: Res LI Appliances Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	1	271.5%	0.5	15.2%
Dehumidifier	1	161.9%	0.5	41.6%
Refrigerator	2	93.7%	0.5	16.0%
Clothes Dryer	0	113.0%	0.5	41.6%
Freezer	0	94.8%	0.5	72.0%
Program Total	4	172.4%	0.5	12.3%

Table 264: Res LI Appliances Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	4	253.0%	0.5	17.4%
Dehumidifier	2	94.3%	0.5	18.5%
Refrigerator	2	121.3%	0.5	22.4%
Clothes Dryer	0	110.4%	0.5	33.9%
Freezer	0	106.3%	0.5	88.2%
Program Total	9	169.6%	0.5	12.1%

L.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 265, Table 266, Table 267, and Table 268 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 265: Res Appliances Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	0.01	152.3%	0.5	17.6%
Clothes Washer	0.01	220.3%	0.5	17.3%
Dehumidifier	0.03	94.8%	0.5	12.7%
Refrigerator	0.01	72.1%	0.5	16.9%
Clothes Dryer	0.00	97.8%	0.5	32.0%
Freezer	0.00	141.4%	0.5	50.6%
Program Total	0.07	127.2%	0.5	8.3%

Table 266: Res Appliances Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	0.00	154.4%	0.5	18.1%
Clothes Washer	0.01	190.6%	0.5	18.4%
Dehumidifier	0.03	99.4%	0.5	12.1%
Refrigerator	0.01	87.0%	0.5	19.1%
Clothes Dryer	0.00	98.7%	0.5	31.9%
Freezer	0.00	156.5%	0.5	41.2%
Program Total	0.06	116.2%	0.5	8.2%

Table 267: Res Appliances Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	0.00	134.7%	0.5	10.9%
Clothes Washer	0.00	278.0%	0.5	15.3%
Dehumidifier	0.01	96.9%	0.5	13.1%
Refrigerator	0.00	94.0%	0.5	16.1%
Clothes Dryer	0.00	98.6%	0.5	24.7%
Freezer	0.00	179.0%	0.5	71.4%
Program Total	0.02	136.0%	0.5	8.2%

Table 268: Res Appliances Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Heat Pump Water Heater	0.01	164.7%	0.5	18.0%
Clothes Washer	0.01	231.0%	0.5	16.0%
Dehumidifier	0.04	95.6%	0.5	13.2%
Refrigerator	0.01	85.8%	0.5	14.6%
Clothes Dryer	0.00	100.3%	0.5	25.3%
Freezer	0.00	179.0%	0.5	71.9%
Program Total	0.08	128.7%	0.5	7.9%

The gross realization rates for demand and relative precisions for the Res LI Appliances Initiative are shown in Table 265, Table 266, Table 267, and Table 268 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 269: Res LI Appliances Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	0.00	203.1%	0.5	16.2%
Dehumidifier	0.00	97.4%	0.5	25.1%
Refrigerator	0.00	91.3%	0.5	21.5%
Clothes Dryer	0.00	8.6%	0.5	32.9%
Freezer	0.00	135.1%	0.5	55.8%
Program Total	0.00	91.7%	0.5	15.0%

Table 270: Res LI Appliances Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	0.00	188.1%	0.5	16.2%
Dehumidifier	0.00	100.4%	0.5	20.3%
Refrigerator	0.00	77.2%	0.5	16.8%
Clothes Dryer	0.00	10.4%	0.5	53.3%
Freezer	0.00	199.2%	0.5	62.4%
Program Total	0.00	93.3%	0.5	15.0%

Table 271: Res LI Appliances Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	0.00	267.1%	0.5	15.2%
Dehumidifier	0.00	159.5%	0.5	41.6%
Refrigerator	0.00	85.2%	0.5	16.0%
Clothes Dryer	0.00	10.4%	0.5	41.6%
Freezer	0.00	81.3%	0.5	72.0%
Program Total	0.00	113.1%	0.5	15.0%

Table 272: Res LI Appliances Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Clothes Washer	0.00	248.9%	0.5	17.4%
Dehumidifier	0.00	93.0%	0.5	18.5%
Refrigerator	0.00	110.2%	0.5	22.4%
Clothes Dryer	0.00	10.2%	0.5	33.9%
Freezer	0.00	91.2%	0.5	88.2%
Program Total	0.00	93.9%	0.5	15.0%

L.2 NET IMPACT EVALUATION

L.2.1 Net Impact Evaluation Methodology

The net-to-gross evaluation for the downstream Appliances measures was based on self-report data from program participants. This followed the self-report methodologies for free-ridership and spillover from the PA Evaluation Framework. Participants were randomly sampled since the savings for these sub-programs are relatively small and do not qualify for the higher level of rigor of high-impact measures. Individual free-ridership and spillover rates from the participant survey were weighted to adjust for sampling differences, non-response, and claimed energy savings to calculate overall estimates.

Overall NTG ratios were slightly lower than those found in the Phase II evaluation, as customers reported lower amounts of spillover. A net impact evaluation was not conducted for the Low-Income Appliances Initiative. An NTG ratio of 100% is used for reporting of net impacts and for cost effectiveness testing for the Low-Income Appliances Initiative.

L.2.2 Sampling

Tetra Tech sampled randomly from all participants on record in the Companies' tracking and reporting systems in early PY8Q4. The sample designs for the four EDCs are shown in Table 273, Table 274, Table 275, and Table 276 for Met-Ed, Penelec, Penn Power, and WPP.

Table 273: Res Appliances Initiative Net to Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,687	74	26.0%
Program Total	1,687	74	26.0%

Table 274: Res Appliances Initiative Net to Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	1,022	72	26.0%
Program Total	1,022	72	26.0%

Table 275: Res Appliances Initiative Net to Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	466	46	29.0%
Program Total	466	46	29.0%

Table 276: Res Appliances Initiative Net to Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
All Rebates	2,105	74	26.0%
Program Total	2,105	74	26.0%

L.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 277, Table 278, Table 279, and Table 280 for Met-Ed, Penelec, Penn Power, and WPP. In PY8, the free ridership rates tended to be approximately 10% higher than those obtained from the previous NTG study in PY6.

Table 277: Res Appliances Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	870	55.0%	0.0%	45.0%	12.6%
Program Total	870	55.0%	0.0%	45.0%	12.6%

Table 278: Res Appliances Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	814	49.0%	1.0%	52.0%	12.7%
Program Total	814	49.0%	1.0%	52.0%	12.7%

Table 279 Res Appliances Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	177	47.0%	3.0%	56.0%	15.1%
Program Total	177	47.0%	3.0%	56.0%	15.1%

Table 280 Res Appliances Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All Rebates	926	52.0%	1.0%	49.0%	12.6%
Program Total	926	52.0%	1.0%	49.0%	12.6%

Appendix M Evaluation Detail – Low Income Residential Appliance Turn-In Initiative

M.1 GROSS IMPACT EVALUATION

Gross impact evaluation for the Low Income Appliance Turn-In (LI ATI) Initiative included customer verification surveys and TRM calculations of measure-level impacts. There are four distinct measures offered by the program: refrigerator recycling, freezer recycling, room AC (RAC) recycling, and dehumidifier recycling.

M.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical for all four EDCs. A TRM-based calculation was performed for each entry in the tracking and reporting system. The parameter values from the TRM (or for dehumidifiers, IMP) algorithms were taken from project-specific data from the tracking and reporting system when applicable, from TRM defaults, or from customer verification surveys. For refrigerators and freezers, measure attributes that participants would readily recall were determined from participant surveys, and the average parameter values were applied to all measures. Apart from measure verification, these attributes include the part-use factor, the location in the home where the appliance was used, and for refrigerators, whether the appliance was a primary or secondary unit. Technical attributes of the appliances, such as the age, capacity, and configuration, as collected by ARCA, were taken from program tracking and reporting data. TRM or IMP default parameters were used for room air conditioners (RACs) and dehumidifiers. Table 281 lists the data sources for gross impact calculation algorithms.

Table 281: Data Sources for the LI ATI Initiative Gross Impact Evaluation

Measure	TRM Parameter	Data Source
Refrigerator, Freezer	Appliance Age	Tracking and Reporting System
Refrigerator, Freezer	Pre-1990	Tracking and Reporting System
Refrigerator, Freezer	Appliance Size / Capacity	Tracking and Reporting System
Refrigerator, Freezer	Configuration/Type	Tracking and Reporting System
Refrigerator	Primary Usage	Participant Surveys
Refrigerator, Freezer	Part Use Factor	Participant Surveys
Refrigerator, Freezer	In Unconditioned Space?	Participant Surveys
Refrigerator, Freezer	CDD and HDD	TRM - Zip Code Lookup
RAC	Capacity	TRM Default
RAC	EER	TRM Default
RAC	RAC EFLH	TRM - Zip Code Lookup
RAC	CF	TRM Default
Dehumidifier	Capacity	IMP Default
Dehumidifier	Region (to determine kWh)	TRM - Zip Code Lookup
All Measures	Verification Rate	Participant Surveys

Both telephone and online surveys were conducted in PY8. The two modes yielded compatible results, so each survey response for a given stratum was given equal weight. The number of completed surveys, response rates, and energy realization rates, as averaged over all four EDCs are listed in Table 282.

Table 282: LI ATI Initiative Gross Impact Evaluation Survey Mode Comparison

Survey Mode	N Appliances Surveyed	Verification Rate
Telephone	70	94.3%
Online	125	94.4%
Total	195	94.4%

The gross realization rates for energy savings were driven primarily by part-use factors for refrigerators and freezers as determined through verification surveys, and by the unit energy consumptions for refrigerators and freezers, as determined through measure attributes recorded in the tracking and reporting system. Although verification rates determined through surveys were approximately 100%, the realization rates are generally lower than 100% because the part-use factors are lower than the TRM default values, and the calculated unit energy consumptions were lower than what would expect from application of default parameters in the TRM.

M.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 283, Table 284, Table 285, and Table 286. The population sizes and sample sizes represent individual appliances rather than individual customers.

Table 283: LI ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	492	30	Survey (phone + online)
Freezers	124	10	
Dehumidifiers	20	5	
RACs	63	10	
Program Total	699	55	

Table 284: LI ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	713	29	Survey (phone + online)
Freezers	172	12	
Dehumidifiers	26	3	
RACs	79	14	
Program Total	990	58	

Table 285: LI ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	205	19	Survey (phone + online)
Freezers	49	5	
Dehumidifiers	10	2	
RACs	16	2	
Program Total	280	28	

Table 286: LI ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	545	34	Survey (phone + online)
Freezers	148	11	
Dehumidifiers	11	3	
RACs	35	6	
Program Total	739	54	

M.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 287, Table 288, Table 289, and Table 290 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 287: LI ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	464	86.9%	0.5	13.1%
Freezers	103	61.5%	0.5	22.8%
Dehumidifiers	5	279.9%	0.5	32.2%
RACs	7	108.9%	0.5	22.8%
Program Total	580	84.3%	0.5	9.5%

Table 288: LI ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	755	89.2%	0.5	13.4%
Freezers	145	75.4%	0.5	20.8%
Dehumidifiers	7	300.5%	0.5	41.6%
RACs	9	77.3%	0.5	19.2%
Program Total	916	88.4%	0.5	10.2%

Table 289: LI ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	222	74.6%	0.5	16.5%
Freezers	42	40.5%	0.5	32.2%
Dehumidifiers	3	158.8%	0.5	50.9%
RACs	2	33.4%	0.5	50.9%
Program Total	268	69.7%	0.5	10.4%

Table 290: LI ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	559	94.1%	0.5	12.3%
Freezers	128	64.9%	0.5	21.7%
Dehumidifiers	3	105.2%	0.5	41.6%
RACs	4	104.3%	0.5	29.4%
Program Total	693	88.8%	0.5	9.7%

M.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 291, Table 292, Table 293, and Table 294 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 291: LI ATI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.05	86.6%	0.5	13.1%
Freezers	0.01	61.5%	0.5	22.8%
Dehumidifiers	0.00	145.4%	0.5	32.2%
RACs	0.02	90.1%	0.5	22.8%
Program Total	0.08	85.2%	0.5	8.6%

Table 292: LI ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.08	88.9%	0.5	13.4%
Freezers	0.02	75.5%	0.5	20.8%
Dehumidifiers	0.00	181.7%	0.5	41.6%
RACs	0.02	77.0%	0.5	19.2%
Program Total	0.12	87.1%	0.5	8.9%

Table 293: LI ATI Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.02	74.6%	0.5	16.5%
Freezers	0.00	40.5%	0.5	32.2%
Dehumidifiers	0.00	90.9%	0.5	50.9%
RACs	0.00	33.4%	0.5	50.9%
Program Total	0.03	65.4%	0.5	9.3%

Table 294: LI ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.06	93.9%	0.5	12.3%
Freezers	0.01	65.2%	0.5	21.7%
Dehumidifiers	0.00	60.6%	0.5	41.6%
RACs	0.01	100.1%	0.5	29.4%
Program Total	0.09	89.4%	0.5	9.2%

M.2 NET IMPACT EVALUATION

M.2.1 Net Impact Evaluation Methodology

A net impact evaluation was not conducted for the Low-Income ATI initiative in PY8. An NTG ratio of 100% is used for calculation of portfolio-level net verified impacts and for net-level TRC calculations.

