

Prepared by:

**Navigant Consulting, Inc.**

Presented to:

**Pennsylvania Public Utility Commission**

Pennsylvania Act 129 of 2008

Energy Efficiency and Conservation Plan

**Prepared for:**

**PECO**

**November 15, 2016**

**EDC Program Year 7**

**Annual Report**

Program Year 7: June 1, 2015 – May 31, 2016

**EDC Program Year 7**

**Annual Report**

Program Year 7: June 1, 2015 – May 31, 2016

Presented to:

**Pennsylvania Public Utility Commission**

Pennsylvania Act 129 of 2008

Energy Efficiency and Conservation Plan

**November 15, 2016**

Prepared by Navigant Consulting, Inc.

For

**PECO**

November 15, 2016

*This page intentionally left blank.*

Table of Contents

[Table of Contents i](#_Toc466413253)

[List of Tables vi](#_Toc466413254)

[List of Figures xi](#_Toc466413255)

[List of Equations xii](#_Toc466413256)

[Acronyms xiii](#_Toc466413257)

[Report Definitions xvi](#_Toc466413258)

[1. Overview of Portfolio 1](#_Toc466413259)

[1.1 Summary of Progress Toward Compliance Targets 1](#_Toc466413260)

[1.1.1 Summary of Savings Adjustments throughout Phase II 9](#_Toc466413261)

[1.2 Summary of Energy Impacts 11](#_Toc466413262)

[1.3 Summary of Fuel Switching Impacts 14](#_Toc466413263)

[1.4 Summary of Demand Impacts 15](#_Toc466413264)

[1.5 Summary of PY7 Net-to-Gross Ratios 18](#_Toc466413265)

[1.6 Summary of Portfolio Finances and Cost-Effectiveness 20](#_Toc466413266)

[1.7 Summary of Cost-Effectiveness by Program in PY7 21](#_Toc466413267)

[1.8 Comparison of PY7 Performance to Approved EE&C Plan 22](#_Toc466413268)

[1.9 Summary of Cost-Effectiveness by Program for Phase II 24](#_Toc466413269)

[1.10 Comparison of Phase II Performance to Approved EE&C Plan 25](#_Toc466413270)

[1.11 Portfolio Level/Cross-Cutting Process and Impact Evaluation Summary for PY7 28](#_Toc466413271)

[1.12 Site Inspections Summary 29](#_Toc466413272)

[2. Smart Home Rebates 31](#_Toc466413273)

[2.1 Program Updates 31](#_Toc466413274)

[2.1.1 Definition of Participant 31](#_Toc466413275)

[2.2 Impact Evaluation Gross Savings 31](#_Toc466413276)

[2.2.1 Gross Verified Savings Methodology 32](#_Toc466413277)

[2.2.2 Gross Verified Savings Results 34](#_Toc466413278)

[2.3 Impact Evaluation Net Savings 36](#_Toc466413279)

[2.3.1 Net Verified Savings Methodology 36](#_Toc466413280)

[2.3.2 Net Verified Savings Results 38](#_Toc466413281)

[2.4 Process Evaluation 38](#_Toc466413282)

[2.4.1 Process Evaluation Methodology 39](#_Toc466413283)

[2.4.2 Process Findings and Recommendations 39](#_Toc466413284)

[2.5 Status of Recommendations for Program 45](#_Toc466413285)

[2.6 Financial Reporting 46](#_Toc466413286)

[3. Smart House Call Program 47](#_Toc466413287)

[3.1 Program Updates 47](#_Toc466413288)

[3.1.1 Definition of a Participant 47](#_Toc466413289)

[3.2 Impact Evaluation Gross Savings 48](#_Toc466413290)

[3.2.1 Gross Verified Savings Methodology 48](#_Toc466413291)

[3.2.2 Gross Verified Savings Results 49](#_Toc466413292)

[3.2.3 Gross Savings Verification Findings and Recommendations 51](#_Toc466413293)

[3.3 Impact Evaluation Net Savings 52](#_Toc466413294)

[3.3.1 Net Verified Savings Methodology 52](#_Toc466413295)

[3.3.2 Net Verified Savings Results 54](#_Toc466413296)

[3.4 Process Evaluation 55](#_Toc466413297)

[3.4.1 Process Evaluation Methodology 55](#_Toc466413298)

[3.4.2 Process Findings and Recommendations 56](#_Toc466413299)

[3.5 Status of Recommendations for Program 59](#_Toc466413300)

[3.6 Financial Reporting 60](#_Toc466413301)

[4. Smart Appliance Recycling Program 63](#_Toc466413302)

[4.1 Program Updates 63](#_Toc466413303)

[4.1.1 Definition of Participant 63](#_Toc466413304)

[4.2 Impact Evaluation Gross Savings 64](#_Toc466413305)

[4.2.1 Gross Verified Savings Methodology 64](#_Toc466413306)

[4.2.2 Gross Verified Savings Results 66](#_Toc466413307)

[4.3 Impact Evaluation Net Savings 67](#_Toc466413308)

[4.3.1 Net Verified Savings Methodology 67](#_Toc466413309)

[4.3.2 Net Verified Savings Results 69](#_Toc466413310)

[4.4 Process Evaluation 72](#_Toc466413311)

[4.4.1 Process Evaluation Methodology 72](#_Toc466413312)

[4.4.2 Process Findings and Recommendations 73](#_Toc466413313)

[4.5 Status of Recommendations for Program 75](#_Toc466413314)

[4.6 Financial Reporting 75](#_Toc466413315)

[5. Smart Usage Profile Program 77](#_Toc466413316)

[5.1 Program Updates 77](#_Toc466413317)

[5.1.1 Definition of Participant 77](#_Toc466413318)

[5.2 Impact Evaluation Gross Savings 78](#_Toc466413319)

[5.2.1 Gross Verified Savings Methodology 79](#_Toc466413320)

[5.2.2 Gross Verified Savings Results 82](#_Toc466413321)

[5.3 Impact Evaluation Net Savings 83](#_Toc466413322)

[5.3.1 Net Verified Savings Methodology 84](#_Toc466413323)

[5.3.2 Net Verified Savings Results 84](#_Toc466413324)

[5.4 Process Evaluation 84](#_Toc466413325)

[5.4.1 Process Evaluation Methodology 84](#_Toc466413326)

[5.4.2 Process Findings and Recommendations 85](#_Toc466413327)

[5.5 Status of Recommendations for Program 86](#_Toc466413328)

[5.6 Financial Reporting 87](#_Toc466413329)

[6. Smart Energy Saver Program 89](#_Toc466413330)

[6.1 Program Updates 89](#_Toc466413331)

[6.1.1 Definition of Participant 89](#_Toc466413332)

[6.2 Impact Evaluation Gross Savings 90](#_Toc466413333)

[6.2.1 Gross Verified Savings Methodology 90](#_Toc466413334)

[6.2.2 Gross Verified Savings Results 91](#_Toc466413335)

[6.3 Impact Evaluation Net Savings 94](#_Toc466413336)

[6.3.1 Net Verified Savings Methodology 94](#_Toc466413337)

[6.3.2 Net Verified Savings Results 95](#_Toc466413338)

[6.4 Process Evaluation 95](#_Toc466413339)

[6.4.1 Process Findings and Recommendations 95](#_Toc466413340)

[6.5 Status of Recommendations for Program 96](#_Toc466413341)

[6.6 Financial Reporting 96](#_Toc466413342)

[7. Smart Builder Rebates Program 98](#_Toc466413343)

[7.1 Program Updates 98](#_Toc466413344)

[7.1.1 Definition of Participant 98](#_Toc466413345)

[7.2 Impact Evaluation Gross Savings 98](#_Toc466413346)

[7.2.1 Gross Verified Savings Methodology 99](#_Toc466413347)

[7.2.2 Gross Verified Savings Results 100](#_Toc466413348)

[7.3 Impact Evaluation Net Savings 101](#_Toc466413349)

[7.3.1 Net Verified Savings Methodology 101](#_Toc466413350)

[7.3.2 Net Verified Savings Results 102](#_Toc466413351)

[7.4 Process Evaluation 102](#_Toc466413352)

[7.4.1 Process Evaluation Methodology 102](#_Toc466413353)

[7.4.2 Process Findings and Recommendations 103](#_Toc466413354)

[7.5 Status of Recommendations for Program 107](#_Toc466413355)

[7.6 Financial Reporting 107](#_Toc466413356)

[8. Low-Income Energy Efficiency Program 109](#_Toc466413357)

[8.1 Program Updates 110](#_Toc466413358)

[8.1.1 Definition of Participant 110](#_Toc466413359)

[8.2 Impact Evaluation Gross Savings 110](#_Toc466413360)

[8.2.1 Gross Verified Savings Methodology 111](#_Toc466413361)

[8.2.2 Gross Verified Savings Results 112](#_Toc466413362)

[8.3 Impact Evaluation Net Savings 114](#_Toc466413363)

[8.3.1 Net Verified Savings Methodology 114](#_Toc466413364)

[8.3.2 Net Verified Savings Results 115](#_Toc466413365)

[8.3.3 Impact Evaluation Findings and Recommendations 116](#_Toc466413366)

[8.4 Process Evaluation 117](#_Toc466413367)

[8.4.1 Process Evaluation Methodology 117](#_Toc466413368)

[8.4.2 Process Findings and Recommendations 118](#_Toc466413369)

[8.5 Status of Recommendations for Program 121](#_Toc466413370)

[8.6 Financial Reporting 121](#_Toc466413371)

[9. Smart AC Saver: Residential 123](#_Toc466413372)

[9.1 Program Updates 123](#_Toc466413373)

[9.1.1 Definition of Participant 123](#_Toc466413374)

[9.2 Impact Evaluation Gross Savings 123](#_Toc466413375)

[9.2.1 Gross Verified Savings Methodology 124](#_Toc466413376)

[9.2.2 Gross Verified Savings Results 125](#_Toc466413377)

[9.3 Process Evaluation 125](#_Toc466413378)

[9.3.1 Process Evaluation Methodology 126](#_Toc466413379)

[9.3.2 Process Findings and Recommendations 126](#_Toc466413380)

[9.4 Status of Recommendations for Program 127](#_Toc466413381)

[9.5 Financial Reporting 128](#_Toc466413382)

[10. Smart AC Saver: Commercial 130](#_Toc466413383)

[10.1 Program Updates 130](#_Toc466413384)

[10.1.1 Definition of Participant 130](#_Toc466413385)

[10.2 Impact Evaluation Gross Savings 130](#_Toc466413386)

[10.2.1 Gross Verified Savings Methodology 131](#_Toc466413387)

[10.2.2 Gross Verified Savings Results 132](#_Toc466413388)

[10.3 Impact Evaluation Net Savings 132](#_Toc466413389)

[10.4 Process Evaluation 132](#_Toc466413390)

[10.4.1 Process Evaluation Methodology 133](#_Toc466413391)

[10.4.2 Process Evaluation Results 133](#_Toc466413392)

[10.5 Status of Recommendations for Program 134](#_Toc466413393)

[10.6 Financial Reporting 134](#_Toc466413394)

[11. Smart Equipment Incentives: C&I 136](#_Toc466413395)

[11.1 Program Updates 136](#_Toc466413396)

[11.1.1 Definition of Participant 136](#_Toc466413397)

[11.2 Impact Evaluation Gross Savings 136](#_Toc466413398)

[11.2.1 Gross Verified Savings Methodology 137](#_Toc466413399)

[11.2.2 Gross Verified Savings Results 140](#_Toc466413400)

[11.3 Impact Evaluation Net Savings 141](#_Toc466413401)

[11.3.1 Net Verified Savings Methodology 142](#_Toc466413402)

[11.3.2 Net Verified Savings Results 146](#_Toc466413403)

[11.4 Process Evaluation 147](#_Toc466413404)

[11.4.1 Process Evaluation Methodology 147](#_Toc466413405)

[11.4.2 Process Evaluation Results 147](#_Toc466413406)

[11.5 Status of Recommendations for Program 149](#_Toc466413407)

[11.6 Financial Reporting 150](#_Toc466413408)

[12. Smart Equipment Incentives: GNI 151](#_Toc466413409)

[12.1 Program Updates 151](#_Toc466413410)

[12.1.1 Definition of Participant 151](#_Toc466413411)

[12.2 Impact Evaluation Gross Savings 152](#_Toc466413412)

[12.2.1 Gross Verified Savings Methodology 152](#_Toc466413413)

[12.2.2 Gross Verified Savings Results 155](#_Toc466413414)

[12.3 Impact Evaluation Net Savings 156](#_Toc466413415)

[12.3.1 Net Verified Savings Methodology 156](#_Toc466413416)

[12.3.2 Net Verified Savings Results 161](#_Toc466413417)

[12.4 Process Evaluation 162](#_Toc466413418)

[12.4.1 Process Evaluation Methodology 162](#_Toc466413419)

[12.4.2 Process Evaluation Results 162](#_Toc466413420)

[12.5 Status of Recommendations for Program 164](#_Toc466413421)

[12.6 Financial Reporting 165](#_Toc466413422)

[13. Smart Construction Incentives 166](#_Toc466413423)

[13.1 Program Updates 166](#_Toc466413424)

[13.1.1 Definition of Participant 166](#_Toc466413425)

[13.2 Impact Evaluation Gross Savings 166](#_Toc466413426)

[13.2.1 Gross Verified Savings Methodology 167](#_Toc466413427)

[13.2.2 Gross Verified Savings Results 169](#_Toc466413428)

[13.3 Impact Evaluation Net Savings 171](#_Toc466413429)

[13.3.1 Net Verified Savings Results 172](#_Toc466413430)

[13.4 Process Evaluation 172](#_Toc466413431)

[13.4.1 Process Evaluation Methodology 172](#_Toc466413432)

[13.4.2 Process Findings and Recommendations 173](#_Toc466413433)

[13.5 Status of Recommendations for Plug-in 175](#_Toc466413434)

[13.6 Financial Reporting 175](#_Toc466413435)

[14. Smart Multi-Family Solutions Program 177](#_Toc466413436)

[14.1 Program Updates 177](#_Toc466413437)

[14.1.1 Definition of Participant 177](#_Toc466413438)

[14.2 Impact Evaluation Gross Savings 177](#_Toc466413439)

[14.2.1 Gross Verified Savings Methodology 178](#_Toc466413440)

[14.2.2 Gross Verified Savings Results 179](#_Toc466413441)

[14.3 Impact Evaluation Net Savings 182](#_Toc466413442)

[14.3.1 Net Verified Savings Methodology 183](#_Toc466413443)

[14.3.2 Net Verified Savings Results 185](#_Toc466413444)

[14.4 Process Evaluation 186](#_Toc466413445)

[14.4.1 Process Evaluation Methodology 186](#_Toc466413446)

[14.4.2 Process Findings and Recommendations 187](#_Toc466413447)

[14.5 Status of Recommendations for Program 190](#_Toc466413448)

[14.6 Financial Reporting 190](#_Toc466413449)

[15. Smart On-Site 194](#_Toc466413450)

[15.1 Program Updates 194](#_Toc466413451)

[15.1.1 Definition of Participant 194](#_Toc466413452)

[15.2 Impact Evaluation Gross Savings 194](#_Toc466413453)

[15.2.1 Gross Verified Savings Methodology 195](#_Toc466413454)

[15.2.2 Gross Verified Savings Results 196](#_Toc466413455)