Appendix N – Residential Low-Income Direct Install Initiative

The Low-Income direct install initiative is comprised of the WARM program. The WARM program has 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. In PY8, project numbers have a one-to-one correspondence with account numbers for this 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 2017 Federal Poverty Guideline.

To join this program, new participants must submit their most recent Household Income Tax Return and pay stubs for the last 30 days to FirstEnergy to verify their income. FirstEnergy also maintains a list of known Low Income customers to verify customer's income.

N.1 GROSS IMPACT EVALUATION

N.1.1 Gross Impact Evaluation Methodology

Gross impact evaluation for the LI DI Initiative involved using TRM calculations for measures installed throughout the program. Unique measure calculations were performed in accordance with the 2016 PA TRM for each measure type. The impact evaluation process is described below.

N.1.1.1 Determination of In-Service Rates

In-service rates are calculated by using QA/QC forms created by a third-party inspector. Inspectors verified measure installations during a site visit after the project was completed. The verified installed quantities were compared to reported quantities to develop the in-service rates.

ADM performed 19 ride along site visits with three different QA/QC contractors to ensure that the contractors were performing the QA/QC visit properly. It was found that the QA/QC contractors were indeed looking for the right measures and measure quantities. ADM verified the same quantity of measures as the QA/QC contractors.

In-service rates were used in all savings calculations except air sealing and attic insulation measures.

N.1.1.2 TRM Calculations

For lighting measures, the efficient wattage ranges and bulb type are stated in equipment name columns of the customer tracking data. ADM used data from the PY8 upstream lighting program to determine average baseline watts and average energy efficient watts for each unique equipment name. The hours of use are assumed to be 3 hours because the bulb installation location is not known. TRM defaults were used for other portions of the calculation.

TRM defaults were used for the LED Nights Lights.

For refrigerator and freezer measures, each installation was assigned a category number using the equipment name and equipment description fields in the customer tracking data. If the name and description fields contradicted each other, the description field was used because the description column is more accurate and detailed. The implementer stated that the newly installed appliances are required to have the same size and configuration as the replaced appliance. Portions of the recycling part of the savings calculation come from the appliance turn-in program, other portions come from the determined category number. All appliances were assumed to be primary use. The default part use factors were used in the calculation.

For domestic hot water measures, first the water heater type was verified. The housing type identified in the customer tracking data is used in showerhead and aerator measure savings calculations. The percentage of residences with a clothes washer stated in the 2014 SWE PA residential baseline study is used in the water heater temperature setback measure calculation. The heat pump water heater measure calculation uses the efficient energy factor rating and volume stated in the customer tracking data or found in the supporting documentation. TRM defaults are assumed when specific values are not known or found. The PA 2016 TRM does not have a measure for electric resistance water heaters, therefore this type of measure saves zero energy.

Billing analysis was used to verify heating and cooling equipment types for accounts which received attic insulation. Once the heating and cooling equipment type was verified, the attic insulation savings calculation was completed. Insulation area, Rbase, Ree were provided in the project documentation. The HDDs, CDDs, and EFLHcool were found using the zip code lookup table to the projects reference city.

Residential air sealing measures used CFM50post and CFM50pre values found in the project audit forms. The heating equipment type was found in the customer tracking data and the cooling equipment type was in project audit forms.

The default savings values were used for the smart strip plug outlets. All smart strips were assumed tier 1 smart strips. The equip name or description columns were used to find the quantity of the plugs on the smart strips. Projects which have multiple smart strips installed were assigned the savings values for the “Unspecified use or multiple purchased” smart strips. The description column indicates if the smart strip was installed on an entertainment center. Descriptions which included phrases such as “TV”, “Living room”, or “entertain” were considered entertainment center installations.

Room air conditioner measures were evaluated using section 2.2.4 of the 2016 PA TRM. The capacity of the RAC is given the measures equipment name. All RACs were assumed to have louvered sides. The CEERbase and CEERee were found using the louvered sided assumption. The hour of use for room air conditioners were found using the zip code lookup table in the TRM.

Duct sealing measures were not evaluated because no supporting documentation was given to support the saving calculations. This did not adversely affect the program realization rates because there were very few duct sealing jobs¹⁴.

N.1.1.3 Billing Based Verification of Electric Space Heat

The customer tracking data often times misreported the heating and cooling equipment type for a given address which received attic insulation. To verify the heating and cooling equipment type, a billing analysis was performed on a sample of homes which received attic insulation measures. It was found that in many situations an address had an inoperable non-electric central furnace as the primary heat source and therefore uses electric resistance heaters to heat the residence. The billing analysis uses monthly billing data, actual weather data, house size, and energy intensity (btu/sqft for heating and tons/sqft for cooling) assumptions to predict the heating and cooling type. Once the heating and cooling equipment types are confirmed, insulation savings calculation were made. Attic insulation savings realization rates were developed and applied to the attic insulation measure population.

N.1.2 Sampling

The sampling strategy for gross impact evaluation is summarized in Table 295, Table 296, Table 297, and Table 298 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 295: LI DI Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,350	270	18	TRM Analysis with On-Site Verification
Medium Savings	815	485	17	
Low Savings	0	1,261	17	
Program Total		2,016	52	

Table 296: LI DI Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,350	384	21	TRM Analysis with On-Site Verification
Medium Savings	650	783	17	
Low Savings	0	1,979	17	
Program Total		3,146	55	

¹⁴ There are other measures with sparse implementation that are also not credited savings. One example is the installation of a clothes line. Although it is expected that this measure can reduce energy usage associated with clothes drying, it is difficult to quantify impacts to the level of certainty that would warrant a TRM addition or interim measure protocol.

Table 297: LI DI Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	1,300	131	16	TRM Analysis with On-Site Verification
Medium Savings	700	265	17	
Low Savings	0	580	17	
Program Total		976	50	

Table 298: LI DI Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
High Savings	2,600	109	12	TRM Analysis with On-Site Verification
Medium Savings	1,150	366	16	
Low Savings	0	1,085	18	
Program Total		1,560	46	

N.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 299, Table 300, Table 301, and Table 302 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 299: LI DI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1,350	522	109.1%	0.5	16%
Medium Savings	815	498	101.8%	0.5	17%
Low Savings	0	385	123.4%	0.5	17%
Program Total		1,404	110.5%	0.5	9.8%

Table 300: 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	1,350	712	105.2%	0.5	15%
Medium Savings	650	758	115.8%	0.5	17%
Low Savings	0	618	130.5%	0.5	17%
Program Total		2,088	116.5%	0.5	9.7%

Table 301: LI DI Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1,300	240	115.3%	0.5	17%
Medium Savings	700	252	120.0%	0.5	17%
Low Savings	0	201	130.7%	0.5	17%
Program Total		693	121.5%	0.5	9.8%

Table 302: Res DI Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	2,600	468	128.1%	0.5	20%
Medium Savings	1,150	601	115.9%	0.5	18%
Low Savings	0	518	126.9%	0.5	17%
Program Total		1,588	123.1%	0.5	10.4%

N.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown Table 303, Table 304, Table 305, and Table 306 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 303: LI DI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1,350	0.05	128.4%	0.5	16%
Medium Savings	815	0.05	109.2%	0.5	17%
Low Savings	0	0.04	132.4%	0.5	17%
Program Total		0.15	122.3%	0.5	9.8%

Table 304: 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	1,350	0.07	107.0%	0.5	15%
Medium Savings	650	0.08	116.6%	0.5	17%
Low Savings	0	0.06	137.1%	0.5	17%
Program Total		0.20	118.9%	0.5	9.7%

Table 305: LI DI Initiative Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
High Savings	1,300	0.03	116.7%	0.5	17%
Medium Savings	700	0.03	121.4%	0.5	17%
Low Savings	0	0.02	137.5%	0.5	17%
Program Total		0.07	124.4%	0.5	9.8%

Table 306: 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	2,600	0.05	120.9%	0.5	20%
Medium Savings	1,150	0.07	114.1%	0.5	18%
Low Savings	0	0.06	125.4%	0.5	17%
Program Total		0.17	119.7%	0.5	10.4%

N.2 NET IMPACT EVALUATION

N.2.1 Net Impact Evaluation Methodology

An independent net impact evaluation was not conducted for this initiative in PY8.

Appendix O Evaluation Detail – LI EE Kits Initiative

O.1 GROSS IMPACT EVALUATION

The Low Income EE Kits initiative has two sub-components. Low-income EE Kits, administered by PowerDirect, and the Low-Income School Education program, administered by (AMCG). Both program components are similar to their non-income-qualified counterparts described in Appendix E . Other than minor differences in kit contents, the low-income EE Kit program components differ from the general EE Kit program components in the way customers are targeted and enrolled. The Low Income EE Kit program from PowerDirect targets customers that are income qualified in the Companies’ customer information systems databases. The Low-Income Schools program targets schools in low-income areas.

O.1.1 Gross Impact Evaluation Methodology

ADM’s gross impact evaluation methodology was identical to the process described for EE Kits in Appendix E. The evaluation results are also comparable. Figure 27 shows the ISR by measure type for LI and non-LI EE Kits distributed by PowerDirect.