[15.3 Impact Evaluation Net Savings 197](#_Toc466413456)

[15.3.1 Net Verified Savings Methodology 197](#_Toc466413457)

[15.3.2 Net Verified Savings Results 201](#_Toc466413458)

[15.4 Process Evaluation 201](#_Toc466413459)

[15.4.1 Process Evaluation Methodology 201](#_Toc466413460)

[15.4.2 Process Findings and Recommendations 202](#_Toc466413461)

[15.5 Status of Recommendations for Program 204](#_Toc466413462)

[15.6 Financial Reporting 204](#_Toc466413463)

[16. Smart Business Solutions 206](#_Toc466413464)

[16.1 Program Updates 206](#_Toc466413465)

[16.1.1 Definition of Participant 206](#_Toc466413466)

[16.2 Impact Evaluation Gross Savings 206](#_Toc466413467)

[16.2.1 Gross Verified Savings Methodology 207](#_Toc466413468)

[16.2.2 Gross Verified Savings Results 208](#_Toc466413469)

[16.3 Impact Evaluation Net Savings 209](#_Toc466413470)

[16.4 Process Evaluation 209](#_Toc466413471)

[16.4.1 Process Evaluation Methodology 209](#_Toc466413472)

[16.4.2 Process Evaluation Results and Recommendations 210](#_Toc466413473)

[16.5 Status of Recommendations for Program 211](#_Toc466413474)

[16.6 Financial Reporting 212](#_Toc466413475)

[Appendix A. EM&V Information 214](#_Toc466413476)

[A.1 Participant Definitions 214](#_Toc466413477)

[A.2 PY7 Evaluation Activities 215](#_Toc466413478)

[Appendix B. TRC Incremental Costs 216](#_Toc466413479)

[Appendix C. Low-Income Participation in Non-Low-Income Programs 225](#_Toc466413480)

[Appendix D. SHR Residential Lighting Upstream Program Cross-Sector Sales 228](#_Toc466413481)

[Appendix E. Glossary of Terms 230](#_Toc466413482)

List of Tables

[Table 1‑1: Phase II Verified Gross Savings and Verified Gross Savings from PY4 Carried Into Phase II 2](#_Toc466413483)

[Table 1‑2: Phase II Verified Gross Lifetime Savings and Verified Gross Lifetime Savings from Phase I Carried Into Phase II 3](#_Toc466413484)

[Table 1‑3: Phase I and Phase II Cumulative Annual Savings 3](#_Toc466413485)

[Table 1‑4: Phase II Verified Net First-Year and Lifetime Savings 4](#_Toc466413486)

[Table 1‑5: Phase II Low-Income Sector Compliance (Number of Measures) 5](#_Toc466413487)

[Table 1‑6: Phase II Low-Income Sector Compliance (Percentage of Savings) 6](#_Toc466413488)

[Table 1‑7: Phase II GNI Sector Compliance 6](#_Toc466413489)

[Table 1‑8: Summary of Phase II Performance by Sector 7](#_Toc466413490)

[Table 1‑9: Summary of Phase I Verified Gross Savings Remaining through Phase II 8](#_Toc466413491)

[Table 1‑10: Reported Participation and Gross Energy Savings by Program 13](#_Toc466413492)

[Table 1‑11: Verified Gross Energy Savings by Program 14](#_Toc466413493)

[Table 1‑12: Reported Participation and Gross Demand Reduction by Program 17](#_Toc466413494)

[Table 1‑13: Verified Gross Demand Reduction by Program 18](#_Toc466413495)

[Table 1‑14: PY7 NTG Ratios by Program 19](#_Toc466413496)

[Table 1‑15: Summary of Portfolio Finances 20](#_Toc466413497)

[Table 1‑16: PYTD TRC Ratios by Program 21](#_Toc466413498)

[Table 1‑17: Comparison of PY7 Program Expenditures to PY7 EE&C Plan 22](#_Toc466413499)

[Table 1‑18: Comparison of PY7 Actual Program Savings to EE&C Plan for PY7 23](#_Toc466413500)

[Table 1‑19: Phase II TRC Ratios by Program 25](#_Toc466413501)

[Table 1‑20: Comparison of Phase II Program Expenditures to Phase II EE&C Plan 26](#_Toc466413502)

[Table 1‑21: Comparison of Phase II Actual Program Savings to EE&C Plan for Phase II 27](#_Toc466413503)

[Table 1‑22: Phase II Process and Impact Evaluation Recommendations from PY7 Evaluations 29](#_Toc466413504)

[Table 1‑23: Summary of PY7 Site Visits 30](#_Toc466413505)

[Table 2‑1: Phase II Smart Home Rebates Reported Results by Customer Sector 32](#_Toc466413506)

[Table 2‑2: Smart Home Rebates Sampling Strategy for PY7 34](#_Toc466413507)

[Table 2‑3: PY7 Smart Home Rebates Summary of Evaluation Results for Energy 34](#_Toc466413508)

[Table 2‑4: PY7 Smart Home Rebates Summary of Evaluation Results for Demand (With Line Loss) 35](#_Toc466413509)

[Table 2‑5: Nonresidential Installation Rate and Verified Energy and Demand Savings for All Bulb Purchases 35](#_Toc466413510)

[Table 2‑6: Nonresidential Installation Rate and Verified Energy and Demand Savings Analyzed by Program Bulb Purchases Only 36](#_Toc466413511)

[Table 2‑7: Smart Home Rebates Sampling Strategy for PY7 NTG Research 37](#_Toc466413512)

[Table 2‑8: PY7 Smart Home Rebates Summary of Evaluation Results for Lighting NTG Research 38](#_Toc466413513)

[Table 2‑9: Smart Home Rebates Process Sampling Strategy for PY7 39](#_Toc466413514)

[Table 2‑10: In-Store Participant Awareness of PECO as Source of Lighting Discounts (n = 109) 41](#_Toc466413515)

[Table 2‑11: Source of First Learning of PECO’s Lighting Discounts (n = 77) 41](#_Toc466413516)

[Table 2‑12: Customer Light Bulb Purchase Intentions 41](#_Toc466413517)

[Table 2‑13: Reasons Cited for Not Purchasing Energy Efficient Bulb Types 42](#_Toc466413518)

[Table 2‑14: Smart Home Rebates Status Report on Process and Impact Recommendations 45](#_Toc466413519)

[Table 2‑15: Summary of Smart Home Rebates Program Finances 46](#_Toc466413520)

[Table 3‑1: Phase II Smart House Call Reported Results by Customer Sector 48](#_Toc466413521)

[Table 3‑2: Smart House Call Sampling Strategy for PY7 49](#_Toc466413522)

[Table 3‑3: PY7 Smart House Call Summary of Evaluation Results for Energy 50](#_Toc466413523)

[Table 3‑4: PY7 Smart House Call Summary of Evaluation Results for Demand 51](#_Toc466413524)

[Table 3‑5: Smart House Call Sampling Strategy for PY7 NTG Research 52](#_Toc466413525)

[Table 3‑6: PY7 Smart House Call Summary of Evaluation Results for NTG Research 55](#_Toc466413526)

[Table 3‑7: Smart House Call Process Sampling Strategy for PY7 55](#_Toc466413527)

[Table 3‑8: Smart House Call Status Report on Process and Impact Recommendations 60](#_Toc466413528)

[Table 3‑9: Summary of Smart House Call Program Finances 61](#_Toc466413529)

[Table 4‑1: Phase II Smart Appliance Recycling Reported Results by Customer Sector 64](#_Toc466413530)

[Table 4‑2: Smart Appliance Recycling Sampling Strategy for PY7 65](#_Toc466413531)

[Table 4‑3: PY7 Smart Appliance Recycling Summary of Evaluation Results for Energy 66](#_Toc466413532)

[Table 4‑4: PY7 Smart Appliance Recycling Summary of Evaluation Results for Demand 67](#_Toc466413533)

[Table 4‑5: Smart Appliance Recycling Sampling Strategy for PY7 NTG Research 68](#_Toc466413534)

[Table 4‑6: Smart Appliance Recycling Refrigerator Discard/Keep Proportions 68](#_Toc466413535)

[Table 4‑7: Smart Appliance Recycling Freezer Discard/Keep Proportions 69](#_Toc466413536)

[Table 4‑8: PY7 Smart Appliance Recycling Summary of Evaluation Results for NTG Research 72](#_Toc466413537)

[Table 4‑9: Smart Appliance Recycling Process Sampling Strategy for PY7 73](#_Toc466413538)

[Table 4‑10: Net-to-Gross Method Benchmarking 75](#_Toc466413539)

[Table 4‑11: Smart Appliance Recycling Status Report on Process and Impact Recommendations 75](#_Toc466413540)

[Table 4‑12: Summary of Smart Appliance Recycling Program Finances 76](#_Toc466413541)

[Table 5‑1: Phase II Smart Usage Profile Reported Results by Customer Sector 79](#_Toc466413542)

[Table 5‑2: Smart Usage Profile Sampling Strategy for PY7 81](#_Toc466413543)

[Table 5‑3: PY7 Smart Usage Profile Summary of Evaluation Results for Energy 83](#_Toc466413544)

[Table 5‑4: Share of SUP Participants Channeled into other PECO Programs 83](#_Toc466413545)

[Table 5‑5: Smart Usage Profile Process Sampling Strategy for PY7 85](#_Toc466413546)

[Table 5‑6: Smart Usage Profile Status Report on Process and Impact Recommendations 86](#_Toc466413547)

[Table 5‑7: Summary of Smart Usage Profile Program Finances 88](#_Toc466413548)

[Table 6‑1: Phase II Smart Energy Saver Reported Results by Customer Sector 90](#_Toc466413549)

[Table 6‑2: Smart Energy Saver Sampling Strategy for PY7 91](#_Toc466413550)

[Table 6‑3: PY7 Smart Energy Saver Summary of Evaluation Results for Energy 92](#_Toc466413551)

[Table 6‑4: PY7 Smart Energy Saver Summary of Evaluation Results for Demand 92](#_Toc466413552)

[Table 6‑5: Smart Energy Saver Status Report on Process and Impact Recommendations 96](#_Toc466413553)

[Table 6‑6: Summary of Smart Energy Saver Program Finances 97](#_Toc466413554)

[Table 7‑1: Phase II Smart Builder Rebates Reported Results by Customer Sector 99](#_Toc466413555)

[Table 7‑2: Smart Builder Rebates Sampling Strategy for PY7 100](#_Toc466413556)

[Table 7‑3: PY7 Smart Builder Rebates Summary of Evaluation Results for Energy 100](#_Toc466413557)

[Table 7‑4: PY7 Smart Builder Rebates Summary of Evaluation Results for Demand 101](#_Toc466413558)

[Table 7‑5: Smart Builder Rebates Sampling Strategy for PY7 NTG Research 102](#_Toc466413559)

[Table 7‑6: PY7 Smart Builder Rebates Summary of Evaluation Results for NTG Research 102](#_Toc466413560)

[Table 7‑7: Smart Builder Rebates Sampling Strategy for PY7 103](#_Toc466413561)

[Table 7‑8: Smart Builder Rebates PY7 Market Penetration 106](#_Toc466413562)

[Table 7‑9: Smart Builder Rebates Status Report on Process and Impact Recommendations 107](#_Toc466413563)

[Table 7‑10: Smart Builder Rebates Summary of Program Finances 108](#_Toc466413564)

[Table 8‑1: Low-Income Energy Efficiency Program Components 109](#_Toc466413565)

[Table 8‑2: Phase II Low-Income Energy Efficiency Program Reported Results by Customer Sector 111](#_Toc466413566)

[Table 8‑3: Low-Income Energy Efficiency Program Sampling Strategy for PY7 112](#_Toc466413567)

[Table 8‑4: PY7 Low-Income Energy Efficiency Program Summary of Evaluation Results for Energy 112](#_Toc466413568)

[Table 8‑5: PY7 Low-Income Energy Efficiency Program Summary of Evaluation Results for Demand 112](#_Toc466413569)

[Table 8‑6: PY7 Low-Income Energy Efficiency Program Onsite Inspections Summary 113](#_Toc466413570)

[Table 8‑7: Low-Income Energy Efficiency Program Sampling Strategy for PY7 NTG Research 114](#_Toc466413571)

[Table 8‑8: PY7 Low-Income Energy Efficiency Program Summary of Evaluation Results for NTG Research 116](#_Toc466413572)

[Table 8‑9: Low-Income Energy Efficiency Program Sampling Strategy for Program Year 7 117](#_Toc466413573)

[Table 8‑10: Low-Income Energy Efficiency Program Status Report on Process and Impact Recommendations 121](#_Toc466413574)

[Table 8‑11: Summary of Low-Income Energy Efficiency Program Finances 122](#_Toc466413575)

[Table 9‑1: Phase II Residential Smart AC Saver Reported Results by Customer Sector 124](#_Toc466413576)

[Table 9‑2: Residential AC Saver Sampling Strategy for PY7 125](#_Toc466413577)

[Table 9‑3: PY7 Residential AC Saver Summary of Evaluation Results for Demand 125](#_Toc466413578)

[Table 9‑4: Residential AC Saver Process Sampling Strategy for PY7 126](#_Toc466413579)

[Table 9‑5: Residential AC Saver Status Report on Process and Impact Recommendations 128](#_Toc466413580)

[Table 9‑6: Summary of Residential AC Saver Program Finances 129](#_Toc466413581)

[Table 10‑1: Phase II Commercial Smart AC Saver Reported Results by Customer Sector 131](#_Toc466413582)

[Table 10‑2: Commercial AC Saver Sampling Strategy for PY7 132](#_Toc466413583)

[Table 10‑3: PY7 Commercial AC Saver Summary of Evaluation Results for Demand 132](#_Toc466413584)

[Table 10‑4: Commercial AC Saver Process Sampling Strategy for PY7 133](#_Toc466413585)

[Table 10‑5: Commercial AC Saver Status Report on Process and Impact Recommendations 134](#_Toc466413586)

[Table 10‑6: Summary of Commercial AC Saver Program Finances 135](#_Toc466413587)

[Table 11‑1: Phase II Smart Equipment Incentives (C&I) Reported Results by Customer Sector 137](#_Toc466413588)

[Table 11‑2: Smart Equipment Incentives (C&I) Sampling Strategy for PY7 138](#_Toc466413589)

[Table 11‑3: PY7 Smart Equipment Incentives (C&I) Summary of Evaluation Results for Energy 140](#_Toc466413590)

[Table 11‑4: PY7 Smart Equipment Incentives (C&I) Summary of Evaluation Results for Demand 141](#_Toc466413591)

[Table 11‑5: PY7 Smart Equipment Incentives (C&I) Onsite Inspections Summary 141](#_Toc466413592)

[Table 11‑6: Smart Equipment Incentives (C&I) Sampling Strategy for PY7 NTG Research 142](#_Toc466413593)

[Table 11‑7: PY7 Smart Equipment Incentives (C&I) Summary of Evaluation Results for NTG Research 147](#_Toc466413594)

[Table 11‑8: Smart Equipment Incentives (C&I) Process Sampling Strategy for PY7 147](#_Toc466413595)

[Table 11‑9: Smart Equipment Incentives (C&I) Status Report on Process and Impact Recommendations 149](#_Toc466413596)

[Table 11‑10: Summary of Smart Equipment Incentives (C&I) Program Finances 150](#_Toc466413597)