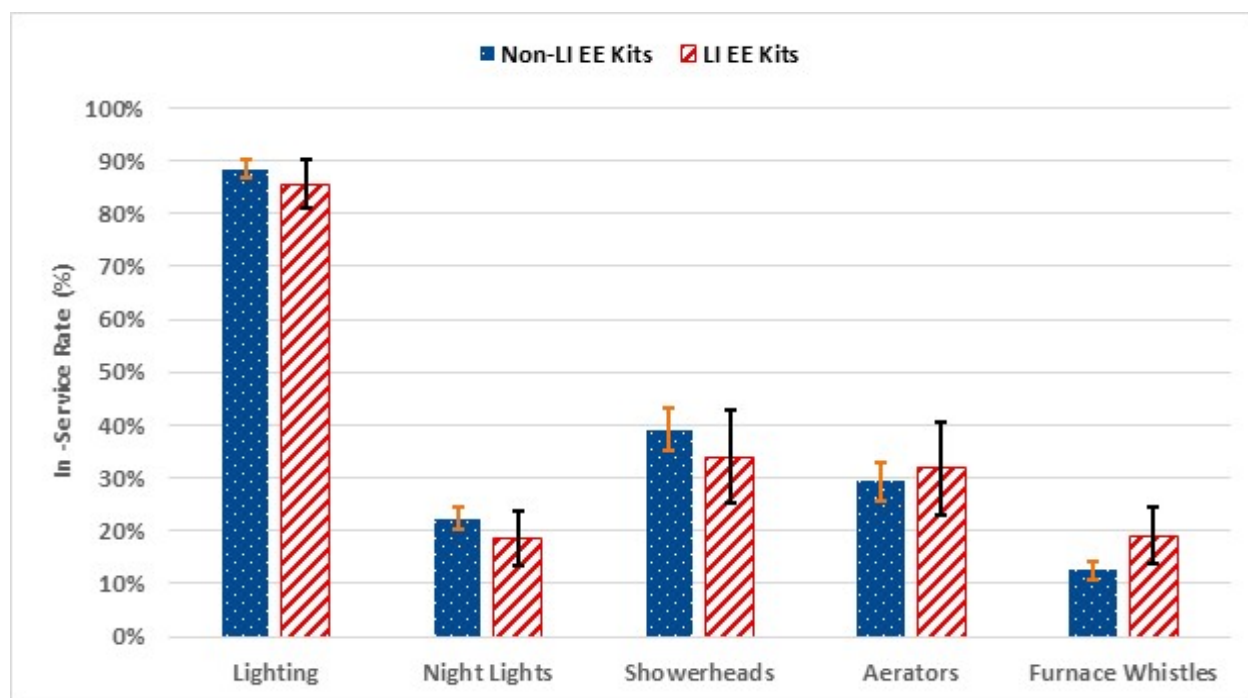


Figure 27: ISRs by measure for Non-LI and LI kits.

O.1.2 Sampling

Each kit type was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 307, Table 308, Table 309, and Table 310.

Table 307: LI EE Kits Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	3,117	19	Survey (phone + online)
LI EE Kits - Standard	5,100	16	
LI School Education Kits	1,453	27	
Program Total	9,670	62	

Table 308: LI EE Kits Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	3,288	16	Survey (phone + online)
LI EE Kits - Standard	5,930	16	
LI School Education Kits	3,561	37	
Program Total	12,779	69	

Table 309: LI EE Kits Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	810	14	Survey (phone + online)
LI EE Kits - Standard	1,559	16	
LI School Education Kits	463	24	
Program Total	2,832	54	

Table 310: LI EE Kits Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI EE Kits - Electric	3,075	18	Survey (phone + online)
LI EE Kits - Standard	4,188	15	
LI School Education Kits	3,839	41	
Program Total	11,102	74	

O.1.3 Determination of Low-Income Eligibility

The low-income EE Kits program component targets customers that are designated as income-qualified customers. The two programs, however, have different methods of identifying low-income customers. The Low Income EE Kits are delivered to customers that are known to be low-income qualified in the Companies' customer information systems databases. Customers may be identified as low-income due to past or present participation in income-qualified programs offered by the Companies. Such programs include the Act 129 WARM programs, the Low Income Home Energy Assistance Program, and Pennsylvania Customer Assistance Program. The School Education program component focuses on students in participating school within the Companies' service territories. Participation in the School Education program does not require the disclosure of account numbers. It is therefore not possible to match customers to Low Income status "SAP tags" in the customer information systems databases. As a result, the program implementer assigned all students in schools that are known to be in low-income

areas to the low-income program component, and all other students to the non-low-income component.

ADM included an income battery at the end of verification surveys for most residential measures. Survey results for the EE Kits and LI EE Kits are shown in Figure 28 below. According to the figure, the process of using income status SAP tags from the Companies' customer information system databases appears to separate low-income and non-low-income customers. There are a number of reasons to expect the first bin to lower than 100% for the low-income kits. For example, household income and the number of persons per household can change over time, and this may cause some shifting of customers both in and out of the income qualified group. Furthermore, we have noted lower response rates in low-income customers. Therefore, the survey may have overrepresented customers in the upper range of the qualified incomes. The SAP tag method of identifying low-income customers appears to result in a relatively pure set of income-qualified customers. However, it is noteworthy to consider the efficiency of identifying low-income customers. For example, the number of non-LI EE Kits is approximately five fold larger than the number of LI EE kits. Therefore, the first histogram bin for the non-LI EE kits represents almost as many actual customers as the first bin for the LI EE kits. This suggests that the low-income benefits are actually greater than reported by the Companies, and an ex-post rather than ex-ante reporting methodology may help to increase the efficiency of identifying low-income customers.

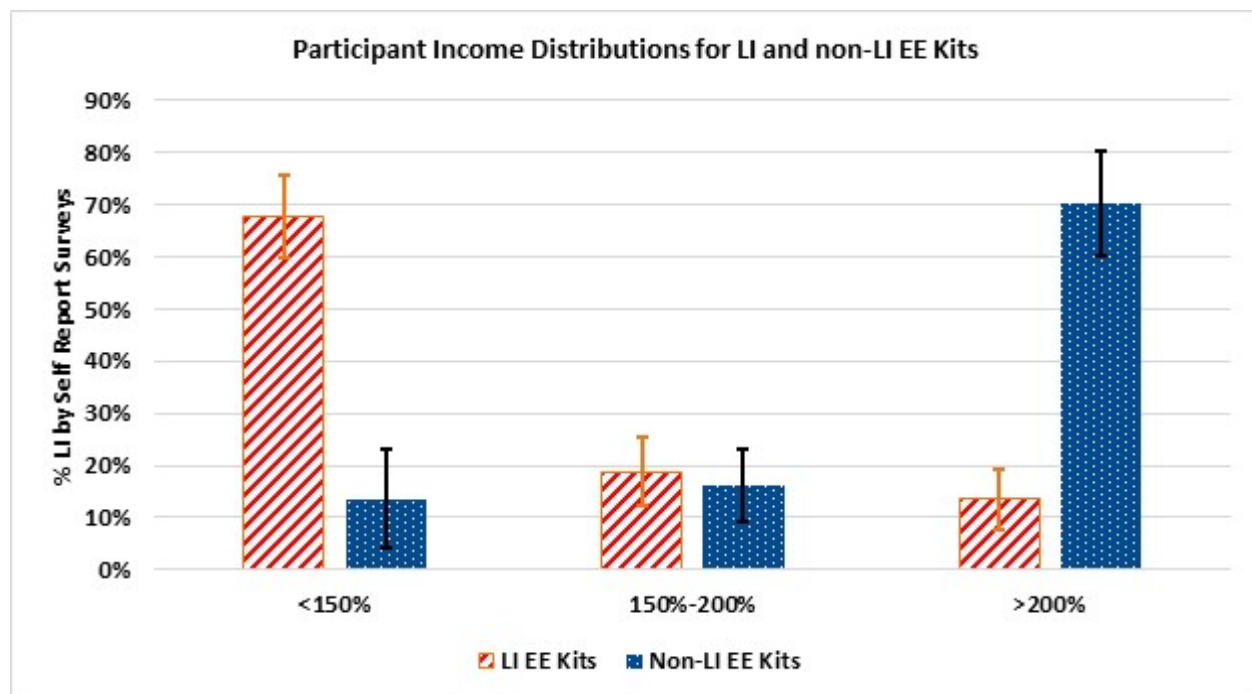


Figure 28: Reported income brackets for LI and Non-LI EE Kit Recipients

The school kits program does not have customer account numbers to cross reference against the Companies' customer information systems databases. As a result, the method for

identification of LI School Kit participants is indirect, as described above. Survey results for the School Kits and LI School Kits are shown in Figure 29 below. According to the figure, the indirect process of assigning an “all or none” low-income status to students at schools does not seem to differentiate between income qualified and non-income qualified customers.

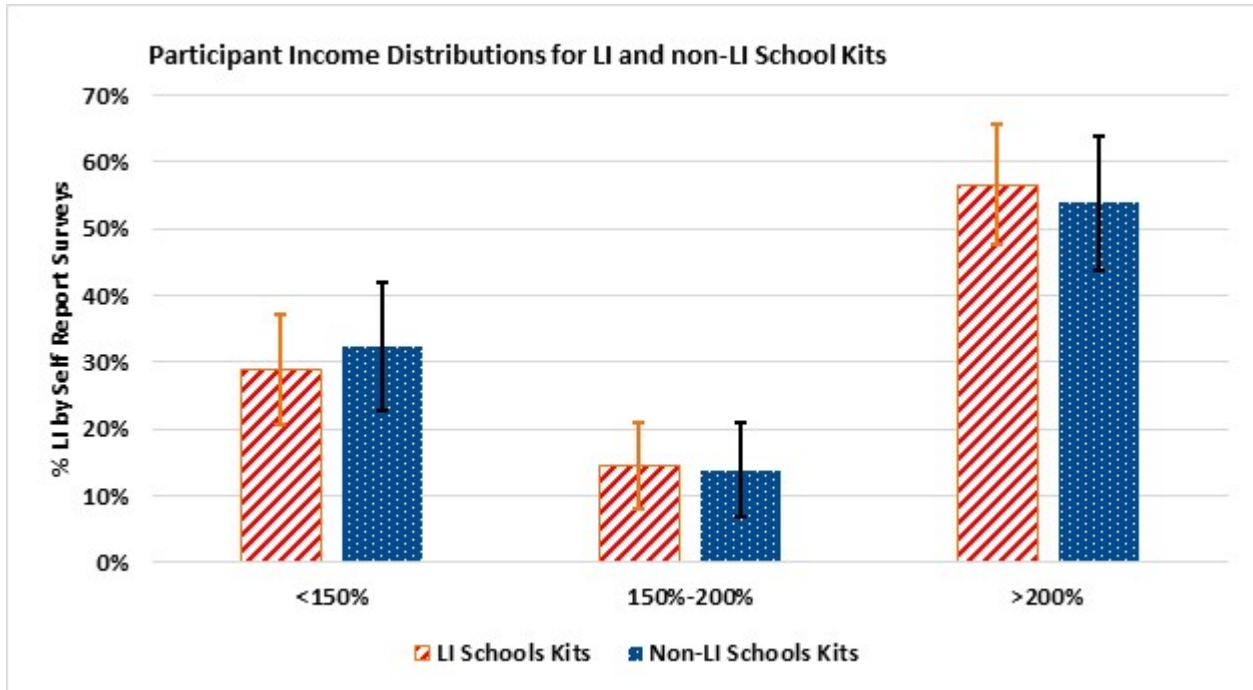


Figure 29: Reported income brackets for LI and Non-LI School Kit Recipients

According to the survey results it is clear that 100% of the LI School Kits customers are not low-income. On the other hand, a significant number of low-income customers are classified as non-income-qualified. ADM decided that robust reporting of the low-income contribution of the School Kits program requires an independent assessment of the number of low-income customers served by the School Education Program Component. Instead of using an all-or-none approach, we estimated the low-income fraction from the percentages of students at each school that are eligible for free or reduced priced lunches, according to the Pennsylvania Department of Education¹⁵. The Department of Education reports the percent of students at each school that are eligible for free or reduced price lunches. Students from families with incomes below 130% of the Federal Poverty line are eligible for free lunches, while students from families with incomes below 185% of the Federal Poverty line are eligible for reduced price lunches. ADM interpolated between these two points by taking half of the number students that qualify for reduced price lunches (but not free lunches) and adding this value to the number of students that qualify for free lunches at each school. The results are shown below. Accordingly,

¹⁵ The report can be found on the Pennsylvania Department of Education web site: http://www.education.pa.gov/_layouts/download.aspx?SourceUrl=http://www.education.pa.gov/Documents/Teachers-Administrators/Food%20and%20Nutrition/Reports/2015-2016%20Building%20Data%20Report.xls

the School Education Kit program’s verified contribution to the low-income sector is taken to be a portion of the verified savings for the low-income component, and a portion of the verified savings for the non-low-income component.

Table 311 – Low Income fractions determined from PA Dept. of Education data

EDC	Income Classification	% Low Income
Met-Ed	Res LI	53.20%
Met-Ed	Res	36.69%
Penelec	Res LI	45.28%
Penelec	Res	54.05%
Penn Power	Res LI	45.14%
Penn Power	Res	57.82%
WPP	Res LI	41.36%
WPP	Res	30.67%

A detailed breakdown of reported and verified impacts for the School Education Kits program component is provided in Table 312 below.

Table 312 – Detailed Comparison of Reported and Verified Impacts for the School Education Kits Program

EDC	Reported Low-Income Status	Low-Income Status Assigned by ADM	Participants	Reported kWh	Reported kW	Verified kWh	Verified kW
Met-Ed	1	0	680	218,734	24.9	259,040	30.4
Met-Ed	1	1	773	248,649	28.3	294,467	34.5
Met-Ed	0	0	1,132	369,341	42.6	384,044	45.2
Met-Ed	0	1	656	214,035	24.7	222,556	26.2
Penelec	1	0	1,948	680,389	67.6	724,324	75.6
Penelec	1	1	1,613	563,118	55.9	599,480	62.6
Penelec	0	0	959	336,181	34.4	344,071	37.2
Penelec	0	1	1,128	395,424	40.5	404,705	43.7
Penn Power	1	0	254	88,147	9.8	87,285	11.0
Penn Power	1	1	209	72,530	8.1	71,821	9.1
Penn Power	0	0	410	142,987	16.2	143,893	17.4
Penn Power	0	1	562	195,996	22.2	197,239	23.9
WPP	1	0	2,251	766,834	94.0	863,499	109.2
WPP	1	1	1,588	540,974	66.3	609,168	77.1
WPP	0	0	1,774	608,704	75.0	661,104	88.3
WPP	0	1	785	269,289	33.2	292,470	39.1

O.1.4 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 313, Table 314, Table 315, and Table 316 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 313: EE Kits Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	1,302	126.6%	0.5	16.5%
LI EE Kits - Standard	1,540	112.6%	0.5	18.0%
LI School Education Kits	467	118.4%	0.5	13.7%
Program Total	3,309	119.0%	0.5	10.7%

Table 314: EE Kits Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	1,456	132.1%	0.5	18.0%
LI EE Kits - Standard	1,942	81.2%	0.5	18.0%
LI School Education Kits	1,244	106.5%	0.5	11.8%
Program Total	4,641	103.9%	0.5	9.8%

Table 315: EE Kits Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	358	131.1%	0.5	19.1%
LI EE Kits - Standard	508	121.3%	0.5	17.9%
LI School Education Kits	161	99.0%	0.5	14.3%
Program Total	1,026	121.2%	0.5	11.6%

Table 316: EE Kits Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	1,339	114.9%	0.5	16.9%
LI EE Kits - Standard	1,338	121.3%	0.5	18.6%
LI School Education Kits	1,308	112.6%	0.5	11.2%
Program Total	3,986	116.3%	0.5	9.3%

O.1.5 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 317, Table 318, Table 319, and Table 320 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 317: EE Kits Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.14	131.9%	0.5	16%
LI EE Kits - Standard	0.17	111.8%	0.5	18%
LI School Education Kits	0.05	122.1%	0.5	14%
Program Total	0.37	121.0%	0.5	11%

Table 318: EE Kits Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.14	142.9%	0.5	18%
LI EE Kits - Standard	0.19	86.3%	0.5	18%
LI School Education Kits	0.12	111.9%	0.5	12%
Program Total	0.46	110.9%	0.5	10%

Table 319: EE Kits Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.04	124.8%	0.5	19%
LI EE Kits - Standard	0.06	128.9%	0.5	18%
LI School Education Kits	0.02	112.1%	0.5	14%
Program Total	0.11	124.8%	0.5	11%

Table 320: EE Kits Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
LI EE Kits - Electric	0.15	111.3%	0.5	17%
LI EE Kits - Standard	0.16	127.0%	0.5	19%
LI School Education Kits	0.16	116.2%	0.5	11%
Program Total	0.48	118.3%	0.5	9%

O.2 NET IMPACT EVALUATION

A net impact evaluation was not conducted for the LI EE Kits Initiative in PY8.

Appendix P Evaluation Detail – Commercial and Industrial Lighting Initiative

P.1 GROSS IMPACT EVALUATION

Gross impact evaluation for the Commercial and Industrial Lighting (C&I Lighting) Initiative involved stratified sampling, on-site verifications, and TRM Appendix C calculations with primary data collection for lighting hours of use for medium savings and high savings projects, and application of TRM deemed hours of operation for low savings projects.

P.1.1 Gross Impact Evaluation Methodology

As a first step, projects are placed into one of four sampling strata as described in the next section. Each sampled lighting project first undergoes a desk review. The desk review includes reconciliation of invoices, fixture specification sheets (cut sheets), and re-calculating reported savings using TRM algorithms and/or ex-ante assumptions, and identifying key parameters to be researched in the M&V plan. One aspect of the desk review in PY8 is to transfer the calculation data into the PA TRM's Appendix C calculator. Sodexo processes rebates with their own Appendix C style calculator. Upon SWE's request, Sodexo developed a method of completing and filing an Appendix C calculator for all rebated lighting projects in late PY8. Our feedback to Sodexo was to make a clean transition to Appendix C inclusion at PY9 to avoid a different rebate processing scheme for the last batch of projects in PY8¹⁶. The transferring of the data to Appendix C is a remediation step to ensure that all verified impacts for lighting projects are derived using the 2016 TRM's Appendix C.

Evaluation of all but the simplest of projects requires a site-specific M&V plan (SSMVP). The first step in the M&V planning process is to check that the project is sufficiently documented. For example, contractors working on large projects often have detailed, space-by-space inventories of the baseline and new lighting fixtures. If such detailed information is found to be lacking, ADM analysts will contact the applicant or the contractor directly, or through a request to the ICSP, and ask if such documentation is available.

The desk review and M&V plan inform the data acquisition activities needed to evaluate the sampled project. For most lighting projects, the default activities are on-site verification and logging hours of use. Most lighting projects are metered unless there is a good reason not to meter. However, all projects with ex ante savings under 25 MWh are evaluated with TRM hours of use, without exception. Although there can be considerable variation in project-specific impacts as calculated by the TRM and by primary data collection, the two methodologies produce compatible results at the aggregate level.

¹⁶ Our recommendation was based on the principle that inclusion of two different lighting calculators in a program year may complicate sampling, as project realization rates may be related to inclusion of the TRM Appendix C calculator. In practice, the gross impacts as calculated with the two calculators are essentially identical.

In rare cases, the desk review process may indicate that an on-site visit would not add sufficient value to the evaluation effort. In such cases, a verification interview may suffice to reduce uncertainty regarding the project. Where loggers are used, data analysis is finalized following their retrieval. Billing analysis is a viable option for certain projects, and in some cases the verified results are determined wholly or partially by billing analysis. Figure 30 shows the fraction of verified energy savings, as averaged over the four PA Companies, by primary evaluation activities. Details regarding gross impact evaluation activities for each sampled project can be found in Appendix B.

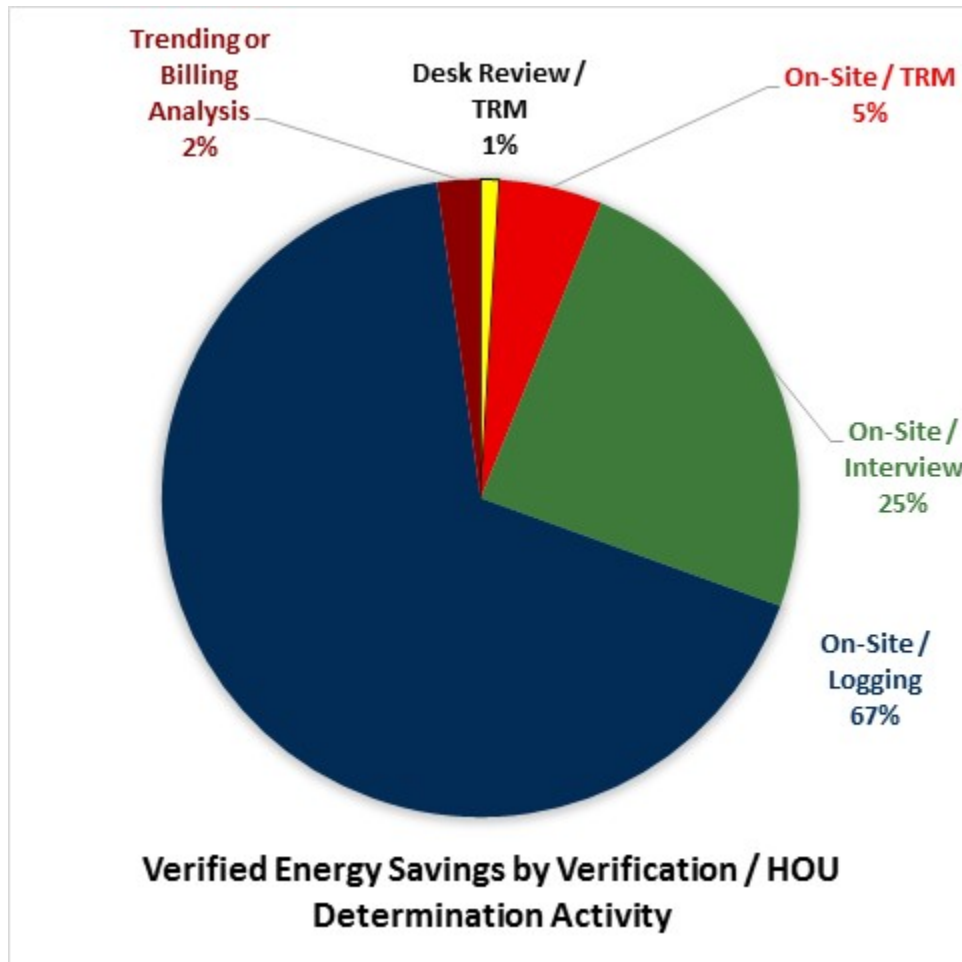


Figure 30 – Fraction of verified energy savings by evaluation activity.

As a final step in lighting project analysis, ADM analysts determine the incremental material and labor costs. In estimating the material and labor costs, preference is given first to invoices, then to the SWE incremental cost database, and then to the cost values from the CA DEER database, then to the costs used in the EDCs' EE&C plans.

P.1.2 Sampling

Projects are placed into four strata. The first stratum or “certainty” stratum consists of projects that are expected to result in energy savings in excess of 750 MWh. All of these projects are sampled for evaluation, and nearly all of them are evaluated prior to rebate approval. Therefore, the gross realization rate for the certainty stratum is essentially 100% by design, although reported impacts may at times be lower than the 750 MWh threshold, as the threshold is on ex ante MWh, while ex post MWh are reported for these projects. The remaining projects are placed into three sampling strata according to their reported energy impacts. The sample design is not optimized for efficiency in the sense of achieving the desired precision with the absolute minimum number of sample points. Rather, the sample is designed to facilitate specific evaluation protocols that are based on energy savings thresholds. For example, projects in the certainty stratum are evaluated with the highest level of rigor, and evaluated in advance of rebate approval to ensure that customers’ incentives are determined from verified energy savings. The smallest projects, those with expected impacts under 25 MWh, are placed in a separate stratum. For these projects, hours of use are determined by application of deemed hours in the PA TRM. The sample designs for the four EDCs are shown in Table 321, Table 322, Table 323, and Table 324.