[Table 12‑1: Phase II Smart Equipment Incentives (GNI) Reported Results by Customer Sector 152](#_Toc466413598)

[Table 12‑2: Smart Equipment Incentives (GNI) Sampling Strategy for PY7 153](#_Toc466413599)

[Table 12‑3: PY7 Smart Equipment Incentives (GNI) Summary of Evaluation Results for Energy 155](#_Toc466413600)

[Table 12‑4: PY7 Smart Equipment Incentives (GNI) Summary of Evaluation Results for Demand 156](#_Toc466413601)

[Table 12‑5: PY7 Smart Equipment Incentives (GNI) Onsite Inspections Summary 156](#_Toc466413602)

[Table 12‑6: Smart Equipment Incentives (GNI) Sampling Strategy for PY7 NTG Research 157](#_Toc466413603)

[Table 12‑7: PY7 Smart Equipment Incentives (GNI) Summary of Evaluation Results for NTG Research 162](#_Toc466413604)

[Table 12‑8: Smart Equipment Incentives (GNI) Process Sampling Strategy for PY7 162](#_Toc466413605)

[Table 12‑9: Smart Equipment Incentives (GNI) Status Report on Process and Impact Recommendations 164](#_Toc466413606)

[Table 12‑10: Summary of Smart Equipment Incentives (GNI) Program Finances 165](#_Toc466413607)

[Table 13‑1: Phase II Smart Construction Incentives Reported Results by Customer Sector 167](#_Toc466413608)

[Table 13‑2: Smart Construction Incentives Original Sampling Strategy for PY7 168](#_Toc466413609)

[Table 13‑3: Smart Construction Incentives Modified Sampling Strategy for PY7 169](#_Toc466413610)

[Table 13‑4: PY7 Smart Construction Incentives Summary of Evaluation Results for Energy 170](#_Toc466413611)

[Table 13‑5: PY7 Smart Construction Incentives Summary of Evaluation Results for Demand 170](#_Toc466413612)

[Table 13‑6: PY7 Smart Construction Incentives Onsite Inspections Summary 171](#_Toc466413613)

[Table 13‑7: PY6 Smart Construction Incentives Summary of Evaluation Results for NTG Research 171](#_Toc466413614)

[Table 13‑8: PY7 and Phase II Smart Construction Incentives Summary of NTG Savings Results 172](#_Toc466413615)

[Table 13‑9: Smart Construction Incentives Process Sampling Strategy for PY7 173](#_Toc466413616)

[Table 13‑10: Smart Construction Incentives Status Report on Process and Impact Recommendations 175](#_Toc466413617)

[Table 13‑11: Summary of Smart Construction Incentives Program Finances 176](#_Toc466413618)

[Table 14‑1: Phase II Smart Multi-Family Solutions Program Reported Results by Customer Sector 178](#_Toc466413619)

[Table 14‑2: Smart Multi-Family Solutions Program Sampling Strategy for PY7 179](#_Toc466413620)

[Table 14‑3: PY7 Smart Multi-Family Solutions Residential Sector Summary of Evaluation Results for Energy 180](#_Toc466413621)

[Table 14‑4: PY7 Smart Multi-Family Solutions Nonresidential Sector Summary of Evaluation Results for Energy 180](#_Toc466413622)

[Table 14‑5: PY7 Smart Multi-Family Solutions Residential Sector Summary of Evaluation Results for Demand 181](#_Toc466413623)

[Table 14‑6: PY7 Smart Multi-Family Solutions Nonresidential Sector Summary of Evaluation Results for Demand 182](#_Toc466413624)

[Table 14‑7: PY7 Smart Multi-Family Solutions Onsite Inspections Summary 182](#_Toc466413625)

[Table 14‑8: Smart Multi-Family Solutions NTG Intention Score Method 183](#_Toc466413626)

[Table 14‑9: Smart Multi-Family Solutions NTG Influence Score Method 183](#_Toc466413627)

[Table 14‑10: Smart Multi-Family Solutions NTG Spillover Method 184](#_Toc466413628)

[Table 14‑11: Smart Multi-Family Solutions Residential Sector Sampling Strategy for PY7 NTG Research 185](#_Toc466413629)

[Table 14‑12: Smart Multi-Family Solutions Nonresidential Sector Sampling Strategy for PY7 NTG Research 185](#_Toc466413630)

[Table 14‑13: PY7 Smart Multi-Family Solutions Residential Sector Summary of Evaluation Results for NTG Research 186](#_Toc466413631)

[Table 14‑14: PY7 Smart Multi-Family Solutions Nonresidential Sector Summary of Evaluation Results for NTG Research 186](#_Toc466413632)

[Table 14‑15: Smart Multi-Family Solutions Process Sampling Strategy for PY7 187](#_Toc466413633)

[Table 14‑16: Smart Multi-Family Solutions Program Status Report on Process and Impact Recommendations 190](#_Toc466413634)

[Table 14‑17: Summary of SMF Solutions Residential Sector Program Finances 191](#_Toc466413635)

[Table 14‑18: Summary of SMF Solutions Nonresidential Sector Program Finances 192](#_Toc466413636)

[Table 15‑1: Phase II Smart On-Site Reported Results by Customer Sector 195](#_Toc466413637)

[Table 15‑2: Smart On-Site Sampling Strategy for PY7 196](#_Toc466413638)

[Table 15‑3: PY7 Smart On-Site Summary of Evaluation Results for Energy 196](#_Toc466413639)

[Table 15‑4: PY7 Smart On-Site Summary of Evaluation Results for Demand 196](#_Toc466413640)

[Table 15‑5: PY7 Smart On-Site: Onsite Inspections Summary 197](#_Toc466413641)

[Table 15‑6: Smart On-Site Sampling Strategy for PY7 NTG Research 201](#_Toc466413642)

[Table 15‑7: PY7 Smart On-Site Summary of Evaluation Results for NTG Research 201](#_Toc466413643)

[Table 15‑8: Smart On-Site Process Sampling Strategy for PY7 202](#_Toc466413644)

[Table 15‑9: Smart On-Site Status Report on Process and Impact Recommendations 204](#_Toc466413645)

[Table 15‑10: Summary of Smart On-Site Program Finances 205](#_Toc466413646)

[Table 16‑1: Phase II Smart Business Solutions Reported Results by Customer Sector 207](#_Toc466413647)

[Table 16‑2: PY7 Smart Business Solutions Sampling Strategy 208](#_Toc466413648)

[Table 16‑3: PY7 Smart Business Solutions Summary of Evaluation Results for Energy 208](#_Toc466413649)

[Table 16‑4: PY7 Smart Business Solutions Summary of Evaluation Results for Demand 209](#_Toc466413650)

[Table 16‑5: Smart Business Solutions Sampling Strategy for PY7 209](#_Toc466413651)

[Table 16‑6: Smart Business Solutions Status Report on Process and Impact Recommendations 212](#_Toc466413652)

[Table 16‑7: Smart Business Solutions Summary of Program Finances 213](#_Toc466413653)

[Table A‑1: PY7 Participant Definition by Program 214](#_Toc466413654)

[Table A‑2: PY7 Actual Evaluation Activities 215](#_Toc466413655)

[Table B‑1: Measure Incremental Costs Not Taken from SWE Database or Filed Plan 216](#_Toc466413656)

[Table D‑1: Store Sampling for PY5 Intercepts Based on Proportion of Program Bulb Sales 228](#_Toc466413657)

[Table D‑2: PY7 Cross-Sector Bulb Installations by Business Type 229](#_Toc466413658)

List of Figures

[Figure 1‑1: Cumulative Portfolio Phase II Inception to Date Verified Gross Energy Impacts 1](#_Toc466413659)

[Figure 1‑2: Phase II Portfolio Reported and Verified Demand Reduction 5](#_Toc466413660)

[Figure 1‑3: Government, Nonprofit, and Institutional Sector Phase II Verified Gross Energy Impacts 7](#_Toc466413661)

[Figure 1‑4: PYTD Reported and Verified Gross Energy Savings by Program (MWh/yr) 11](#_Toc466413662)

[Figure 1‑5: Phase II Reported and Verified Gross Energy Savings by Program (MWh/yr) 12](#_Toc466413663)

[Figure 1‑6: PYTD Reported and Verified Gross Demand Reduction by Program 15](#_Toc466413664)

[Figure 1‑7: Phase II Reported and Verified Gross Demand Reduction by Program 16](#_Toc466413665)

[Figure 2‑1: Lighting Shelf Space by Lamp Type, PY2 and PY5-PY7 40](#_Toc466413666)

[Figure 2‑2: Smart Home Rebates Non-Lighting Average Customer Satisfaction Responses (n=200) 43](#_Toc466413667)

[Figure 2‑3: Smart Home Rebates Non-Lighting Participant Knowledge of Program (n=250) 44](#_Toc466413668)

[Figure 3‑1: Smart House Call Distribution of Free Ridership Scores in PY5 vs. PY7 54](#_Toc466413669)

[Figure 3‑2: Customer Satisfaction with Elements of the SHC Program (n=130) 56](#_Toc466413670)

[Figure 4‑1: Smart Appliance Recycling Refrigerator Net Savings Calculation 70](#_Toc466413671)

[Figure 4‑2: Smart Appliance Recycling Freezer Net Savings Calculation 71](#_Toc466413672)

[Figure 4‑3: Smart Appliance Recycling Regular Customer vs. Impacted Average Customer Satisfaction 74](#_Toc466413673)

[Figure 6‑1: PY7 Smart Energy Saver Program Baseline Conditions for Installed Nightlights (n=3,710) 93](#_Toc466413674)

[Figure 6‑2: PY7 Smart Energy Saver Program Savings Associated with Installed Nightlights (n=3,710) 94](#_Toc466413675)

[Figure 7‑1: Smart Builder Rebates Builder Satisfaction Ratings (1-10 Scale, n=7) 104](#_Toc466413676)

[Figure 7‑2: Smart Builder Rebates Average Incentive Processing Duration 104](#_Toc466413677)

[Figure 7‑3: Greatest Challenge in Meeting ENERGY STAR Standards (n=7) 105](#_Toc466413678)

[Figure 7‑4: Portion of Respondents’ Homes Participating in PY7 (n=7) 105](#_Toc466413679)

[Figure 7‑5: Builder Forecast for PY8 Program Activity (n=7) 106](#_Toc466413680)

[Figure 8‑1: Refrigerator Measure kWh Savings 114](#_Toc466413681)

[Figure 8‑2: Additional Actions Taken by LEEP Component 1 Participants (n=26) 116](#_Toc466413682)

[Figure 8‑3: Low-Income Energy Efficiency Program Participant Satisfaction (n=55) 118](#_Toc466413683)

[Figure 8‑4: Low-Income Energy Efficiency Program Component 3 First-Year CFL In-Service-Rate 119](#_Toc466413684)

[Figure 8‑5: Low-Income Energy Efficiency Program Do You Currently Have Any Incandescent Light Bulbs Installed in Your Home? (n=14) 119](#_Toc466413685)

[Figure 8‑6: Low-Income Energy Efficiency Program: What Types of Bulbs Did You Replace When You Installed the Program Bulbs? (n=30) 120](#_Toc466413686)

[Figure 11‑1: Phase II Free Ridership Algorithm 144](#_Toc466413687)

[Figure 11‑2: Smart Equipment Incentives (C&I) Spillover Results Illustration 146](#_Toc466413688)

[Figure 12‑1: Phase II Free Ridership Algorithm 159](#_Toc466413689)

[Figure 12‑2: PY7 Smart Equipment Incentives (GNI) Spillover Results Illustration 161](#_Toc466413690)

[Figure 14‑1: How Landlords First Learned of Smart Multi-Family Solutions Program (n=24) 188](#_Toc466413691)

[Figure 14‑2: Smart Multi-Family Solutions Average Participant Satisfaction over Time 188](#_Toc466413692)

[Figure 14‑3: Smart Multi-Family Solutions Participant Satisfaction with DI Equipment over Time 189](#_Toc466413693)

[Figure 14‑4: Smart Multi-Family Solutions Nonresidential Landlord Reasons for Program Participation (n=24) 189](#_Toc466413694)

[Figure 15‑1: Phase II Free Ridership Algorithm 199](#_Toc466413695)

List of Equations

[Equation 2‑1: Total NTG Ratio 38](#_Toc466413696)

[Equation 5‑1: One-Way Fixed-Effects Regression Model 80](#_Toc466413697)

[Equation 5‑2: PPR Model with Monthly Fixed Effects 80](#_Toc466413698)

[Equation 11‑1: Total NTG Ratio 142](#_Toc466413699)

[Equation 11‑2: Total Free Ridership 142](#_Toc466413700)

[Equation 11‑3: Spillover Savings from Installed Measures 145](#_Toc466413701)

[Equation 11‑4: Overall Participant Spillover 145](#_Toc466413702)

[Equation 11‑5: Spillover Savings for the Program 145](#_Toc466413703)

[Equation 11‑6: Participant Spillover Percentage 146](#_Toc466413704)

[Equation 12‑1: Total NTG Ratio 157](#_Toc466413705)

[Equation 12‑2: Total Free Ridership 157](#_Toc466413706)

[Equation 12‑3: Spillover Savings from Installed Measures 160](#_Toc466413707)

[Equation 12‑4: Overall Participant Spillover 160](#_Toc466413708)

[Equation 12‑5: Spillover Savings for the Program 160](#_Toc466413709)

[Equation 12‑6: Participant Spillover Percentage 161](#_Toc466413710)

[Equation 14‑1: Total NTG Ratio 183](#_Toc466413711)

[Equation 15‑1: Total NTG Ratio 197](#_Toc466413712)

[Equation 15‑2: Total Free Ridership 197](#_Toc466413713)

[Equation 15‑3: Spillover Savings from Installed Measures 200](#_Toc466413714)

[Equation 15‑4: Overall Participant Spillover 200](#_Toc466413715)

[Equation 15‑5: Spillover Savings for the Program 200](#_Toc466413716)

[Equation 15‑6: Participant Spillover Percentage 200](#_Toc466413717)