Table 321: CI Lighting Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Lighting-Certainty	750	6	6	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	23	11	
Lighting-2	25	121	10	
Lighting-1	0	199	13	
Program Total	n/a	349	40	

Table 322: CI Lighting Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Lighting-Certainty	750	1	1	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	30	12	
Lighting-2	25	200	15	
Lighting-1	0	561	16	
Program Total	n/a	792	44	

Table 323: CI Lighting Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Lighting-Certainty	750	1	1	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	5	4	
Lighting-2	25	57	10	
Lighting-1	0	353	15	
Program Total	n/a	416	30	

Table 324: CI Lighting Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Lighting-Certainty	750	0	0	Desk Review, On-Site Verification, Logging HOU
Lighting-3	250	30	14	
Lighting-2	25	225	15	
Lighting-1	0	384	12	
Program Total	n/a	639	41	

P.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 325, Table 326, Table 327, and Table 328 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 31 plots the verified energy savings against the reported energy savings for all evaluated lighting projects for all in PY8. The figure includes data points from all four EDCs, and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficient of variation of 0.5, but the actual error ratios tend to be somewhat lower than 0.5.

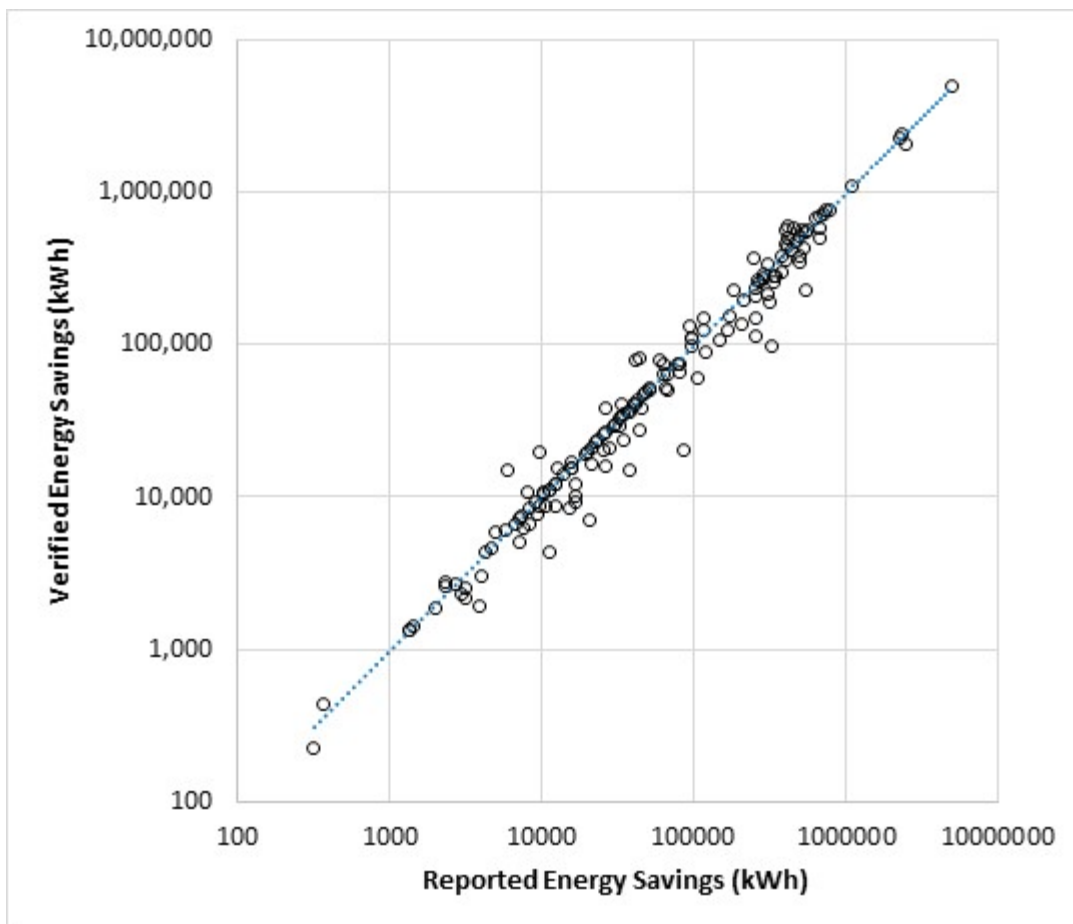


Figure 31: Verified vs. Reported Energy Savings for Sampled Lighting Projects.

Table 325: CI Lighting Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	11,769	99.8%	0.5	0%
Lighting-3	250	9,321	88.5%	0.5	16%
Lighting-2	25	8,279	82.2%	0.5	22%
Lighting-1	0	2,080	92.8%	0.5	19%
Program Total	n/a	31,450	91.3%	0.5	6.4%

Table 326: CI Lighting Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	558	100.0%	0.5	0%
Lighting-3	250	10,336	87.7%	0.5	16%
Lighting-2	25	12,745	98.9%	0.5	18%
Lighting-1	0	4,409	89.3%	0.5	18%
Program Total	n/a	28,049	93.3%	0.5	9.9%

Table 327: CI Lighting Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	2,447	85.1%	0.5	0%
Lighting-3	250	1,824	110.5%	0.5	16%
Lighting-2	25	3,317	101.6%	0.5	21%
Lighting-1	0	2,812	83.7%	0.5	18%
Program Total	n/a	10,400	94.4%	0.5	8.5%

Table 328: CI Lighting Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	0	0.0%	0.5	0%
Lighting-3	250	9,895	96.4%	0.5	14%
Lighting-2	25	12,351	102.7%	0.5	18%
Lighting-1	0	3,726	105.3%	0.5	20%
Program Total	n/a	25,972	100.7%	0.5	10.6%

P.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 329, Table 330, Table 331, and Table 332 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 329: CI Lighting Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	1.50	104.7%	0.5	0%
Lighting-3	250	1.10	106.0%	0.5	16%
Lighting-2	25	1.16	108.6%	0.5	22%
Lighting-1	0	0.28	94.2%	0.5	19%
Program Total	n/a	4.05	105.4%	0.5	8.3%

Table 330: CI Lighting Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	0.09	109.2%	0.5	0%
Lighting-3	250	1.27	109.6%	0.5	16%
Lighting-2	25	2.01	104.0%	0.5	18%
Lighting-1	0	0.64	79.7%	0.5	18%
Program Total	n/a	4.01	102.0%	0.5	11.1%

Table 331: CI Lighting Initiative Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	0.29	99.1%	0.5	0%
Lighting-3	250	0.35	102.8%	0.5	16%
Lighting-2	25	0.51	123.1%	0.5	21%
Lighting-1	0	0.34	79.3%	0.5	18%
Program Total	n/a	1.49	103.6%	0.5	10.1%

Table 332: CI Lighting Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Lighting-Certainty	750	0.00	0.0%	0.5	0%
Lighting-3	250	1.29	100.1%	0.5	14%
Lighting-2	25	1.23	107.0%	0.5	18%
Lighting-1	0	0.55	96.5%	0.5	20%
Program Total	n/a	3.07	102.2%	0.5	10.3%

P.2 NET IMPACT EVALUATION

P.2.1 Net Impact Evaluation Methodology

The net-to-gross (NTG) evaluation assessed free ridership and spillover through participant customer and vendor surveys following the Pennsylvania Evaluation Framework. NTG was assessed for each EDC at the major measure category level (i.e., custom, lighting, and other prescriptive), as custom and lighting qualified as high-impact measures in PY8.

Free ridership was assessed through the participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. Customer-identified influential vendors were asked a series of questions assessing the program's influence on their recommendations to the customer(s) who identified them as being influential in their decision-making process to support the free-ridership assessment. Similar to the participant customer self-report methodology, an "Influence Component" score was calculated for each influential vendor specific to each project. If the vendor's influence score is greater than the customer's score from the participant survey, the vendor score replaced the customer score in the self-report free-ridership scoring algorithm, under the rationale that the vendor's recommendation was a program-attributable factor.

In addition to free-ridership, the NTG evaluation also assessed both participant spillover and nonparticipant spillover. Participant spillover was assessed through participant customer self-reports. Nonparticipant spillover was estimated from vendor self-reports at the measure-category level (i.e., lighting, HVAC, and food service). Following the Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates, as vendors on average reported that their sales of program-qualifying equipment accounted for less than 90 percent of their total sales of high-efficiency products.

Individual free-ridership and spillover rates from the customer and vendor surveys were weighted to adjust for proportional sampling differences, non-response, and claimed energy savings to calculate overall estimates.

P.2.2 Sampling

Net impact evaluation used the same sampling scheme as gross impact evaluation. Stratification by MWh was necessary because commercial and industrial programs tend to concentrate impacts among a relatively small number of high-savings projects. The high fraction of program verified impacts in the certainty strata means that attainment of relative precision targets hinge on achieving a census or near-census of those strata. Tetra Tech attempted to reach all customers in the "Certainty" strata, but not all decision makers for these customers responded to the survey. Despite relatively high response rates and large sample sizes, attainment of the 85/15 sampling targets was difficult – particularly for Met-Ed. On the other hand, the FirstEnergy implementation team has the benefit of obtaining one independent net-to-gross estimate for each of their EDCs. The sample designs for the four EDCs are shown in Table 333, Table 334, Table 335, and Table 336 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 333: CI Lighting Initiative Net to Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Lighting-Certainty	6	2	33.3%
Lighting-3	23	4	n/a
Lighting-2	121	23	n/a
Lighting-1	199	34	n/a
Program Total	349	63	42.0%

Table 334: CI Lighting Initiative Net to Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Lighting-Certainty	1	0	0.0%
Lighting-3	30	9	n/a
Lighting-2	200	33	n/a
Lighting-1	561	61	n/a
Program Total	792	103	44.0%

Table 335: CI Lighting Initiative Net to Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Lighting-Certainty	1	1	100.0%
Lighting-3	5	2	n/a
Lighting-2	57	12	n/a
Lighting-1	353	30	n/a
Program Total	416	45	38.0%

Table 336: CI Lighting Initiative Net to Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Lighting-Certainty	0	0	n/a
Lighting-3	30	7	23.3%
Lighting-2	225	22	9.8%
Lighting-1	384	41	10.7%
Program Total	639	70	41.0%

P.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 337, Table 338, Table 339, and Table 340 for Met-Ed, Penelec, Penn Power, and WPP respectively. The net-to-gross results show that overall net-to-gross for the commercial lighting is relatively high, with an average of 77% across the four EDCs.

Table 337: CI Lighting Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Lighting-Certainty	11,740	62.5%	1.5%	39.0%	37.6%
Lighting-3	8,250	5.8%	2.4%	96.6%	29.6%
Lighting-2	6,802	28.6%	1.9%	73.3%	12.2%
Lighting-1	1,931	24.9%	3.5%	78.6%	10.2%
Program Total	28,723	35.6%	2.0%	66.3%	15.7%

Table 338: CI Lighting Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Lighting-Certainty	558	20.1%	1.5%	81.4%	100.0%
Lighting-3	9,067	20.1%	1.5%	81.4%	18.2%
Lighting-2	12,607	18.3%	3.7%	85.5%	10.4%
Lighting-1	3,936	23.6%	16.1%	92.4%	7.9%
Program Total	26,168	19.7%	4.8%	85.0%	8.2%

Table 339 CI Lighting Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio
Lighting-Certainty	2,083	37.5%	1.5%	64.0%
Lighting-3	2,015	12.5%	1.5%	89.0%
Lighting-2	3,371	28.9%	3.7%	74.8%
Lighting-1	2,352	32.0%	5.9%	74.0%
Program Total	9,822	28.1%	3.3%	75.2%

Table 340 CI Lighting Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Lighting-Certainty	0	n/a	n/a	#VALUE!	0.0%
Lighting-3	9,542	27.1%	2.5%	75.4%	21.6%
Lighting-2	12,690	17.1%	5.6%	88.5%	13.2%
Lighting-1	3,922	26.3%	9.0%	82.7%	9.6%
Program Total	26,155	22.1%	5.0%	82.9%	#VALUE!

Appendix Q Evaluation Detail – Commercial and Industrial Custom Initiative

Q.1 GROSS IMPACT EVALUATION

Gross impact evaluation for the Commercial and Industrial Custom (C&I Custom) Initiative involved stratified sampling, on-site verifications, and project-specific data collection and calculations.

Q.1.1 Gross Impact Evaluation Methodology

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

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

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

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

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

General Space and Process Cooling Improvements: Data acquisition for such projects involves the determination of independent variables that predict the cooling load (units produced, degree-days, etc.) along with utility bills, EMS trending data, or sub-metering. The data analysis may involve regressions or energy simulation models.

In some cases, the desk review process may indicate that an on-site visit would not add sufficient value to the evaluation effort. For example, billing analysis or trending data analysis is a viable option for certain projects. Figure 32 shows the fraction of verified energy savings, as averaged over the four PA Companies, by primary evaluation activities. Details regarding gross impact evaluation activities for each sampled project can be found in Appendix B.

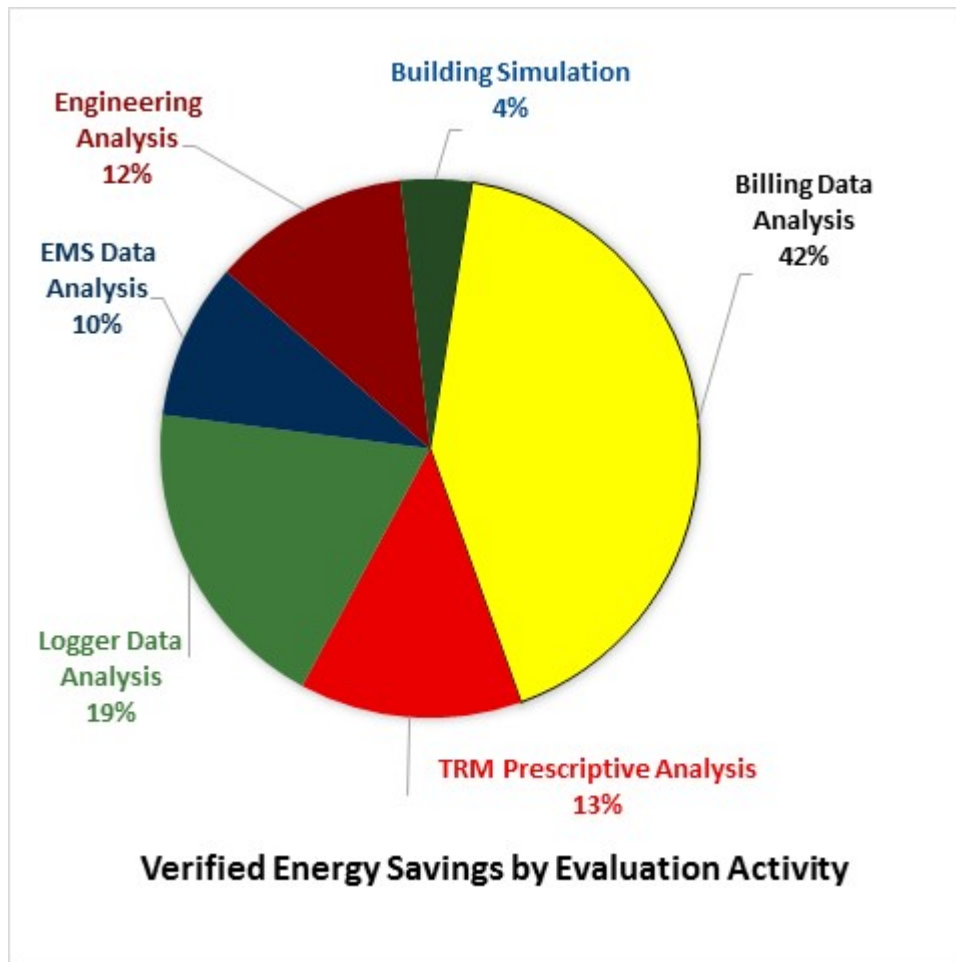


Figure 32 – Fraction of verified energy savings by evaluation activity.

As a final step in custom project analysis, ADM analysts determine the incremental material and labor costs. In estimating the material and labor costs, preference is given first to invoices, then

to the SWE incremental cost database, and then to the cost values from the CA DEER database, then to the costs used in the EDCs' EE&C plans.

Q.1.2 Sampling

Projects are placed into three strata. The first stratum or “certainty” stratum consists of projects that are expected to result in energy savings in excess of 500 MWh. All of these projects are sampled for evaluation, and nearly all of them are evaluated prior to rebate approval. Therefore, the gross realization rate for the certainty stratum is essentially 100% by design, although reported impacts may at times be lower than the 750 MWh threshold, as the threshold is on ex ante MWh, while ex post MWh are reported for these projects. The remaining projects are placed into two sampling strata according to their reported energy impacts. The sample design is not optimized for efficiency in the sense of achieving the desired precision with the absolute minimum number of sample points. Rather, the sample is designed to facilitate specific evaluation protocols that are based on energy savings thresholds. For example, the certainty stratum is evaluated with the highest level of rigor, and are evaluated in advance of rebate approval to ensure that customers’ incentives are determined from verified energy savings. The next largest projects, those with expected impacts above 250 MWh, are placed in a separate stratum and evaluated with primary data collection and a high level of rigor. Projects with impacts below 250 MWh are assigned a level of rigor assigned on a case by case basis. In this stratum, if the weighted MWh uncertainty (as determined from the sample scheme and a review of project documentation) is low, then basic rigor is preferred. The sample designs for the four EDCs are shown in Table 341, Table 342, Table 343, and Table 344.

Table 341: CI Custom Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	4	4	On-Site Verification, Metering
Custom-2	250	2	2	
Custom-1	0	34	17	
Program Total	n/a	40	23	

Table 342: CI Custom Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	2	2	On-Site Verification, Metering
Custom-2	250	2	2	
Custom-1	0	54	9	
Program Total	n/a	58	13	

Table 343: CI Custom Initiative Gross Impact Sample Design for Penn Power

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	2	2	On-Site Verification, Metering
Custom-2	250	2	2	
Custom-1	0	16	13	
Program Total	n/a	20	17	

Table 344: CI Custom Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Custom-Certainty	500	2	2	On-Site Verification, Metering
Custom-2	250	2	2	
Custom-1	0	43	10	
Program Total	n/a	47	14	

Q.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 345, Table 346, Table 347, and Table 348 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 33 plots the verified energy savings against the reported energy savings for all evaluated lighting projects for all in PY8. The figure includes data points from all four EDCs, and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficient of variation of 0.5, but the actual error ratios tend to be somewhat lower than 0.5.

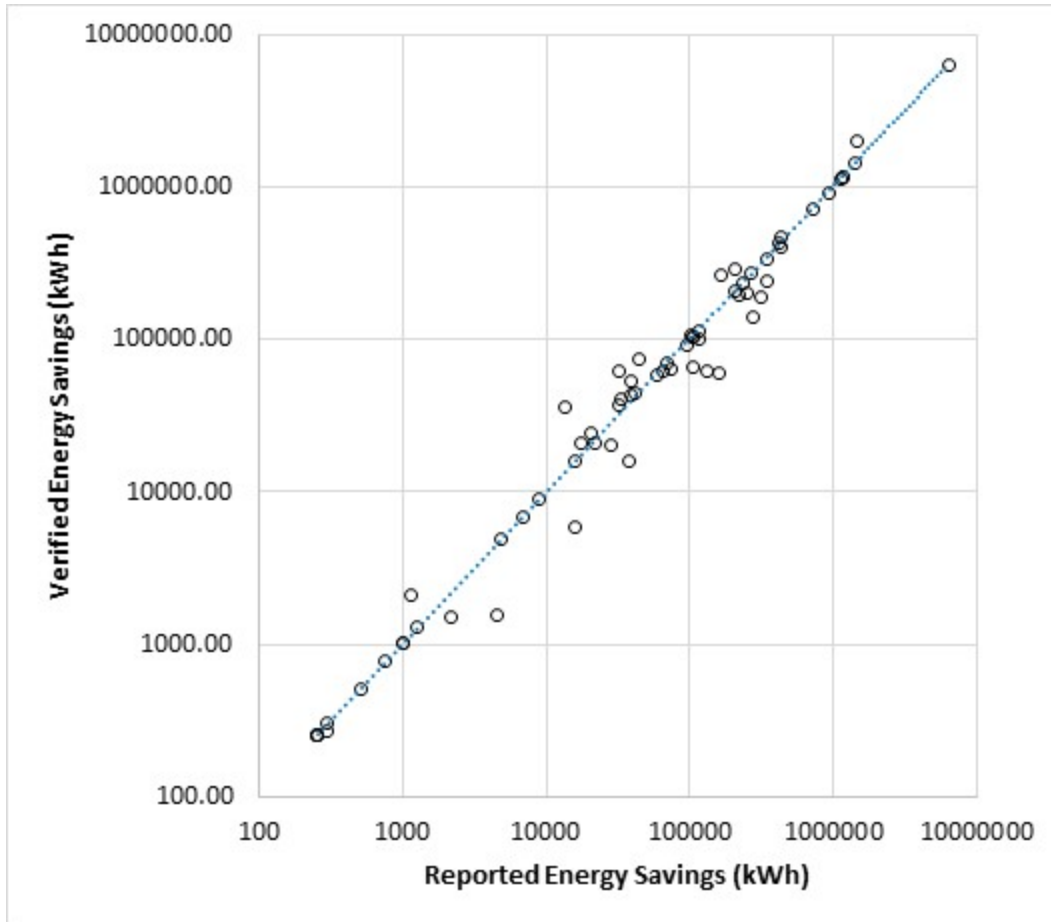


Figure 33: Verified vs. Reported Energy Savings for Sampled Custom Projects.

Table 345: CI Custom Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-Certainty	500	9,386	100.0%	0.5	0%
Custom-2	250	548	74.8%	0.5	0%
Custom-1	0	1,950	128.5%	0.5	12%
Program Total	n/a	11,884	103.5%	0.5	2.6%

Table 346: CI Custom Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-Certainty	500	2,076	100.0%	0.5	0%
Custom-2	250	1,734	127.9%	0.5	0%
Custom-1	0	2,463	59.2%	0.5	22%
Program Total	n/a	6,272	91.7%	0.5	5.1%

Table 347: CI Custom Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-Certainty	500	656	101.6%	0.5	0%
Custom-2	250	787	82.3%	0.5	0%
Custom-1	0	1,278	84.9%	0.5	9%
Program Total	n/a	2,721	88.1%	0.5	3.4%

Table 348: CI Custom Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Custom-Certainty	500	1,779	100.0%	0.5	0%
Custom-2	250	742	87.8%	0.5	0%
Custom-1	0	1,371	97.1%	0.5	20%
Program Total	n/a	3,891	96.7%	0.5	6.8%

Q.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 349, Table 350, Table 351, and Table 352 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 349: CI Custom Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-Certainty	500	1.63	100.0%	0.5	0%
Custom-2	250	0.04	72.6%	0.5	0%
Custom-1	0	0.25	126.1%	0.5	12%
Program Total	n/a	1.93	102.7%	0.5	2.0%

Table 350: CI Custom Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-Certainty	500	0.16	100.0%	0.5	0%
Custom-2	250	0.31	82.5%	0.5	0%
Custom-1	0	0.33	13.8%	0.5	22%
Program Total	n/a	0.80	57.7%	0.5	1.2%

Table 351: CI Custom Initiative Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-Certainty	500	0.03	335.6%	0.5	0%
Custom-2	250	0.09	85.7%	0.5	0%
Custom-1	0	0.14	87.8%	0.5	9%
Program Total	n/a	0.26	117.6%	0.5	4.0%

Table 352: CI Custom Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Custom-Certainty	500	0.43	100.0%	0.5	0%
Custom-2	250	0.08	97.4%	0.5	0%
Custom-1	0	0.22	66.8%	0.5	20%
Program Total	n/a	0.74	89.6%	0.5	4.0%

Q.2 NET IMPACT EVALUATION

Q.2.1 Net Impact Evaluation Methodology

The net-to-gross (NTG) evaluation assessed free ridership and spillover through participant customer and vendor surveys following the Pennsylvania Evaluation Framework. NTG was assessed for each EDC at the major measure category level (i.e., custom, lighting, and other prescriptive), as custom and lighting qualified as high-impact measures in PY8.