Acronyms

|  |  |
| --- | --- |
| ADC | Average Daily Consumption |
| AMI | Advanced Metering Infrastructure |
| ARCA | Appliance Recycling Centers of America |
| ASHP | Air Source Heat Pump |
| CAC | Central Air Conditioning |
| CAP | Customer Assistance Program |
| C&I | Commercial and Industrial |
| CF | Coincidence Factor |
| CFL | Compact Fluorescent Lamp |
| CHP | Combined Heat and Power |
| CMC | CMC Energy Services |
| CMP | Custom Measure Protocol |
| Phase II Verified / (Phase II-VG) | Verified/ Ex Post Cumulative Program/Portfolio Phase II Inception to Date |
| Phase II Reported | Reported/ Ex Ante Cumulative Program/Portfolio Phase II Inception to Date |
| Phase II+CO | Cumulative Program/Portfolio Phase II Inception to Date including Carry-Over Savings from Phase I (this is cumulative Phase II verified savings) |
| CSP | Conservation Service Provider |
| CV | Coefficient of Variation |
| DCS | Double Counted Savings |
| DCU | Digital Control Unit |
| DEP | Department of Environmental Protection |
| DI | Direct Install |
| DID | Difference-in-Difference |
| DR | Demand Response |
| EDC | Electric Distribution Company |
| EE&C | Energy Efficiency and Conservation |
| EISA | Energy Independence and Security Act |
| EM&V | Evaluation, Measurement, and Verification |
| EPA | Environmental Protection Agency (United States) |
| ETO | Energy Trust of Oregon |
| GNI | Government, Nonprofit, and Institutional |
| HER | Home Energy Report |
| HOA | Homeowner’s Association |
| HOU | Hours of Use |
| HP | Horsepower |
| HPSF | Heating Seasonal Performance Factor |
| HVAC | Heating, Ventilation, and Air Conditioning |
| IMP | Interim Measure Protocol |
| ISR | In-Service Rate |
| kW | Kilowatt |
| kWh | Kilowatt-Hour |
| LED | Light-Emitting Diode |
| LEEP | Low-Income Energy Efficiency Program |
| LFER | Linear Fixed-Effects Regression |
| LIURP | Low-Income Usage Reduction Program |
| M&V | Measurement and Verification |
| MW | Megawatt |
| MWh | Megawatt-Hour |
| NTG | Net-to-Gross |
| NPV | Net Present Value |
| PEEP | PECO Energizing Education Program |
| PEG | Program Evaluators Group |
| Phase II Verified/ (Phase II-VG) | Verified/Ex Post Cumulative Program/Portfolio Phase II Inception to Date |
| Phase II Reported | Reported/Ex Ante Cumulative Program/Portfolio Phase II Inception to Date |
| Phase II+CO | Cumulative Program/Portfolio Phase II Inception to Date including Carry-Over Savings from Phase I (Cumulative Phase II Verified Savings) |
| PPR | Post-Program Regression |
| PUC | Pennsylvania Public Utility Commission |
| PY5 | Program Year 2013, from June 1, 2013 to May 31, 2014 |
| PY6 | Program Year 2014, from June 1, 2014 to May 31, 2015 |
| PY7 | Program Year 2015, from June 1, 2015 to May 31, 2016 |
| PY8 | Program Year 2016, from June 1, 2016 to May 31, 2017 |
| PYX QX | Program Year X, Quarter X |
| PYTD | Program Year to Date |
| QA | Quality Assurance |
| QC | Quality Control |
| RAP | Research Action Programs |
| RCT | Randomized Control Trial |
| SAR | Smart Appliance Recycling |
| SBR | Smart Builder Rebates |
| SCI | Smart Construction Incentives |
| SEER | Seasonal Energy Efficiency Rating |
| SEI | Smart Equipment Incentives |
| SES | Smart Energy Saver |
| SHC | Smart House Call |
| SMF | Smart Multi-Family |
| SOS | Smart On-Site |
| SSMVP | Site-Specific M&V Plan |
| SUP | Smart Usage Profile |
| SWE | Statewide Evaluator |
| TLED | Tubular Light-Emitting Diode |
| TRC | Total Resource Cost |
| TRM | Technical Reference Manual |
| UEC | Unit Energy Consumption |
| US | United States |
| VFD | Variable Frequency Drive |

Report Definitions

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

REPORTING PERIODS

Phase I

Refers to the Act 129 programs implemented prior to June 1, 2013. Phase I carry-over references verified gross Phase I savings in excess of Act 129 Phase I targets.

Phase II

Refers to the period from the start of Phase II Act 129 programs on June 1, 2013 through May 31, 2016. Phase II savings are calculated by totaling all program year results, including the current program year to date results, and subtracting any Phase II savings that expired during the current program year. For example, Phase II results for PY7 Q4 is the sum of PY5, PY6, PY7 Q1, PY7 Q2, PY7 Q3, and PY7 Q4 results, minus any Phase II savings that expired during PY5, PY6, or PY7.

Program Year to Date (PYTD)

Refers to the current reporting program year only. Activities occurring during previous program years are not included. For example, PYTD results for PY7 Q4 will include only results that occurred during PY7 Q1, PY7 Q2, PY7 Q3, and PY7 Q4; they will not include results from PY5 or PY6.

SAVINGS TYPES

Preliminary

Qualifier used in all reports except the final Annual Report to signify that evaluations are still in progress and that results have not been finalized. Most often used with realization rates or verified gross savings.

Reported Gross

Refers to results of the program or portfolio as determined by the program administrator—e.g., the electric distribution company (EDC) or the program implementer. Also known as ex ante or “before the fact” savings (uses annual evaluation activities as the reference point for the post period).

Adjusted Ex Ante Gross

References to adjusted ex ante gross (oradjusted ex ante) savings in this report refer to reported gross savings from the EDC’s tracking system that have been adjusted, where necessary, to reflect differences between the methods used to record and track savings and the methods in the Technical Reference Manual (TRM), or to correct data capture errors. These corrections are made to the population prior to evaluation, measurement, and verification (EM&V) activities. The adjusted ex ante gross savings are then verified through EM&V activities.

Verified Gross

Refers to the verified gross savings results of the program or portfolio as determined by the evaluation activities. Also known as ex post or “after the fact” savings (uses annual evaluation activities as the reference point for the post period).

**Verified Net**

The total change in load that is attributable to an energy efficiency program. This change in load may include, implicitly or explicitly, the effects of spillover, free riders, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption or demand. Net savings are calculated by multiplying verified savings by a net-to-gross (NTG) ratio.

Total Resource Cost COMPONENTS[[1]](#footnote-2)

Administration, Management, and Technical Assistance Costs

Includes rebate processing, tracking system, general administration, EDC and conservation service provider (CSP) program management, general management and legal, and technical assistance.

EDC Costs

Per the Pennsylvania Public Utility Commission (PUC) 2013 Total Resource Cost (TRC) Test Order, the total EDC costs refer to EDC-incurred expenditures only. This includes but is not limited to: administration, management, technical assistance, design and development of energy efficiency and conservation (EE&C) plans and programs, marketing, evaluation, and incentives.

Participant Costs

Participant costs as defined by the 2013 TRC Test Order.

Total TRC Costs

Total TRC costs as defined by the 2013 TRC Test Order.

Total TRC Benefits

Benefits as defined by the 2013 TRC Test Order.

# Overview of Portfolio

Pennsylvania Act 129 of 2008, which was 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). In 2009, each EDC submitted energy efficiency and conservation (EE&C) plans pursuant to these goals, which were approved by the Pennsylvania Public Utility Commission (PUC). Each EDC filed new EE&C plans with the PUC in 2012 for Phase II (June 2013 through May 2016) of the Act 129 programs. These plans were approved by the PUC in 2013.

Implementation of Phase II Act 129 programs began June 1, 2013. This report documents the progress and effectiveness of the Phase II EE&C accomplishments for PECO in Program Year 7 (PY7), defined as June 1, 2015 through May 31, 2016, as well as the cumulative accomplishments of the programs since inception of Phase II. This report also documents the energy savings carried over from Phase I. The Phase I carry-over savings count toward EDC savings compliance targets for Phase II.

Navigant Consulting, Inc. (Navigant) evaluated the programs, which included measurement and verification (M&V) of the savings.

## Summary of Progress Toward Compliance Targets

PECO achieved 118% of the energy savings compliance target based on cumulative portfolio Phase II inception to date, which includes carry-over savings from Phase I (Phase II+CO) verified gross energy savings, as shown in Figure 1‑1.

Figure ‑: Cumulative Portfolio Phase II Inception to Date Verified Gross Energy Impacts

**Source: Navigant analysis**

According to the Phase II Implementation Order, PECO is allowed by the PUC to carry over megawatt-hour (MWh) savings in excess of its Phase I compliance target into Phase II of Act 129. The total verified savings based on the Technical Reference Manual (TRM) that PECO reported for Phase I was 1,399,242 MWh. The PA PUC tentatively accepted this value in its Act 129 Phase I Compliance Determination Order.[[2]](#footnote-3) At the time PECO filed its Phase I Final Report, there were three combined heat and power (CHP) projects—one in the commercial and industrial (C&I) sector and two in the government, nonprofit, institutional (GNI) sector—that had commercial dates of operation (CDO) in Phase I. However, completion of the projects was too late in the program year for Navigant to verify them fully. Per the statewide evaluator’s (SWE’s) September 13, 2013 guidance memo on reporting unverified savings,[[3]](#footnote-4) PECO presented reported (unverified) savings for these projects in the Phase I report. Navigant fully evaluated these three projects and initially reported the verified savings in PECO’s PY5, Quarter 3 report;[[4]](#footnote-5) the verified savings totaled 25,101 MWh. In combination with the TRM-verified savings from Phase I, PECO’s total TRM-verified savings from Phase I are, therefore, 1,424,342 MWh. This amount exceeds PECO’s Phase I compliance target of 1,181,550 MWh by 242,793 MWh (one MWh difference due to rounding), which is the amount that PECO is carrying over into Phase II.

Table 1‑1 shows the incremental annual MWh savings from Phase I that PECO is carrying over into Phase II. Table 1‑2 shows the lifetime MWh savings from Phase I that PECO is carrying over into Phase II.

Table 1‑1: Phase II Verified Gross Savings and Verified Gross Savings from PY4 Carried Into Phase II

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sector [1]** | **PYTD Verified Gross Savings (MWh)** | **Phase II Verified Gross Savings (Cumulative Phase II MWH/Yr)** | **Verified Gross Savings Carried Over from Phase I (Cumulative Annual MWh/Yr)** | **Phase II+CO Verified gross Savings (Cumulative MWh/Yr)** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Residential (Non-Low-Income) | 213,367 | 394,070 | 109,888 | 503,958 |
| Residential (Low-Income) **[2]** | 37,329 | 91,673 | 0 | 91,673 |
| Total Residential (Non-Low-Income plus Low-Income) | 250,696 | 485,743 | 109,888 | 595,631 |
| C&I | 152,203 | 376,776 | 54,944 | 431,720 |
| GNI | 125,402 | 227,985 | 77,961 | 305,946 |
| **TOTAL** | **528,301** | **1,090,505** | **242,793** | **1,333,298** |

[1] All customer sector totals (excluding Total Residential—Non-Low-Income plus Low-Income) are exclusive of each other and may be added together to get the Phase II totals.  
[2] The evaluation team verified the percentage of customers participating in non-low-income-specific programs that were low-income-qualified through self-report surveys. The survey results were used to estimate program savings and incentives paid to low-income customers and were added to the savings achieved through low-income-specific programs.  
**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

Table ‑: Phase II Verified Gross Lifetime Savings and Verified Gross Lifetime Savings from Phase I Carried Into Phase II

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sector [1]** | **PYTD Verified Gross Savings (Lifetime MWh)** | **Phase II Verified Gross Savings (Lifetime MWh)** | **Verified Gross Savings Carried Over from Phase I (Lifetime MWh)** | **Phase II+CO Verified gross Savings (Lifetime MWh)** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Residential (Non-Low-Income) | 2,170,099 | 4,089,898 | 763,893 | 4,853,791 |
| Residential (Low-Income) **[2]** | 111,335 | 347,822 | 0 | 347,822 |
| Total Residential (Non-Low-Income plus Low-Income) | 2,281,435 | 4,437,721 | 763,893 | 5,201,614 |
| C&I | 2,076,890 | 4,374,445 | 954,726 | 5,329,171 |
| GNI | 1,666,978 | 3,133,894 | 1,055,854 | 4,189,748 |
| **TOTAL** | **6,025,303** | **11,946,060** | **2,774,473** | **14,720,533** |

[1] All customer sector totals (excluding Total Residential (Non-Low-Income plus Low-Income) are exclusive of each other and may be added together to get the Phase II totals.  
[2] The evaluation team verified the percentage of customers participating in non-low-income-specific programs that were low-income-qualified through self-report surveys. The survey results were used to estimate program savings and incentives paid to low-income customers and were added to the savings achieved through low-income-specific programs.  
**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

Table 1‑3 summarizes PECO’s cumulative verified gross energy savings since the inception of Act 129.

Table ‑: Phase I and Phase II Cumulative Annual Savings

|  |  |  |  |
| --- | --- | --- | --- |
| **Sector [1]** | **Phase I Cumulative Annual Verified Gross Savings (MWh)** | **Phase II Cumulative Annual Verified Gross Savings (MWh)** | **Act 129 Cumulative Annual Verified Gross Savings (MWh) Through Phase II** |

|  |  |  |  |
| --- | --- | --- | --- |
| Residential (Non-Low-Income) | 714,282 | 394,070 | 1,108,352 |
| Residential (Low-Income) **[2]** | 104,558 | 91,673 | 196,231 |
| Total Residential (Non-Low-Income plus Low-Income) | 818,840 | 485,743 | 1,304,583 |
| C&I | 409,476 | 376,776 | 786,252 |
| GNI | 196,027 | 227,985 | 424,012 |
| **TOTAL** | **1,424,342** | **1,090,505** | **2,514,848** |

[1] All customer sector totals (excluding Total Residential (Non-Low-Income plus Low-Income) are exclusive of each other and may be added together to get the Phase II totals.  
[2] The evaluation team verified the percentage of customers participating in non-low-income-specific programs that were low-income-qualified through self-report surveys. The survey results were used to estimate program savings and incentives paid to low-income customers and were added to the savings achieved through low-income-specific programs.  
**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

PECO achieved an overall net-to-gross ratio for Phase II of roughly 0.7 indicating that PECO has directly influenced a little over two-thirds of participants to install a more energy efficient product than they otherwise would have without PECO’s programs. Table 1‑4 summarizes PECO’s PY7 and Phase II verified net first year energy savings and lifetime energy savings. Additional detail on net savings can be found in Section 1.5 of this report.

Table ‑: Phase II Verified Net First-Year and Lifetime Savings

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sector [1]** | **PYTD Verified Net Savings (MWh/year)** | **Phase II Verified Net Savings (Cumulative Phase II MWh/Yr)** | **PYTD Verified Net Savings (Lifetime MWh)** | **Phase II Verified Net Savings (Lifetime MWh)** |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Residential (Non-Low-Income) | 147,072 | 240,469 | 1,218,187 | 2,207,728 |
| Residential (Low-Income) **[2]** | 14,033 | 58,431 | 90,319 | 326,806 |
| Total Residential (Non-Low-Income plus Low-Income) | 161,106 | 298,899 | 1,308,506 | 2,534,534 |
| C&I | 99,321 | 301,597 | 1,354,445 | 3,063,691 |
| GNI | 64,145 | 143,250 | 868,627 | 1,877,204 |
| **TOTAL** | **324,572** | **743,747** | **3,531,577** | **7,475,429** |

[1] All customer sector totals (excluding Total Residential (Non-Low-Income plus Low-Income) are exclusive of each other and may be added together to get the Phase II totals.  
[2] The evaluation team verified the percentage of customers participating in non-low-income-specific programs that were low-income-qualified through self-report surveys. The survey results were used to estimate program savings and incentives paid to low-income customers and were added to the savings achieved through low-income-specific programs.  
**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

In addition, PECO achieved 224.8 MW of gross verified demand reduction during Phase II[[5]](#footnote-6) (see Figure 1‑2). Additional detail on achieved demand reduction by program can be found in Section 1.4 of this report and Table 1‑13 of this section.

Figure ‑: Phase II Portfolio Reported and Verified Demand Reduction

**Source: Navigant analysis**

PECO offers measures at no cost to low-income customers. These measures offered to the low-income sector comprise 17% of the total measures offered. As required by the Phase II Implementation Order[[6]](#footnote-7), this exceeds the fraction of the electric consumption of PECO’s low-income households divided by the total electricity consumption in the PECO territory by 8.2%.[[7]](#footnote-8) These values are shown in Table 1‑5.