Free ridership was assessed through the participant customer self-reports following the standardized self-report methodology for downstream programs, enhanced with influential vendor reports. Customer-identified influential vendors were asked a series of questions assessing the program's influence on their recommendations to the customer(s) who identified them as being influential in their decision-making process to support the free-ridership assessment. Similar to the participant customer self-report methodology, an "Influence Component" score was calculated for each influential vendor specific to each project. If the vendor's influence score is greater than the customer's score from the participant survey, the vendor score replaced the customer score in the self-report free-ridership scoring algorithm, under the rationale that the vendor's recommendation was a program-attributable factor.

In addition to free-ridership, the NTG evaluation also assessed both participant spillover and nonparticipant spillover. Participant spillover was assessed through participant customer self-reports. Nonparticipant spillover was estimated from vendor self-reports at the measure-category level (i.e., lighting, HVAC, and food service). Following the Evaluation Framework, total spillover was calculated by summing the participant and vendor-reported nonparticipant spillover rates, as vendors on average reported that their sales of program-qualifying equipment accounted for less than 90 percent of their total sales of high-efficiency products.

Individual free-ridership and spillover rates from the customer and vendor surveys were weighted to adjust for proportional sampling differences, non-response, and claimed energy savings to calculate overall estimates.

Q.2.2 Sampling

Net impact evaluation used the same sampling scheme as gross impact evaluation. For the custom initiative, the concentration of savings in the largest projects is even more pronounced. For example, 75% of the verified savings in Penelec's custom initiative were attributable to the four largest projects. Although Tetra tech managed to interview three of these four customers, and 15 of the remaining 54 customers, the relative precision on net verified impacts was still nearly 32%. For custom projects in particular, we have noticed that some large customers hire energy services companies (ESCOs) to act as a proxy for Act 129. While the ESCOs are generally knowledgeable about project details and are generally very effective at providing M&V access for gross impact evaluation, we do not find it appropriate to field the NTG surveys to ESCOs. For PY8, custom projects are considered to be a mid-impact measure: they account for 21% of sector-level verified impacts. We will conduct a net impact evaluation of the custom initiative again in PY10, possibly as a high impact measure. In PY10, we will attempt to field NTGR surveys as part of the rebate application package.

At the sector level, the relative precisions on the C/I programs tended to be at the 85/15 level or better because most of the impacts were attributable to lighting measures. However, both NTG results and precision for custom projects can be volatile in any given year due to the high positive skew in the savings distribution. As with lighting, the FirstEnergy implementation team has the benefit of obtaining one independent net-to-gross estimate for each of their EDCs, and this can help to balance out cases where the NTG is driven up or down by one dominantly large customer.

The sample designs for the four EDCs are shown in Table 353, Table 354, Table 355, and Table 356 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 353: CI Custom Initiative Net to Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom-Certainty	4	2	50.0%
Custom-2	2	1	n/a
Custom-1	34	14	n/a
Program Total	40	17	57.0%

Table 354: CI Custom Initiative Net to Gross Sampling for Penelec

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom-Certainty	2	2	100.0%
Custom-2	2	1	n/a
Custom-1	54	15	n/a
Program Total	58	18	51.0%

Table 355: CI Custom Initiative Net to Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom-Certainty	2	2	100.0%
Custom-2	2	1	n/a
Custom-1	16	4	n/a
Program Total	20	7	47.0%

Table 356: CI Custom Initiative Net to Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
Custom-Certainty	2	0	0.0%
Custom-2	2	2	n/a
Custom-1	43	12	n/a
Program Total	47	14	48.0%

Q.2.3 Net Impact Evaluation Results

The PYTD verified gross energy impacts, free ridership, spillover, net-to-gross ratios, and relative precisions for net-to-gross are shown in Table 357, Table 358, Table 359, and Table

360 for Met-Ed, Penelec, Penn Power, and WPP respectively. Despite the difficulty of achieving a census of the largest customers, overall net-to-gross ratios for the custom initiatives were in a reasonably tight range around 50%. Inspection of stratum-level NTG ratios for all four EDCs suggests that NTG ratios are lower for custom projects than for lighting projects, and this is particularly true for large custom projects.

Table 357: CI Custom Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom-Certainty	9,386	62.5%	0.0%	37.5%	32.6%
Custom-2	410	12.5%	0.0%	87.5%	46.1%
Custom-1	2,506	71.3%	0.1%	28.8%	13.4%
Program Total	12,302	62.6%	0.0%	37.4%	25.3%

Table 358: CI Custom Initiative Net-to-Gross Results for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom-Certainty	2,076	88.9%	0.0%	11.1%	0.0%
Custom-2	2,217	0.0%	0.0%	100.0%	46.1%
Custom-1	1,457	47.3%	1.6%	54.3%	14.3%
Program Total	5,749	44.1%	0.4%	56.3%	31.8%

Table 359: CI Custom Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom-Certainty	666	62.5%	0.0%	37.5%	0.0%
Custom-2	647	62.5%	0.0%	37.5%	46.1%
Custom-1	1,085	39.9%	0.0%	60.1%	28.2%
Program Total	2,398	52.3%	0.0%	47.7%	18.8%

Table 360: CI Custom Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Custom-Certainty	1,779	55.3%	0.0%	44.7%	100.0%
Custom-2	652	55.3%	0.0%	44.7%	0.0%
Custom-1	1,331	31.7%	0.0%	68.3%	16.0%
Program Total	3,761	47.0%	0.0%	53.0%	40.5%

Appendix R Evaluation Detail – Commercial and Industrial Prescriptive Initiative

R.1 GROSS IMPACT EVALUATION

Gross impact evaluation for the Commercial and Industrial Prescriptive (C&I Prescriptive) Initiative involved stratified sampling, on-site verifications, and project-specific data collection and calculations.

R.1.1 Gross Impact Evaluation Methodology

As a first step, projects are spaced into one of three sampling strata as described in the next section. As with lighting projects, each sampled prescriptive project undergoes a desk review prior to M&V activities. The desk review includes a full documentation review and if needed, additional topical research. Some projects may require M&V plans, but most projects can be evaluated with a combination of verification of measure installation and a TRM-based calculation. The first step in the M&V planning process is to check that the project is sufficiently documented and that sufficient data exist to identify the proper TRM protocol (or IMP) and the values of key input parameters as required by the protocol. Details regarding gross impact evaluation activities for each sampled project can be found in Appendix B.

As a final step in custom project analysis, ADM analysts determine the incremental material and labor costs. In estimating the material and labor costs, preference is given first to invoices, then to the SWE incremental cost database, and then to the cost values from the CA DEER database, then to the costs used in the EDCs' EE&C plans.

R.1.2 Sampling

Projects are placed into two strata. The impact evaluation activities are similar for both strata. The sample designs for the four EDCs are shown in Table 361, Table 362, Table 363, and Table 364.

Table 361: CI Prescriptive Initiative Gross Impact Sample Design for Met-Ed

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	7	5	Desk Review, On-Site Verification
Prescriptive-1	0	20	10	
Program Total	n/a	27	15	

Table 362: CI Prescriptive Initiative Gross Impact Sample Design for Penelec

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	7	5	Desk Review, On-Site Verification
Prescriptive-1	0	30	17	
Program Total	n/a	37	22	

Table 363: CI Prescriptive Initiative Gross Impact Sample Design for Penn Power

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

Table 364: CI Prescriptive Initiative Gross Impact Sample Design for WPP

Stratum	MWh Threshold	Population Size	Achieved Sample Size	Evaluation Activity
Prescriptive-2	20	11	8	Desk Review, On-Site Verification
Prescriptive-1	0	28	13	
Program Total	n/a	39	21	

R.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 365, Table 366, Table 367, and Table 368 for Met-Ed, Penelec, Penn Power, and WPP respectively. Figure 34 plots the verified energy savings against the reported energy savings for all evaluated lighting projects for all in PY8. The figure includes data points from all four EDCs, and is designed to show the reader the correspondence between reported and verified impacts. The relative precision values in the following tables are calculated with a coefficient of variation of 0.5, but the actual error ratios tend to be somewhat lower than 0.5.

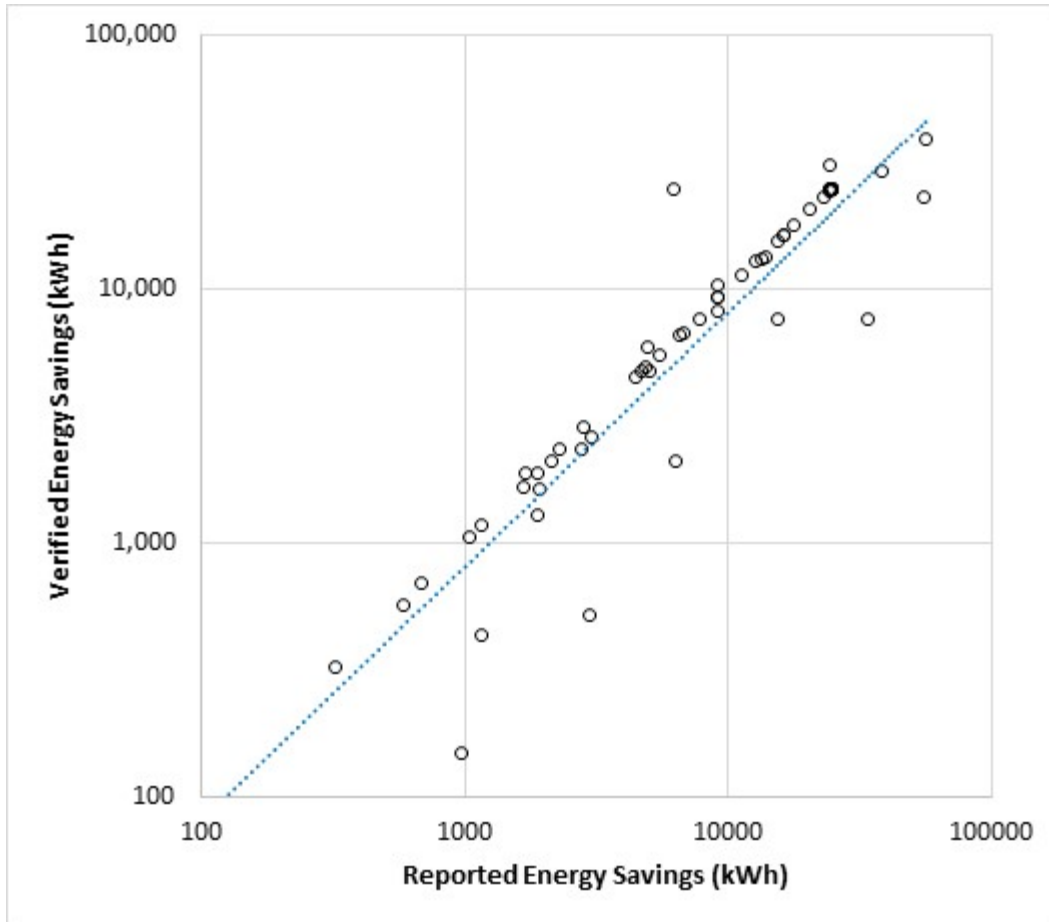


Figure 34: Verified vs. Reported Energy Savings for Sampled Custom Projects.