Table ‑: Phase II Low-Income Sector Compliance (Number of Measures)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Low-Income Sector** | **All Sectors** | **% Low-Income** | **Goal** |
| **# of Measures Offered** | 19 | 112 | 17% | 8.8% |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

The Phase II verified gross energy savings are 54,392 MWh/yr achieved through programs specifically designed for income-eligible customers, and 37,281 MWh/yr through other programs. This is 107 percent of the 4.5% Phase II total portfolio verified gross energy savings carve-out target for the low-income sector achieved through LEEP only, and 181 percent of the carve-out target from all programs. These results are shown in Table 1‑6.

Table 1‑6: Phase II Low-Income Sector Compliance (Percentage of Savings)

|  |  |
| --- | --- |
|  | Phase II Gross Verified |
| Low-Income Verified Gross Savings from Low-Income Programs (Cumulative Annual MWh/Yr) | 54,392 |
| Low-Income Verified Gross Savings from Other Residential Programs [1] (Cumulative Annual MWh/Yr) | 37,281 |
| Low-Income Verified Gross Savings Carried Over from Phase I (Cumulative Annual MWh/Yr) | 0 |
| All Low-Income Verified Gross Savings (Sum of First Three Rows) | 91,673 |
| Progress Toward Low-Income Goal from All Programs (Previous Row divided by Phase II MWh Target) | 181% |
| Progress Toward Low-Income Goal from Phase II LEEP Program (First Row divided by Phase II MWh Target) | 107% |
| Goal (4.5% of portfolio savings target) (MWh/Yr) | 50,663 |

[1] The evaluation team verified the percentage of customers participating in non-low-income-specific programs that were low-income-qualified through self-report surveys. The survey results were used to estimate program savings and incentives paid to low-income customers.  
**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

PECO achieved 272% of the May 31, 2016 energy reduction compliance target for the GNI sector based on cumulative program/portfolio savings from Phase II+CO verified gross energy savings achieved from the inception of Phase II through PY7 and including carry-over savings from Phase I as shown in Table 1‑7 and in Figure 1‑3.

Table ‑: Phase II GNI Sector Compliance

|  |  |
| --- | --- |
|  | Phase II Gross Verified |
| GNI Verified Gross Savings (Cumulative Annual MWh/Yr) | 227,985 |
| GNI Verified Gross Savings Carried Over from Phase I (Cumulative Annual MWh/Yr) | 77,961 |
| All GNI Verified Gross Savings (Sum of First Two Rows) | 305,946 |
| Progress Toward GNI Goal from All Programs + CO (Previous Row divided by Phase II MWh Target) | 272% |
| Progress Toward GNI Goal from All Phase II Programs Only (First Row divided by Phase II MWh Target) | 203% |
| Goal (10.0% of portfolio savings target) (MWh/Yr) | 112,585 |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

Figure ‑: Government, Nonprofit, and Institutional Sector Phase II Verified Gross Energy Impacts

**Source: Navigant analysis**

A summary of the number of participants, Phase II verified gross energy savings, Phase II demand reduction, and incentives paid are shown in Table 1‑8.

Table ‑: Summary of Phase II Performance by Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Sector [1]** | **Participants** | **Phase II Reported Gross Energy Savings (MWh/yr)** | **Phase II Reported Gross Demand Reduction [2] (MW)** | **Phase II Verified Gross Energy Savings (MWh/yr)** | **Phase II Verified Gross Demand Reduction [2] (MW)** | **Incentives Paid ($1,000)** |

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Residential (Non-Low-Income) | 7,086,270 | 404,975 | 107.4 | 394,070 | 106.0 | 57,343 |
| Residential (Low-Income) **[3]** | 1,544,027 | 52,684 | 6.2 | 91,673 | 11.5 | 4,130 |
| Small C&I | 81,119 | 112,748 | 21.9 | 173,009 | 37.5 | 7,481 |
| Large C&I | 1,047 | 199,294 | 29.9 | 203,768 | 31.7 | 15,899 |
| GNI | 988 | 232,022 | 38.6 | 227,985 | 38.0 | 20,506 |
| **PHASE II TOTAL** | **8,713,451** | **1,001,723** | **204.1** | **1,090,505** | **224.8** | **105,360** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
[3] The evaluation team verified the percentage of customers participating in non-low-income-specific programs that were low-income-qualified through self-report surveys. The survey results were used to estimate program savings and incentives paid to low-income customers and were added to the savings achieved through low-income-specific programs.  
**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

Table 1‑9 provides a summary of the carryover savings from Phase I programs and the savings PECO plans to carry over into Phase III. PECO is not eligible to carry over savings to count towards its Phase III portfolio level target; however, PECO is eligible to carry over verified gross savings towards its low-income and GNI carve-outs in the amount of 3,729 MWh and 115,400 MWh, respectively. PECO’s Phase II Residential Low-Income savings used to determine Phase II carryover includes only the 54,392 MWh of Phase II savings achieved through PECO’s low-income specific energy efficiency program. PECO’s GNI carryover calculation does not include Phase I GNI carryover savings.

Table 1‑9: Summary of Phase I Verified Gross Savings Remaining through Phase II

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sector [1]** | **Phase I Carry-Over Savings (MWh)** | **Phase II Cumulative Annual Savings (MWh)** | **Phase I Carry-Over Savings + Phase II Cumulative Annual Savings (MWh)** | **Phase II Compliance Targets (MWh)** | **Phase II Carry-Over Savings (MWh) [2]** |

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Residential (Non-Low-Income) | 109,888 | 394,070 | 503,958 | N/A | 0 |
| Residential (Low-Income) **[3]** | 0 | 91,673  [54,392] **[4]** | 91,673 | 50,663 | 3,729**[4]** |
| Small C&I | N/A | 173,009 | N/A | N/A | 0 |
| Large C&I | N/A | 203,768 | N/A | N/A | 0 |
| Total C&I (excluding GNI) | 54,944 | 376,776 | 431,720 | N/A | 0 |
| GNI | 77,961 | 227,985 | 305,946 | 112,585 | 115,400 |
| **TOTAL** | **242,793** | **1,090,505** | **1,333,298** | **1,125,851** | **0** |

[1] All customer sector totals (excluding Total C&I (excluding GNI)) are exclusive of each other and may be added together to get the Phase II totals.  
[2] Phase II Carry-Over Savings are calculated using savings achieved in Phase II only and do not consider Phase I Carry-Over Savings. Phase II Carry-Over Savings = Phase II Cumulative Annual Savings – Phase II Compliance Targets

[3] The evaluation team verified the percentage of customers participating in non-low-income-specific programs that were low-income-qualified through self-report surveys. The survey results were used to estimate program savings and incentives paid to low-income customers and were added to the savings achieved through low-income-specific programs.  
[4] Per the PA Act 129 Phase III Implementation Order, low-income savings achieved only through low-income specific programs are eligible to carry over into Phase III. The Phase II Cumulative Annual Savings from low-income specific programs (i.e., LEEP only) are shown in brackets [] and were used to calculated the Residential (Low-Income) Phase II Carry-Over Savings. The 91,673 MWh of Phase II Residential Low-Income savings includes savings from non-low-income specific programs, but was not used to determine Phase II Carry-Over Savings.  
**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

### Summary of Savings Adjustments throughout Phase II

In some cases, PECO has adjusted how it reports participation, energy savings, and demand reduction across the different sectors and programs, since the start of Phase II, to more accurately represent PECO’s performance in alignment with the Pennsylvania SWE reporting template. For example, C&I participation and savings were reallocated to the appropriate customer class to more accurately report achievements by the small and large C&I customer classes. Additionally, other adjustments were required to more accurately describe the participation, energy savings, and demand reduction achieved through the Phase II EE&C portfolio. Most of these adjustments to PY5 and PY6 values were previously reported in PECO’s PY7 Q4/Preliminary Annual Report[[8]](#footnote-9) and are restated here for clarity and consistency only. Adjustments to PY5 and PY6 values include the following:

* **Participation Adjustments:**
  + **Smart Appliance Recycling (SAR) program:** Reallocated PY5 and PY6 participation between Small C&I and Large C&I customer classes.
  + **Smart Home Rebates (SHR) program:** Added upstream light bulb counts to PY5 and PY6 measure participation. Previous reports did not include participation of upstream light bulbs and only reported non-lighting measure participation. Reallocated PY5 and PY6 participation between Small C&I and Large C&I customer classes.
  + **Low-Income Energy Efficiency Program (LEEP):** Added participation counts from Component 2, 3, and 4 in addition to Component 1. Previous reports only included participation from component 1. Reallocated PY5 and PY6 participation from Residential (Low-Income) customer sector to the Residential (Non-Low-Income) customer sector to account for participating customers that had income levels ranging from 151% to 200% of the federal poverty level.
  + **Smart House Call (SHC) program:** At the beginning of Phase II, PECO defined SHC participants as being a combination of unique premise number and invoice number; however, in PY7 both the evaluation team and PECO identified several cases where this definition did not provide an accurate count of participants. The evaluation team and PECO worked together to develop a new participant definition where participation is equal to the count of unique project numbers, excluding all project numbers denoted as “other installation” projects in program tracking data, by program year. PECO and the evaluation team confirmed that this updated operational definition successfully distinguishes unique participants. Participation counts have been updated accordingly.
  + **Smart Multi-Family Solutions (SMFS) program:** Reallocated PY5 and PY6 participation between Small C&I and Large C&I customer classes.
  + **Smart Equipment Incentives (SEI) C&I program:** Reallocated PY5 and PY6 participation between Small C&I and Large C&I customer classes.
  + **Smart Construction Incentives (SCI) program:** Reallocated PY5 and PY6 participation between Small C&I and Large C&I customer classes.
  + **Smart Business Solutions (SBS) program:** Reallocated PY5 and PY6 participation between Small C&I and Large C&I customer classes.
* **Verified Energy Savings Adjustments:**
  + **SAR program:** Reallocated PY5 and PY6 ex ante and verified energy savings between Small C&I and Large C&I customer classes.
  + **SHR program:** Removed 32,869 MWh of inadvertently double counted energy savings from the Phase II-to-date totals reported in PECO’s PY6 Annual Compliance Report.[[9]](#footnote-10) Reallocated all PY5 upstream lighting ex ante energy savings to the residential customer class. Reallocated PY6 ex ante and verified energy savings between Small C&I and Large C&I customer classes.
  + **LEEP:** Adjusted the savings associated with the air sealing Interim Measure Protocol (IMP) in response to SWE comments regarding PECO’s PY6 Annual Compliance Report. This adjusted the PY6 verified energy savings. Reallocated PY5 and PY6 ex ante and verified energy savings from Residential (Low-Income) customer sector to the Residential (Non-Low-Income) customer sector to account for participating customers that had income levels ranging from 151% to 200% of the federal poverty level.
  + **Smart Energy Saver (SES) program:** Adjusted the ISR used for 18W and 23W light bulbs in response to SWE comments regarding PECO’s PY6 Annual Compliance Report. This adjusted the PY6 verified energy savings.
  + **SMFS program:** Reallocated PY5 and PY6 ex ante and verified energy savings between Small C&I and Large C&I customer classes.
  + **SEI C&I program:** Reallocated PY5 and PY6 ex ante and verified energy savings between Small C&I and Large C&I customer classes.
  + **SCI program:** Reallocated PY5 and PY6 ex ante and verified energy savings between Small C&I and Large C&I customer classes.
  + **SBS program:** Reallocated PY5 and PY6 ex ante and verified energy savings between Small C&I and Large C&I customer classes.
* **Verified Demand Reduction Adjustments:**
  + **SHR program:** Reallocated all PY5 upstream lighting ex ante demand savings to the residential customer class. Reallocated PY6 verified demand savings between Small C&I and Large C&I customer classes.
  + **LEEP:** Adjusted the savings associated with the air sealing IMP in response to SWE comments regarding PECO’s PY6 Annual Compliance Report. This adjusted the PY6 verified demand savings. Reallocated PY5 and PY6 ex ante and verified demand savings from Residential (Low-Income) customer sector to the Residential (Non-Low-Income) customer sector to account for participating customers that had income levels ranging from 151% to 200% of the federal poverty level.
  + **SES program:** Adjusted the ISR used for 18-watt and 23-watt light bulbs in response to SWE comments regarding PECO’s PY6 Annual Compliance Report. This adjusted the PY6 verified demand savings.
  + **SMFS program:** Reallocated PY5 and PY6 ex ante and verified demand savings between Small C&I and Large C&I customer classes.
  + **SEI C&I program:** Removed 5.5 MW of verified demand reduction from the Phase II-to-date totals incorrectly reported in PECO’s PY6 Annual Compliance Report. Reallocated PY5 and PY6 ex ante and verified demand savings between Small C&I and Large C&I customer classes.
  + **SCI program:** Reallocated PY5 and PY6 ex ante and verified demand savings between Small C&I and Large C&I customer classes.
  + **SBS program:** Reallocated PY5 and PY6 ex ante and verified demand savings between Small C&I and Large C&I customer classes.

## Summary of Energy Impacts

A summary of the reported and verified energy savings by program for PY7 is presented in Figure 1‑4**.**

Figure ‑: PYTD Reported and Verified Gross Energy Savings by Program (MWh/yr)

**Source: Navigant analysis**

A summary of the Phase II reported and verified energy savings by program is presented in Figure 1‑5.

Figure ‑: Phase II Reported and Verified Gross Energy Savings by Program (MWh/yr)

**Source: Navigant analysis**

Summaries of energy impacts by program through PY7 are presented in Table 1‑10 and Table 1‑11.

Table ‑: Reported Participation and Gross Energy Savings by Program

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Program | Participants | | Reported Gross Impact (MWh/yr) | |
| **PYTD** | **Phase II** | **PYTD** | **Phase II** |
| Smart Appliance Recycling | 9,367 | 28,224 | 9,322 | 25,834 |
| Smart Builder Rebates | 158 | 248 | 365 | 590 |
| Smart Energy Saver | 12,324 | 37,827 | 2,786 | 9,017 |
| Smart Home Rebates | 3,640,919 | 7,667,436 | 142,472 | 314,502 |
| Smart House Call | 6,479 | 12,101 | 6,742 | 10,566 |
| Smart Multi-Family Solutions | 3,889 | 22,338 | 5,573 | 17,737 |
| Smart Usage Profile | 132,289 | 132,289 | 36,690 | 36,690 |
| Low-Income Energy Efficiency | 222,711 | 737,371 | 19,801 | 52,899 |
| Residential Smart AC Saver | 65,274 | 69,077 | 0 | 0 |
| Smart Business Solutions | 189 | 1,172 | 5,114 | 31,844 |
| Smart Construction Incentives | 181 | 283 | 26,545 | 45,254 |
| Smart Equipment Incentives - C&I | 1,329 | 2,446 | 119,944 | 229,217 |
| Smart Equipment Incentives - GNI | 469 | 796 | 97,768 | 133,586 |
| Smart On-Site | 6 | 8 | 34,043 | 93,988 |
| Commercial Smart AC Saver | 1,686 | 1,834 | 0 | 0 |
| TOTAL PORTFOLIO | **4,097,270** | **8,713,451** | **507,165** | **1,001,723** |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

PECO achieved an overall PY7 energy savings realization rate of 1.04 with PYTD verified gross energy savings estimated at 528,301 MWh/yr with an achieved portfolio level precision of 3% at the 85% confidence interval (4% at the 90% confidence interval, exceeding the SWE Evaluation Framework requirements). PECO achieved Phase II verified gross energy savings of 1,090,505 MWh/yr with an achieved portfolio level precision of 1% at the 90% confidence interval, not including Phase I carryover, thus exceeding the SWE Evaluation Framework requirements.

Table 1‑11: Verified Gross Energy Savings by Program

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Program | PYTD Reported Gross Energy Savings (MWh/yr) | PYTD Energy Realization Rate | PYTD Verified Gross Energy Savings (MWh/Year) | PYTD Achieved Precision[1] | Phase II Verified Gross Energy Savings (MWh/Year) | Phase II Achieved Precision[2] |
| Smart Appliance Recycling | 9,322 | 0.95 | 8,843 | 0% | 24,212 | 0% |
| Smart Builder Rebates | 365 | 0.99 | 363 | 2% | 592 | 1% |
| Smart Energy Saver | 2,786 | 0.87 | 2,413 | 1% | 7,219 | 0% |
| Smart Home Rebates | 142,472 | 1.22 | 173,382 | 4% | 403,631 | 2% |
| Smart House Call | 6,742 | 0.98 | 6,640 | 1% | 10,566 | 1% |
| Smart Multi-Family Solutions | 5,573 | 0.90 | 5,038 | 3% | 16,835 | 2% |
| Smart Usage Profile | 36,690 | 1.06 | 39,041 | 0% | 39,041 | 0% |
| Low-Income Energy Efficiency | 19,801 | 0.92 | 18,304 | 0% | 54,607 | 0% |
| Residential Smart AC Saver | 0 | 0.00 | 0 | N/A | 0 | N/A |
| Smart Business Solutions | 5,114 | 0.97 | 4,971 | 11% | 29,004 | 3% |
| Smart Construction Incentives | 26,545 | 0.87 | 22,995 | 29% | 43,348 | 6% |
| Smart Equipment Incentives - C&I | 119,944 | 1.00 | 119,579 | 11% | 238,518 | 4% |
| Smart Equipment Incentives - GNI | 97,768 | 0.99 | 97,110 | 7% | 133,883 | 2% |
| Smart On-Site | 34,043 | 0.87 | 29,621 | 0% | 90,049 | 0% |
| Commercial Smart AC Saver | 0 | 0.00 | 0 | N/A | 0 | N/A |
| TOTAL PORTFOLIO | **507,165** | **1.04** | **528,301** | **3%** | **1,090,505** | **1%** |
| Phase I Carry-Over | N/A | N/A | N/A | N/A | 242,793 | N/A |
| Total Phase II+CO | **N/A** | **N/A** | **N/A** | **N/A** | **1,333,298** | **N/A** |

[1] At the 85% confidence level

[2] At the 90% confidence level

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

## Summary of Fuel Switching Impacts

PECO customers completed projects in PY7 in which services originally provided by electricity were converted to run on natural gas (i.e. “fuel switching measures”[[10]](#footnote-11)). In PY5 and PY7, the Smart Home Rebate (SHR) and Smart On-Site (SOS) programs included fuel-switching measures, but in PY6 only SHR included fuel switching measures. Fuel switching measures in the phase included:

* Combined heat and power
* Electric heat to gas/propane/oil heat (ASHP to gas)
* Electric Heat to gas/propane/oil heat (electric baseboard/electric furnace)
* Electric domestic hot water (DHW) heater to gas
* Electric clothes dryer to gas

Total verified gross energy and demand savings for SHR fuel-switching measures in PY7 were 783 MWh and 0.02 MW. The total verified gross energy and demand savings for SOS fuel-switching measures in PY7 were 29,621 MWh and 3.9 MW. This brings PECO’s total verified gross savings for fuel-switching measures in PY7 to 30,410 MWh and 3.9 MW. The ex-ante and verified savings were based on the 2015 TRM[[11]](#footnote-12) algorithms. The total value of rebates for fuel-switching measures was $56,350 for SHR and $1,546,660 for SOS, for a total of $1,603,010 in fuel-switching rebates in PY7.

## Summary of Demand Impacts

A summary of the reported and verified demand reduction by program for PY7 is presented in Figure 1‑6. The impacts below reflect the line loss factors shown in Table 1‑16.

Figure ‑: PYTD Reported and Verified Gross Demand Reduction by Program

**Source: Navigant analysis**

A summary of the cumulative reported and verified demand reduction by program is presented in Figure 1‑7.

Figure ‑: Phase II Reported and Verified Gross Demand Reduction by Program

**Source: Navigant analysis**

A summary of demand reduction impacts by program through PY7 is presented in Table 1‑12 and Table 1‑13. PECO achieved an overall PY7 demand reduction realization rate of 0.97 with PYTD verified gross demand reductions estimated at 124.8 MW with an achieved portfolio level precision of 3% at the 85% confidence interval (3.3% at the 90% confidence interval, exceeding the SWE Evaluation Framework requirements). PECO achieved Phase II verified gross demand reductions of 224.8 MW with an achieved portfolio level precision of 1% at the 90% confidence interval, thus exceeding the SWE Evaluation Framework requirements.

Table 1‑13

Table ‑: Reported Participation and Gross Demand Reduction by Program

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Program | Participants | | Reported Gross Impact (MW) | |
| **PYTD** | **Phase II** | **PYTD** | **Phase II** |
| Smart Appliance Recycling | 9,367 | 28,224 | 1.3 | 3.7 |
| Smart Builder Rebates | 158 | 248 | 0.1 | 0.2 |
| Smart Energy Saver | 12,324 | 37,827 | 0.3 | 0.9 |
| Smart Home Rebates | 3,640,919 | 7,667,436 | 20.6 | 41.7 |
| Smart House Call | 6,479 | 12,101 | 1.0 | 1.5 |
| Smart Multi-Family Solutions | 3,889 | 22,338 | 0.7 | 1.9 |
| Smart Usage Profile | 132,289 | 132,289 | 0.0 | 0.0 |
| Low-Income Energy Efficiency | 222,711 | 737,371 | 2.6 | 6.2 |
| Residential Smart AC Saver | 65,274 | 69,077 | 49.6 | 58.6 |
| Smart Business Solutions | 189 | 1,172 | 1.1 | 6.2 |
| Smart Construction Incentives | 181 | 283 | 5.1 | 8.0 |
| Smart Equipment Incentives - C&I | 1,329 | 2,446 | 18.4 | 35.2 |
| Smart Equipment Incentives - GNI | 469 | 796 | 20.6 | 25.3 |
| Smart On-Site | 6 | 8 | 4.5 | 12.3 |
| Commercial Smart AC Saver | 1,686 | 1,834 | 3.0 | 2.3 |
| TOTAL PORTFOLIO | **4,097,270** | **8,713,451** | **129.0** | **204.1** |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

PECO achieved an overall PY7 demand reduction realization rate of 0.97 with PYTD verified gross demand reductions estimated at 124.8 MW with an achieved portfolio level precision of 3% at the 85% confidence interval (3.3% at the 90% confidence interval, exceeding the SWE Evaluation Framework requirements). PECO achieved Phase II verified gross demand reductions of 224.8 MW with an achieved portfolio level precision of 1% at the 90% confidence interval, thus exceeding the SWE Evaluation Framework requirements.

Table ‑: Verified Gross Demand Reduction by Program

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Program | PYTD Reported Demand Savings (MW) | PYTD Demand Realization Rate | PYTD Verified Gross Demand Savings (MW) | PYTD Achieved Precision[1] | Phase II Verified Gross Demand Savings (MW) | Phase II Achieved Precision[2] |
| Smart Appliance Recycling | 1.3 | 0.95 | 1.2 | 0% | 3.4 | 0% |
| Smart Builder Rebates | 0.1 | 0.76 | 0.1 | 22% | 0.2 | 9% |
| Smart Energy Saver | 0.3 | 0.90 | 0.3 | 1% | 0.8 | 1% |
| Smart Home Rebates | 20.6 | 1.36 | 27.9 | 4% | 63.5 | 2% |
| Smart House Call | 1.0 | 0.99 | 0.9 | 1% | 1.5 | 1% |
| Smart Multi-Family Solutions | 0.7 | 1.80 | 1.2 | 3% | 1.8 | 2% |
| Smart Usage Profile | 0.0 | N/A | 0.0 | N/A | 0.0 | N/A |
| Low-Income Energy Efficiency | 2.6 | 0.92 | 2.4 | 0% | 6.2 | 0% |
| Residential Smart AC Saver | 49.6 | 0.82 | 40.5 | 0% | 55.5 | 0% |
| Smart Business Solutions | 1.1 | 0.97 | 1.1 | 8% | 7.6 | 3% |
| Smart Construction Incentives | 5.1 | 0.72 | 3.7 | 22% | 6.6 | 8% |
| Smart Equipment Incentives - C&I | 18.4 | 1.07 | 19.6 | 17% | 39.1 | 7% |
| Smart Equipment Incentives - GNI | 20.6 | 1.04 | 21.4 | 6% | 25.5 | 4% |
| Smart On-Site | 4.5 | 0.86 | 3.9 | 0% | 11.6 | 0% |
| Commercial Smart AC Saver | 3.0 | 0.18 | 0.6 | 0% | 1.5 | 0% |
| TOTAL PORTFOLIO | **129.0** | **0.97** | **124.8** | **3%** | **224.8** | **1%** |
| Phase I Carry-Over | N/A | N/A | N/A | N/A | N/A | N/A |
| Total Phase II+CO | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** | **N/A** |

[1] At the 85% confidence level

[2] At the 90% confidence level

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

## Summary of PY7 Net-to-Gross Ratios

Per the 2013 TRC Order, EDCs are required to conduct net-to-gross (NTG) research. NTG ratios are not used for compliance purposes, but are used for cost-effectiveness reporting and future program planning purposes and should be applied to gross savings in order to calculate net verified energy and demand savings. NTG should be estimated for all programs, including low-income and programs that distribute free measures. The only exception is if an EDC (or its evaluation consultant) provides an explanation, acceptable to the SWE, that estimating NTG for a given program would be inappropriate or unfeasible. Table 1‑14 presents a summary of NTG ratios by program.

Table ‑: PY7 NTG Ratios by Program

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Program | Free Ridership (%) | Spillover (%) | NTG Ratio PY7 | PY7 Verified Net Energy Savings (MWh/Yr) | PY7 Verified Net Demand Savings (MW/Yr) |
| Smart Appliance Recycling | 50% | 0% | 0.50 | 4,408 | 0.6 |
| Smart Builder Rebates | 50% | 0% | 0.50 | 182 | 0.1 |
| Smart Energy Saver[2] | 0% | 0% | 1.00 | 2,413 | 0.3 |
| Smart Home Rebates | 49% | 3% | 0.54 | 92,818 | 14.9 |
| Smart House Call | 13% | 7% | 0.94 | 6,214 | 0.9 |
| Smart Multi-Family Solutions | 40% | 1% | 0.61 | 3,070 | 0.7 |
| Smart Usage Profile[2] | 0% | 0% | 1.00 | 39,041 | 0.0 |
| Low-Income Energy Efficiency | 19% | 0% | 0.81 | 14,849 | 1.9 |
| Residential Smart AC Saver[2] | 0% | 0% | 1.00 | 0 | 40.5 |
| Smart Business Solutions[1] | 10% | 0% | 0.90 | 4,474 | 1.0 |
| Smart Construction Incentives[1] | 48% | 0% | 0.52 | 12,033 | 1.9 |
| Smart Equipment Incentives - C&I | 37% | 1% | 0.64 | 77,055 | 12.7 |
| Smart Equipment Incentives - GNI | 58% | 1% | 0.43 | 41,552 | 9.2 |
| Smart On-Site | 11% | 0% | 0.89 | 26,342 | 3.5 |
| Commercial Smart AC Saver[2] | 0% | 0% | 1.00 | 0 | 0.6 |
| TOTAL PORTFOLIO (Weighted by program savings for programs reporting NTG Ratios) | **39%** | **1%** | **0.62** | **324,450** | **88.7** |

[1] No NTG research was performed for this program in PY7. Therefore, the most recently evaluated NTG value is used.

[2] Due to the program design and prior years' evaluation efforts, the NTG ratio for SUP, SES, and Smart AC Saver is assumed be 1.0.

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

## Summary of Portfolio Finances and Cost-Effectiveness

A breakdown of the portfolio finances is presented in Table 1‑5. PECO’s portfolio was cost-effective based on a final Phase II TRC benefit-cost ratio of 1.76 and a PY7 ratio of 2.05.

Table ‑: Summary of Portfolio Finances

|  |  |  |  |
| --- | --- | --- | --- |
| **Row #** | **Cost Category** | **Actual PYTD Costs** | **Actual Phase II Costs** |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 163,964 | 349,918 |
| 2 | EDC Incentives to Participants | 41,321 | 81,659 |
| 3 | EDC Incentives to Trade Allies | 348 | 659 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 122,295 | 267,600 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10) | 49,479 | 147,530 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance | 30,141 | 94,112 |
| 8 | Marketing | 13,228 | 39,240 |
| 9 | EDC Evaluation Costs | 6,110 | 14,178 |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increase in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 5,900 | 18,944 |
|  | | | |
| 12 | Total TRC Costs (Sum of Rows 1, 5, and 11) | 219,343 | 516,392 |
| 13 | Total NPV Lifetime Energy Benefits | 391,364 | 782,207 |
| 14 | Total NPV Lifetime Capacity Benefits | 45,030 | 91,316 |
| 15 | Total NPV TRC Benefits | 449,835 | 906,714 |
|  | | | |

|  |  |  |  |
| --- | --- | --- | --- |
| 16 | TRC Benefit-Cost Ratio | 2.05 | 1.76 |

**Source: Navigant analysis**

## Summary of Cost-Effectiveness by Program in PY7

TRC benefit-cost ratios were calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. Table 1‑16 shows the TRC ratios by program and other key factors used in the TRC ratio calculation for Phase II programs.