Table 365: CI Prescriptive Initiative Energy Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Prescriptive-2	20	197	79.8%	0.5	17%
Prescriptive-1	0	99	96.7%	0.5	16%
Program Total	n/a	296	85.4%	0.5	10.5%

Table 366: CI Prescriptive Initiative Energy Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Prescriptive-2	20	185	93.0%	0.5	17%
Prescriptive-1	0	152	116.1%	0.5	11%
Program Total	n/a	336	103.4%	0.5	10.6%

Table 367: CI Prescriptive Initiative Energy Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Prescriptive-2	20	21	100.0%	0.5	0%
Prescriptive-1	0	16	57.4%	0.5	16%
Program Total	n/a	37	81.2%	0.5	4.1%

Table 368: CI Prescriptive Initiative Energy Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Prescriptive-2	20	395	82.8%	0.5	13%
Prescriptive-1	0	159	88.5%	0.5	15%
Program Total	n/a	554	84.5%	0.5	8.7%

R.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 369, Table 370, Table 371, and Table 372 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 369: CI Prescriptive Initiative Demand Gross Realization Rates for Met-Ed

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Prescriptive-2	20	0.02	58.9%	0.5	17%
Prescriptive-1	0	0.02	101.0%	0.5	16%
Program Total	n/a	0.04	77.6%	0.5	9.2%

Table 370: CI Prescriptive Initiative Demand Gross Realization Rates for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Prescriptive-2	20	0.02	99.7%	0.5	17%
Prescriptive-1	0	0.02	120.2%	0.5	11%
Program Total	n/a	0.04	111.6%	0.5	10.8%

Table 371: CI Prescriptive Initiative Gross Realization Rates for Penn Power

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Prescriptive-2	20	0.01	100.0%	0.5	0%
Prescriptive-1	0	0.01	56.1%	0.5	16%
Program Total	n/a	0.02	84.2%	0.5	3.3%

Table 372: CI Prescriptive Initiative Demand Gross Realization Rates for WPP

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Prescriptive-2	20	0.15	20.4%	0.5	13%
Prescriptive-1	0	0.03	70.0%	0.5	15%
Program Total	n/a	0.18	28.9%	0.5	2.8%

R.2 NET IMPACT EVALUATION

R.2.1 Net Impact Evaluation Methodology

The Net to Gross evaluation methodology for the prescriptive measures was identical to the methodology used for lighting and custom measures.

R.2.2 Sampling

Sample sizes for prescriptive measures were relatively small, as the initiative accounted for less than 1% of gross and net impacts. The sample designs for the four EDCs are shown in Table 373, Table 374, Table 375, and Table 376 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 373: CI Prescriptive Initiative Net to Gross Sampling for Met-Ed

Stratum	Population Size	Achieved Sample Size	Response Rate
All	27	2	29.0%
Program Total	27	2	29.0%

Table 374: CI Prescriptive Initiative Net to Gross Sampling for Penelec

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Prescriptive-2	348	57.0%	0.2%	43.2%	44.8%
Program Total	348	57.0%	0.2%	43.2%	44.8%

Table 375: CI Prescriptive Initiative Net to Gross Sampling for Penn Power

Stratum	Population Size	Achieved Sample Size	Response Rate
All	6	1	50.0%
Program Total	6	1	50.0%

Table 376: CI Prescriptive Initiative Net to Gross Sampling for WPP

Stratum	Population Size	Achieved Sample Size	Response Rate
All	39	1	17.0%
Program Total	39	1	17.0%

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 357, Table 358, Table 359, and Table 360 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 377: CI Prescriptive Initiative Net-to-Gross Results for Met-Ed

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
All	253	59.3%	0.2%	40.9%	44.4%
Program Total	253	59.3%	0.2%	40.9%	44.4%

Table 378: CI Prescriptive Initiative Net-to-Gross Results for Penelec

Stratum	MWh Threshold	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Prescriptive-2	20	0.15	104.3%	0.5	20%
Prescriptive-1	0	0.03	65.1%	0.5	16%
Program Total	n/a	0.18	97.6%	0.5	17.2%

Table 379 CI Prescriptive Initiative Net-to-Gross Results for Penn Power

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Prescriptive-2	30	62.5%	0.2%	37.7%	59.5%
Program Total	30	62.5%	0.2%	37.7%	59.5%

Table 380 CI Prescriptive Initiative Net-to-Gross Results for WPP

Stratum	PYVTD MWh	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (@ 85% CL)
Prescriptive-2	468	0.0%	0.2%	100.2%	64.3%
Program Total	468	0.0%	0.2%	100.2%	64.3%

Appendix S Evaluation Detail – Commercial and Industrial Direct Install Initiative

S.1 GROSS IMPACT EVALUATION

In PY8, there were only three projects in this initiative – one project for Penelec and two for Penn Power. The projects were small projects and were part of the Multi-Family Direct Install program component. Each project averaged 2,000 kWh in savings and involved screw-based LEDs, LED night lights, and smart power strips installed in multifamily dwelling units. Due to the small size of this initiative in PY8, gross impact evaluation activities consisted of a database review to check that the energy savings and demand reductions are generally consistent with the application of the 2016 PA TRM.

S.2 NET IMPACT EVALUATION

A net impact evaluation was not conducted for this initiative in PY8, as the initiative had an insignificant contribute to gross impacts in PY8. A proxy NTG value of 100% is used for cost effectiveness testing.

Appendix T Evaluation Detail – C&I Appliance Turn-In Initiative

T.1 GROSS IMPACT EVALUATION

Gross impact evaluation for the Commercial Appliance Turn-In (ATI) Initiative involved customer verification surveys and TRM calculations of measure-level impacts. There are four distinct measures offered by the program: refrigerator recycling, freezer recycling, room AC (RAC) recycling, and dehumidifier recycling.

T.1.1 Gross Impact Evaluation Methodology

ADM's gross impact evaluation methodology was identical to the approach taken for residential ATI, as described in Appendix D.

T.1.2 Sampling

Each measure was treated as a separate stratum within the sampling initiative. The sample designs for the four EDCs are shown in Table 381, Table 382, Table 383, and Table 384.

Table 381: C&I ATI Initiative Gross Impact Sample Design for Met-Ed

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	81	33	Phone Surveys + Census Desk Review
Freezers	12	3	
Dehumidifiers	0	0	
RACs	23	11	
Program Total	116	47	

Table 382: C&I ATI Initiative Gross Impact Sample Design for Penelec

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	62	27	Phone Surveys + Census Desk Review
Freezers	10	3	
Dehumidifiers	0	0	
RACs	7	0	
Program Total	79	30	

Table 383: C&I ATI Initiative Gross Impact Sample Design for Penn Power

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	10	8	Phone Surveys + Census Desk Review
Freezers	1	0	
Dehumidifiers	0	0	
RACs	0	0	
Program Total	11	8	

Table 384: C&I ATI Initiative Gross Impact Sample Design for WPP

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Refrigerators	73	5	Phone Surveys + Census Desk Review
Freezers	15	0	
Dehumidifiers	0	0	
RACs	6	23	
Program Total	94	28	

T.1.3 Results for Energy

The gross realization rates for energy, along with relative precisions, are shown in Table 385, Table 386, Table 387, Table 388, and for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 385: C&I ATI Initiative Energy Gross Realization Rates for Met-Ed

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	76	91.8%	0.5	9.6%
Freezers	10	113.3%	0.5	36.0%
Dehumidifiers	0	0.0%	0.5	100.0%
RACs	3	75.2%	0.5	15.7%
Program Total	89	93.7%	0.5	8.9%

Table 386: C&I ATI Initiative Energy Gross Realization Rates for Penelec

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	66	94.0%	0.5	10.4%
Freezers	8	83.4%	0.5	34.8%
Dehumidifiers	0	0.0%	0.5	100.0%
RACs	1	93.8%	0.5	100.0%
Program Total	75	92.8%	0.5	9.2%

Table 387: C&I ATI Initiative Energy Gross Realization Rates for Penn Power

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	11	87.3%	0.5	11.4%
Freezers	1	44.6%	0.5	100.0%
Dehumidifiers	0	0.0%	0.5	100.0%
RACs	0	0.0%	0.5	100.0%
Program Total	12	84.1%	0.5	9.8%

Table 388: C&I ATI Initiative Energy Gross Realization Rates for WPP

Stratum	PYRTD MWh/yr	Energy Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	75	86.7%	0.5	31.1%
Freezers	13	115.0%	0.5	100.0%
Dehumidifiers	0	0.0%	0.5	100.0%
RACs	1	0.0%	0.5	100.0%
Program Total	88	90.2%	0.5	28.3%

T.1.4 Results for Demand

The gross realization rates for demand, along with relative precisions, are shown in Table 389, Table 390, Table 391, and Table 392 for Met-Ed, Penelec, Penn Power, and WPP respectively.

Table 389: C&I ATI Initiative Demand Gross Realization Rates for Met-Ed

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.01	91.8%	0.5	9.6%
Freezers	0.00	113.3%	0.5	36.0%
Dehumidifiers	0.00	0.0%	0.5	100.0%
RACs	0.01	60.7%	0.5	15.7%
Program Total	0.02	81.4%	0.5	6.7%

Table 390: C&I ATI Initiative Demand Gross Realization Rates for Penelec

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.01	94.0%	0.5	10.4%
Freezers	0.00	83.4%	0.5	34.8%
Dehumidifiers	0.00	0.0%	0.5	100.0%
RACs	0.00	92.1%	0.5	100.0%
Program Total	0.01	92.7%	0.5	18.2%

Table 391: C&I ATI Initiative Gross Realization Rates for Penn Power

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.00	87.3%	0.5	11.4%
Freezers	0.00	44.6%	0.5	100.0%
Dehumidifiers	0.00	0.0%	0.5	100.0%
RACs	0.00	0.0%	0.5	100.0%
Program Total	0.00	84.1%	0.5	9.8%

Table 392: C&I ATI Initiative Demand Gross Realization Rates for WPP

Stratum	PYRTD MW/yr	Demand Realization Rate	CV	Relative Precision at 85% C.L.
Refrigerators	0.01	86.7%	0.5	31.1%
Freezers	0.00	115.0%	0.5	100.0%
Dehumidifiers	0.00	0.0%	0.5	100.0%
RACs	0.00	0.0%	0.5	100.0%
Program Total	0.01	78.4%	0.5	24.6%

T.2 NET IMPACT EVALUATION

T.2.1 Net Impact Evaluation Methodology

An independent net impact evaluation was not conducted for this initiative because the initiative accounts for less than 0.1% of portfolio impacts, as averaged for the four PA Companies. The Net to Gross ratios for the C&I Appliance Turn-In program were taken to be the same as the Net to Gross ratios for the Residential Appliance Turn-In program.

Appendix U Evaluation Detail – Commercial and Industrial Direct Install Initiative

U.1 GROSS IMPACT EVALUATION

In PY8, there were only three projects approved in the Commercial and Industrial Direct Install (C&I Direct Install) initiative. Penelec had one project with 2 MWh savings and Penn Power had two projects totaling 4 MWh. The program was expected to fully launch in PY9, but three projects were completed ahead of schedule. Due to the insignificant volume associated with this initiative, the evaluation approach for PY8 was to pass through savings as verified after a tracking data review to ensure that the savings were reasonable. With such small reported savings, the database review is primarily conducted to rule out inadvertent underreporting of impacts (e.g., that the 2 MWh are legitimately 2 MWh and not likely to be a typographical error of 20 MWh or 200 MWh).

U.2 NET IMPACT EVALUATION

Net impact evaluation was not conducted for these three projects in PY8, but a proxy 50% net to gross ratio was applied for calculation of portfolio-level net verified impacts and for net-level TRC calculations.