Table ‑: PYTD TRC Ratios by Program

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Program | TRC NPV Benefits ($1000) | TRC NPV Costs ($1000) | TRC Benefit-Cost Ratio | Discount Rate | Energy Line Loss Factor | Demand Line Loss Factor |
| Smart Appliance Recycling | 6,606 | 1,381 | 4.78 | 7.6% | 1.0760 | 1.1916 |
| Smart Builder Rebates | 433 | 840 | 0.52 | 7.6% | 1.0760 | 1.1916 |
| Smart Energy Saver | 1,775 | 450 | 3.94 | 7.6% | 1.0760 | 1.1916 |
| Smart Home Rebates | 187,505 | 74,069 | 2.53 | 7.6% | 1.0760 | Res = 1.1916; C&I = 1.111; GNI = 1.117 |
| Smart House Call | 7,034 | 7,503 | 0.94 | 7.6% | 1.0760 | 1.1916 |
| Smart Multi-Family Solutions | 2,699 | 1,581 | 1.71 | 7.6% | 1.0760 | Res = 1.1916; C&I = 1.111; GNI = 1.117 |
| Smart Usage Profile | 4,143 | 540 | 7.67 | 7.6% | 1.0760 | 1.1916 |
| Low-Income Energy Efficiency | 12,435 | 8,088 | 1.54 | 7.6% | 1.0760 | 1.1916 |
| Residential Smart AC Saver | 18,387 | 6,754 | 2.72 | 7.6% | 1.0760 | 1.1916 |
| Smart Business Solutions | 3,410 | 1,779 | 1.92 | 7.6% | 1.0760 | C&I = 1.111; GNI = 1.117 |
| Smart Construction Incentives | 18,312 | 13,316 | 1.38 | 7.6% | 1.0760 | C&I = 1.111; GNI = 1.117 |
| Smart Equipment Incentives - C&I | 94,325 | 34,165 | 2.76 | 7.6% | 1.0760 | 1.1110 |
| Smart Equipment Incentives - GNI | 69,659 | 26,964 | 2.58 | 7.6% | 1.0760 | 1.1170 |
| Smart On-Site | 22,861 | 30,571 | 0.75 | 7.6% | 1.0760 | C&I = 1.111; GNI = 1.117 |
| Commercial Smart AC Saver | 251 | 313 | 0.80 | 7.6% | 1.0760 | 1.1916 |
| TOTAL | **449,835** | **219,343** | **2.05** | **7.6%** | **1.0760** | **Res = 1.1916; C&I = 1.111; GNI = 1.117** |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

## Comparison of PY7 Performance to Approved EE&C Plan

Table 1‑17 shows PY7 expenditures compared to the budget estimates set forth in the EE&C plan.

Table 1‑17: Comparison of PY7 Program Expenditures to PY7 EE&C Plan

|  |  |  |  |
| --- | --- | --- | --- |
| **Program** | **PY7 Budget from EE&C Plan** | **PY7 Actual Expenditures** | **% Difference from PY7 EE&C Plan [(Planned - Actual)/Planned]** |
| Smart Appliance Recycling | $1,768,891 | $1,380,653 | 22% |
| Smart Builder Rebates | $596,406 | $503,409 | 16% |
| Smart Energy Saver | $457,166 | $450,255 | 2% |
| Smart Home Rebates | $18,138,930 | $22,560,597 | -24% |
| Smart House Call | $6,365,387 | $5,742,027 | 10% |
| Smart Multi-Family Solutions | $2,412,246 | $1,581,443 | 34% |
| Smart Usage Profile | $1,384,872 | $540,399 | 61% |
| Low-Income Energy Efficiency | $8,592,892 | $8,088,046 | 6% |
| Residential Smart AC Saver | $9,646,570 | $6,753,738 | 30% |
| Smart Business Solutions | $1,533,194 | $999,845 | 35% |
| Smart Construction Incentives | $3,736,313 | $4,026,623 | -8% |
| Smart Equipment Incentives - C&I | $11,944,426 | $13,234,867 | -11% |
| Smart Equipment Incentives - GNI | $7,005,850 | $11,917,300 | -70% |
| Smart On-Site | $1,898,161 | $2,028,202 | -7% |
| Commercial Smart AC Saver | $544,554 | $312,936 | 43% |
| Support Services | $15,055,632 | $11,027,484 | 9% |
| **TOTAL** | **$91,081,490** | **$91,147,823** | **0%** |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

Table 1‑18 shows PY7 program savings compared to the energy and demand savings estimates filed in the EE&C plan.

Table 1‑18: Comparison of PY7 Actual Program Savings to EE&C Plan for PY7

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program** | **PY7 MWh Savings Projected in EE&C Plan** | **Actual Reported PY7 MWh Savings** | **% Difference [(PY7 Planned - PY7 Actual)/PY7 Planned]** | **PY7 MW Savings Projected in EE&C Plan** | **Actual Reported PY7 MW Savings** | **% Difference [(PY7 Planned - PY7 Actual)/PY7 Planned]** |
| Smart Appliance Recycling | 10,666 | 9,322 | 13% | 1.3 | 1.3 | 1% |
| Smart Builder Rebates | 162 | 365 | -125% | 0.0 | 0.1 | -533% |
| Smart Energy Saver | 1,936 | 2,786 | -44% | 0.2 | 0.3 | -91% |
| Smart Home Rebates | 65,583 | 142,472 | -117% | 17.3 | 20.6 | -19% |
| Smart House Call | 5,919 | 6,742 | -14% | 0.7 | 1.0 | -37% |
| Smart Multi-Family Solutions | 8,507 | 5,573 | 34% | 1.5 | 0.7 | 55% |
| Smart Usage Profile | 20,000 | 36,690 | -83% | 2.5 | 0.0 | 100% |
| Low-Income Energy Efficiency | 19,251 | 19,801 | -3% | 2.6 | 2.6 | 0% |
| Residential Smart AC Saver | 0 | 0 | N/A | 78.0 | 49.6 | 36% |
| Smart Business Solutions | 12,636 | 5,114 | 60% | 2.7 | 1.1 | 59% |
| Smart Construction Incentives | 26,543 | 26,545 | 0% | 6.3 | 5.1 | 19% |
| Smart Equipment Incentives - C&I | 78,985 | 119,944 | -52% | 17.8 | 18.4 | -3% |
| Smart Equipment Incentives - GNI | 29,574 | 97,768 | -231% | 9.9 | 20.6 | -108% |
| Smart On-Site | 27,485 | 34,043 | -24% | 3.4 | 4.5 | -34% |
| Commercial Smart AC Saver | 0 | 0 | N/A | 2.6 | 3.0 | -16% |
| **TOTAL** | **307,247** | **507,165** | **-65%** | **146.8** | **129.0** | **12%** |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

Several programs exceeded or fell short of projected gross energy savings by five percent or more in PY7. Reasons for this variation differ from program to program, but there are several general factors that affected results across the portfolio. These include, but are not limited to, the following:

* Higher or lower than projected adoption of planned program measures
* Higher or lower than projected participation in the programs
* Pauses or ramp-ups in program implementation efforts due to strategy, market conditions, or CSP disruptions such as bankruptcy
* Implementation or elimination of special limited-time incentives for program participation

The list below briefly discusses several key reasons why programs exceeded or fell short of projected gross energy savings by 5 percent or more in PY7.

* Smart Appliance Recycling: The SAR program’s implementation team, JACO, went through a bankruptcy in PY7. This caused a disruption in implementation efforts and resulted in a shortfall in program savings.
* Smart Builder Rebates: The SBR program had high adoption among a few key production builders, boosting the program to exceed the planned savings.
* Smart Energy Saver: The SES program had high satisfaction among classroom teachers that helped facilitate the program and the measures had high adoption among participating families, leading the program to exceed the planned savings.
* Smart Home Rebates: The SHR program ramped up implementation efforts to help compensate for a forecast shortfall in overall C&I sector participation, causing the program to exceed planned savings.
* Smart House Call: The SHC program had higher than projected participation in PY7, helped by high customer satisfaction and effective marketing materials such as bill inserts and mailers. This led the program to exceed planned savings.
* Smart Usage Profile: The SUP program ramped up implementation efforts to help compensate for a forecast shortfall in overall C&I sector participation, causing the program to exceed planned savings.
* Smart Multi-Family Solutions: The SMF program had good adoption of DI measures but lower than projected adoption of the non-DI prescriptive measures offered, resulting in a shortfall in program savings.
* Smart Business Solutions: The SBS program had lower implementation of higher-savings non-fluorescent lighting measures than projected, leading to a shortfall in program savings. The SBS program also exceeded its Phase II budget by the end of PY6, and thus had to significantly ramp down outreach and participation in PY7 to compensate.
* Smart Equipment Incentives: The SEI programs had good adoption among C&I and GNI customers with large projects and had more participation than projected in the GNI sector. Further, initial forecasts for projects that would complete in PY7 underestimated the final completion numbers for the year. The program ramped up efforts to compensate for the forecast. This led the program to exceed planned savings in both the C&I and GNI sectors.
* Smart On-Site: The SOS had projects that were larger than projected, causing the program to exceed planned savings.

Navigant summarizes recommendations for Phase III based on these observations in Section 0. Additional details are included in the program-specific chapters contained in this report.

## Summary of Cost-Effectiveness by Program for Phase II

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. Table 1‑19 shows the TRC ratios by program and other key factors used in the TRC ratio calculation for Phase II programs.

Table ‑: Phase II TRC Ratios by Program

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program** | **TRC NPV Benefits ($1000)** | **TRC NPV Costs ($1000)** | **TRC Benefit-Cost Ratio** | **Discount Rate** | **Energy Line Loss Factor** | **Demand Line Loss Factor** |
| Smart Appliance Recycling | 17,471 | 4,101 | 4.26 | 7.6% | 1.0760 | 1.1916 |
| Smart Builder Rebates | 698 | 1,736 | 0.40 | 7.6% | 1.0760 | 1.1916 |
| Smart Energy Saver | 5,327 | 1,351 | 3.94 | 7.6% | 1.0760 | 1.1916 |
| Smart Home Rebates | 362,999 | 162,126 | 2.24 | 7.6% | 1.0760 | Res = 1.1916; C&I = 1.111; GNI = 1.117 |
| Smart House Call | 10,622 | 14,686 | 0.72 | 7.6% | 1.0760 | 1.1916 |
| Smart Multi-Family Solutions | 9,358 | 6,141 | 1.52 | 7.6% | 1.0760 | Res = 1.1916; C&I = 1.111; GNI = 1.117 |
| Smart Usage Profile | 4,143 | 2,903 | 1.43 | 7.6% | 1.0760 | 1.1916 |
| Low-Income Energy Efficiency | 36,409 | 23,453 | 1.55 | 7.6% | 1.0760 | 1.1916 |
| Residential Smart AC Saver | 57,316 | 20,598 | 2.78 | 7.6% | 1.0760 | 1.1916 |
| Smart Business Solutions | 23,417 | 12,706 | 1.84 | 7.6% | 1.0760 | C&I = 1.111; GNI = 1.117 |
| Smart Construction Incentives | 34,335 | 24,563 | 1.40 | 7.6% | 1.0760 | C&I = 1.111; GNI = 1.117 |
| Smart Equipment Incentives - C&I | 183,550 | 71,881 | 2.55 | 7.6% | 1.0760 | 1.1110 |
| Smart Equipment Incentives - GNI | 94,697 | 43,048 | 2.20 | 7.6% | 1.0760 | 1.1170 |
| Smart On-Site | 65,384 | 93,699 | 0.70 | 7.6% | 1.0760 | C&I = 1.111; GNI = 1.117 |
| Commercial Smart AC Saver | 988 | 932 | 1.06 | 7.6% | 1.0760 | 1.1916 |
| **TOTAL** | **906,714** | **516,392** | **1.76** | **7.6%** | **1.0760** | **Res = 1.1916; C&I = 1.111; GNI = 1.117** |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

The portfolio TRC ratio of 1.76 for Phase II exceeded the TRC ratio of 1.5 set forth in the EE&C plan. Total TRC benefits and TRC costs exceeded planned values by 80 percent and 58 percent, respectively. Programs that exceeded their planned TRC value, such as Smart Home Rebates, Smart Usage Profile, Smart Energy Saver, and Smart Equipment Incentives, boosted the overall cost-effectiveness of the portfolio. In contrast, Smart On-Site and Commercial Smart AC Saver fell short of their planned TRC ratios.

## Comparison of Phase II Performance to Approved EE&C Plan

Table 1‑20 shows Phase II expenditures compared to the budget estimates set forth in the EE&C plan.

Table ‑: Comparison of Phase II Program Expenditures to Phase II EE&C Plan

|  |  |  |  |
| --- | --- | --- | --- |
| **Program** | **Phase II Budget from EE&C Plan** | **Phase II Actual Expenditures** | **% Difference from Phase II EE&C Plan [(Planned - Actual)/Planned]** |
| Smart Appliance Recycling | $5,001,431 | $4,086,165 | 18% |
| Smart Builder Rebates | $1,710,536 | $1,212,801 | 29% |
| Smart Energy Saver | $1,363,555 | $1,350,865 | 1% |
| Smart Home Rebates | $50,865,017 | $50,483,467 | 1% |
| Smart House Call | $16,415,058 | $11,923,966 | 27% |
| Smart Multi-Family Solutions | $6,738,560 | $6,140,800 | 9% |
| Smart Usage Profile | $2,977,272 | $2,902,613 | 3% |
| Low-Income Energy Efficiency | $23,843,896 | $23,452,828 | 2% |
| Residential Smart AC Saver | $28,651,944 | $20,598,462 | 28% |
| Smart Business Solutions | $4,364,398 | $5,535,948 | -27% |
| Smart Construction Incentives | $10,606,956 | $8,631,414 | 19% |
| Smart Equipment Incentives - C&I | $33,898,431 | $30,959,918 | 9% |
| Smart Equipment Incentives - GNI | $20,318,877 | $21,360,676 | -5% |
| Smart On-Site | $9,162,725 | $7,786,612 | 15% |
| Commercial Smart AC Saver | $1,620,329 | $931,832 | 42% |
| Support Services | $37,799,127 | $32,468,970 | 14% |
| **TOTAL** | **$255,338,112** | **$229,827,335** | **10%** |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

Table 1‑21 shows Phase II program savings compare to the energy and demand savings estimates filed in the EE&C plan.

Table ‑: Comparison of Phase II Actual Program Savings to EE&C Plan for Phase II

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Program** | **Phase II MWh Savings Projected in EE&C Plan** | **Actual Reported Phase II MWh Savings** | **% Difference [(Phase II Planned - Phase II Actual)/Phase II Planned]** | **Phase II MW Savings Projected in EE&C Plan** | **Actual Reported Phase II MW Savings** | **% Difference [(Phase II Planned - Phase II Actual)/Phase II Planned]** |
| Smart Appliance Recycling | 29,960 | 25,834 | 14% | 3.6 | 3.7 | -2% |
| Smart Builder Rebates | 409 | 590 | -44% | 0.1 | 0.2 | -285% |
| Smart Energy Saver | 5,939 | 9,017 | -52% | 0.5 | 0.9 | -92% |
| Smart Home Rebates | 226,057 | 314,502 | -39% | 55.8 | 41.7 | 25% |
| Smart House Call | 13,717 | 10,566 | 23% | 1.6 | 1.5 | 5% |
| Smart Multi-Family Solutions | 20,200 | 17,737 | 12% | 3.4 | 1.9 | 43% |
| Smart Usage Profile | 20,000 | 36,690 | -83% | 2.5 | 0.0 | 100% |
| Low-Income Energy Efficiency | 52,687 | 52,899 | 0% | 7.0 | 6.2 | 11% |
| Residential Smart AC Saver | 0 | 0 | 0% | 78.0 | 58.6 | 25% |
| Smart Business Solutions | 37,483 | 31,844 | 15% | 7.9 | 6.2 | 22% |
| Smart Construction Incentives | 72,768 | 45,254 | 38% | 17.4 | 8.0 | 54% |
| Smart Equipment Incentives - C&I | 211,937 | 229,217 | -8% | 47.9 | 35.2 | 27% |
| Smart Equipment Incentives - GNI | 83,012 | 133,586 | -61% | 27.8 | 25.3 | 9% |
| Smart On-Site | 105,958 | 93,988 | 11% | 13.3 | 12.3 | 8% |
| Commercial Smart AC Saver | 0 | 0 | 0% | 2.6 | 2.3 | 10% |
| **TOTAL** | **880,127** | **1,001,723** | **-14%** | **269.3** | **204.1** | **24%** |

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

Several programs exceeded or fell short of projected gross energy savings by 5 percent or more in Phase II. Reasons for this variation differ from program to program, but there are several general factors that affected results across the portfolio. These include, but are not limited to, the following:

* Higher or lower than projected adoption of planned program measures
* Higher or lower than projected participation in the programs
* Pauses or ramp ups in program implementation efforts due to strategy, market conditions, or CSP disruptions such as bankruptcy
* Implementation or elimination of special limited-time incentives for program participation

The list below briefly discusses several key reasons why programs exceeded or fell short of projected gross energy savings by 5 percent or more in Phase II.

* Smart Appliance Recycling: The SAR program’s CSP, JACO, went into bankruptcy during PY7. This caused a disruption in implementation efforts and resulted in a shortfall in program savings for Phase II.
* Smart Builder Rebates: The SBR program had difficulty recruiting builders of electrically heated ENERGY STAR-certified homes in PY5, leading to a slow start to Phase II. SBR later expanded the program eligibility to allow gas-heated homes in PY6 and had high adoption among a few key production builders in PY7, boosting the program to exceed the planned savings for Phase II.
* Smart Energy Saver: The SES program had higher than projected participation in Phase II. It also had high satisfaction among classroom teachers that helped facilitate the program and the measures had high adoption among participating families, leading the program to exceed the planned savings for Phase II.
* Smart Home Rebates: The SHR program had high cross-sector installation rates of non-residential lighting measures in Phase II, driving up verified program savings. In addition, PECO ramped the program up in PY7 to help compensate for a forecast shortfall in overall portfolio C&I sector participation, causing the program to exceed planned savings for Phase II.
* Smart House Call: The SHC program had higher than projected participation in PY7, but adoption of prescriptive non-DI measures was slower than projected in PY5 and PY6. This led the program to fall short of planned savings for Phase II.
* Smart Multi-Family Solutions: The SMF program had good adoption of DI measures but lower than projected adoption of the prescriptive measures offered, resulting in a shortfall in program savings for Phase II.
* Smart Usage Profile: The SUP program ramped up implementation efforts to help compensate for a forecast shortfall in overall portfolio C&I sector participation, causing the program to exceed planned savings for Phase II.
* Smart Business Solutions: The SBS program had lower implementation of higher-savings non-fluorescent lighting measures than projected, leading to a shortfall in program savings for Phase II.
* Smart Construction Incentives: The SCI program paused recruiting and marketing efforts at the beginning of PY5 to revamp its messaging, causing a slow ramp up for the program in Phase II. This pause, combined with the long lead-time that is typical for C&I and GNI new construction projects, resulted in a shortfall in program savings for Phase II.
* Smart Equipment Incentives: The SEI program had good adoption among C&I and GNI customers with large projects and had more participation than projected in the GNI sector. Further, initial forecasts for projects that would complete in PY7 underestimated the final completion numbers for the year. The program ramped up efforts to compensate for the forecast. The combination of these factors led the program to exceed planned savings in both the C&I and GNI sectors.
* Smart On-Site: The SOS had projects that were larger than projected, causing the program to exceed planned savings for Phase II.

Navigant summarizes recommendations for Phase III based on these observations in Section 0.

## Portfolio Level/Cross-Cutting Process and Impact Evaluation Summary for PY7

The evaluation team completed the PY7 program-level evaluations using multiple techniques. The team reviewed over 4 million records, conducted dozens of site visits, surveyed nearly 1,500 customers, and conducted interviews with PECO and conservation service provider (CSP) staff, trade allies, and other market actors. These various approaches help ensure both a thorough review of the PECO Smart Ideas portfolio as well as a cost-effective means of evaluation.

The evaluation team provided various recommendations across PECO’s entire portfolio that PECO will evaluate for implementation in Phase III. The evaluation team’s first recommendation is that PECO should strive for a more comprehensive Phase III portfolio to include a more diverse measure mix, a more representative mix of business types and residential demographics, and strive to further penetrate hard-to-reach market segments. PECO moved toward this comprehensive approach in Phase II and should continue down this path in Phase III. Seven of the 13 program evaluations include a recommendation about comprehensiveness. Some focused on the measures (e.g., LED and TLED, moving beyond lighting projects) while others suggested applying outreach tactics to reach new customer segments and expand the reach of the programs.

Another recommendation is that PECO should approach some of its programs as channeling programs to enhance the customer experience across the portfolio. Programs that could be feeder programs include those that offer direct install measures to customers. These programs appear to be missing an opportunity to make the customers that participate an energy efficiency partner for life.

Several programs could benefit from insights derived from data on household and business characteristics, customer lifestyles and decision-making, and customer propensity to participate in PECO programs. This information will help PECO improve customer experience and achieve deeper energy savings across the portfolio in Phase III.

Table 1‑22 shows overarching process and impact recommendations that affect multiple programs or the portfolio. Program specific recommendations are listed in each program section of the report.

Table ‑: Phase II Process and Impact Evaluation Recommendations from PY7 Evaluations

| **Applicability** | **Recommendations** |
| --- | --- |
| Portfolio Level | Continue to build on Phase II to create comprehensive programs including programs with a wide measure mix, different business and residential types, and hard to reach market segments. Seven of the 13 programs suggested a recommendation pertaining to comprehensiveness. |
| Portfolio Level | Build off the successes of Phase II and continue to build strong trade ally relationships to enhance the customer experience. Five of the 13 programs had a recommendation relating to trade ally engagement. |
| SMF, SBS, SHC, SEI , LEEP | Encourage cross program participation by building off relationships established through direct install and other channeling programs to create customers that are energy efficiency partners for life. |
| **SHC, SUP, LEEP, SEI** | Acquire and apply insights from data on household and business characteristics, customer lifestyles and decision-making, and customer propensity to participate in order to improve customer experience and achieve deeper energy savings across the portfolio. |

**Source: Navigant analysis**

## Site Inspections Summary

Table 1‑23 presents the information requested regarding onsite inspections conducted during PY7.

Table ‑: Summary of PY7 Site Visits

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Program | Measure | Inspection Firm | Number of Inspections Planned | Number of Inspections Conducted | Number of Sites with Discrepancies from Reports | Resolution of Discrepancies |
| Low-Income Energy Efficiency Program | CFL Bulb Inspections, Showerhead Installations, Aerator Installations, Refrigerator Installations | Navigant Consulting | 19 | 19 | 1 | Resolved proper number of bulbs |
| Smart Construction Incentives | Whole Building, HVAC, Lighting, Motors and Drives, Custom, Refrigeration | Navigant Consulting, Warren Energy Engineering | 20 | 20 | 5 | For projects not fully complete and occupied by 5/31/2016, verified savings was verified only in portions of the project that were both complete and fully occupied. |
| Smart Equipment Incentives | Lighting, HVAC, Motors & Drives, Custom, Refrigeration | Navigant Consulting, Mondre Energy | 49 | 48 | 19 | N/A |
| Smart Multi-Family Solutions | CFLs, Low-Flow Faucet Aerators, Low-Flow Showerheads | Navigant Consulting, Mondre Energy | 16 | 15 | 6 | Direct install measures removed after installation; no action |
| Smart On-Site | CHP | Navigant | 6 | 6 | 0 | N/A |
| TOTAL |  |  | **110** | **108** | **31** |  |

Source: Navigant analysis

# Smart Home Rebates

The objective of the Smart Home Rebates (SHR) program is to assist residential PECO customers in becoming conscious consumers of energy by encouraging and facilitating their adoption of energy efficient products. The program achieves this by providing incentives to increase the market share of high efficiency lighting (CFLs and LEDs) and appliances sold through retail and heating, ventilation, and air conditioning (HVAC) installer sales channels, as well as by distributing educational materials for increasing customer awareness and acceptance.

The target market for SHR is residential customers in the PECO service territory, especially those engaged in home improvement and new appliance purchases. In general, these consumers have access to many sales channels and are able to choose from competing brands and manufacturers. As such, this target market relies upon the advice of retail staff and HVAC installation contractors (trade allies) to make purchase decisions. For this reason, PECO leverages relationships with retailers and contractors to increase awareness and availability of energy efficient products to this target market.

PECO hired a CSP, Ecova, to implement and market the program throughout PECO’s service territory. The CSP was responsible for administering the upstream lighting portion of the program, including shelf-level marketing, point-of-purchase displays, and price setting. They also handled the program marketing, rebate process, and contractor invoicing for the HVAC installers and retail outlets for the non-lighting technologies offered by SHR.

## Program Updates

The overall structure of the SHR program remained consistent throughout Phase II, with savings accruing from lighting, appliance, and HVAC measures. In PY7, the program continued to shift emphasis from CFLs to LED bulbs.

### Definition of Participant

PECO defines program participation differently for lighting measures and non-lighting measures. PECO delivers the lighting component of the program upstream at the manufacturer and retailer levels, so the program does not collect customer-identifying information to associate to a given purchase. The program, therefore, defines a lighting participant as one program bulb, or purchased measure. For non-lighting, the program defines a participant as one installed measure.

## Impact Evaluation Gross Savings

Verified Phase II gross energy savings for the SHR program were 403,631 MWh and verified gross demand savings were 63.5 MW. Table 2‑1 provides the Phase II totals at the close of PY7.

Table ‑: Phase II Smart Home Rebates Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector [1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW) [2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW) [2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 7,785,480 | 314,485 | 41.7 | 305,818 | 43.9 | $34,875 |
| Residential (Low-Income) **[3]** | 806,475 | 0 | 0.0 | 36,515 | 5.2 | $4,089 |
| Small C&I | 75,433 | 10 | 0.0 | 61,291 | 14.4 | $268 |
| Large C&I | 36 | 5 | 0.0 | 5 | 0.0 | $5 |
| GNI | 11 | 2 | 0.0 | 2 | 0.0 | $1 |
| **PHASE II TOTAL** | **7,667,436** | **314,502** | **41.7** | **403,631** | **63.5** | **$39,237** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals. The evaluation team verified—through in-store intercept surveys—the number of participating bulbs installed in nonresidential sockets versus those installed in residential homes and discusses the results further in Section 2.2.2.  
[2] All reported and verified demand savings in this report include line losses as required.  
[3] The evaluation team verified the percentage of customers participating in the upstream lighting measures that were low-income qualified through in-store intercept surveys. The survey results were used to estimate program savings and incentives paid that went to low-income customers.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

This section details the activities and methodologies Navigant employed for verifying gross savings for the lighting and non-lighting technologies offered by SHR. Verification of lighting measures included two evaluation efforts: 1) a tracking data review, and 2) in-store intercept surveys. There were no site inspections conducted for SHR in PY7.

1. **Tracking data review.** The evaluation team reviewed the program tracking data to verify savings, develop an estimate of gross impacts, and understand the measure characteristics that drive savings (such as lamp type and wattage). This review and verification consisted of the following steps:
   1. **Re-creation of savings:** The evaluation team developed bottom-up calculations of program kilowatt-hour (kWh) and kilowatt (kW) savings based on the tracking data for bulb sales, bulb types, and bulb wattage using the savings input parameter values from the 2015 PA TRM). To calculate the delta watts values used in the TRM-based savings calculations, the evaluation team followed the guidance in the TRM and assigned baseline wattages to each bulb using lumen bins defined by a combination of Energy Independence and Security Act (EISA) minimum efficacy requirements and ENERGY STAR qualification criteria for each lamp type in the program. These calculations were compared against reported kWh and kW savings at the measure level and for the whole program to identify records. Verification of non-lighting measures followed a similar methodology, with a review of each tracking system record for accurate and appropriate application of the relevant TRM methodology. Interviews with the program manager and CSP informed the evaluation regarding the quality assurance/quality control (QA/QC) process for program tracking. In cases of any discrepancy between reported and re-created savings for a given measure, Navigant traced the source of the discrepancy and translated this into recommendations for calculation adjustments.
   2. **Invoice verification:** For lighting measures, the evaluation team compared quarterly tracking data extracts against scanned manufacturer invoices for a census of all program bulbs to independently verify bulb counts in the tracking data. Via the quarterly compliance and annual reporting process, the evaluation team checked the program tracking data against scanned copies of manufacturer invoices associated with the sale of program bulbs. The evaluation team gave feedback to PECO and the CSP on any anomalies observed between these two data sources and tracked the process by which these anomalies were addressed.
   3. **Nonresidential installation of program bulbs:** The verified savings calculations differed from the TRM-based calculations in that Navigant verified that some of the program bulbs were installed in nonresidential locations. To attribute the proportion of program bulbs going into nonresidential sockets, the evaluation team applied the cross-sector installation rates for each bulb type, as determined from the PY7 in-store intercept surveys. Nonresidential installation rates are discussed in detail in Section 2.2. For the proportions of cross-sector LEDs and CFLs going into nonresidential buildings per the PY7 intercept surveys, the nonresidential kWh and kW savings were calculated using hours of use (HOU) and coincidence factor (CF) values that were a simple average of all building-specific HOU and CF values, respectively, in the PA TRM. All other parameter values used to calculate savings for the portion of bulbs estimated to be installed in nonresidential locations are equal to those used to calculate residential savings per TRM guidance.
2. **In-store intercept surveys.** The evaluation team conducted 530 in-store intercept surveys across 23 retail stores with lighting purchasers irrespective of whether they were purchasing program bulbs, non-program bulbs, or both. Ultimately, the survey was conducted with 198 purchasers of program bulbs. Intercept survey data was collected from March 2016 through early May 2016. The evaluation team developed the survey questionnaire, and average survey length was approximately 10 minutes. Survey respondents were given a $10 gift card in exchange for their willingness to participate in the survey. The in-store intercept surveys were the primary and sole data source for the estimation of nonresidential bulb installations and low-income program participation.

Verification of non-lighting measures included two evaluation efforts: 1) an engineering review of all measure-specific records in the tracking database, and 2) a project file review and follow-up telephone verification of a sample of non-lighting project files. There were no site inspections conducted for SHR in PY7.

1. **Engineering review.** The evaluation team conducted a comprehensive engineering review of all measure-specific records in the tracking database to verify proper application of TRM algorithms in reported savings values.
2. **Project file review and follow-up phone verification.** For partially deemed algorithms in the TRM, Navigant reviewed a sample of project files to verify savings. The evaluation team designed a stratified random sample from the population of program participants in the PY7 tracking database at the project level. The team stratified the sample using two application end uses: appliances and HVAC. The team sorted the projects by end use and applied a random number to each.

Table 2‑2 presents an overview of the target and achieved sample sizes for each lighting and non-lighting evaluation activity.

Table ‑: Smart Home Rebates Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| Appliances | 15,181 | 85/15 | 14 | 14 | TRM review and file review |
| HVAC | 10,304 | 85/15 | 56 | 57 | TRM review and file review |
| Lighting | 3,614,906 | 85/15 | 360 | 198 | Cross-sector analysis (in-store intercept survey) |
| Lighting | 3,614,906 | N/A | All | 3,614,906 | Verification of tracking data with scanned manufacturer invoices |
| **PROGRAM TOTAL** | **3,640,391** | **0** | **358** | **3,614,977** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Results

Table 2‑3 provides a summary of the energy savings impacts for both the lighting and non-lighting measures. The realization rate for the SHR program as a whole was approximately 1.22, with lighting at 1.21. The primary reason for the high lighting realization rate was the verified installation of bulbs in nonresidential sockets as confirmed by the in-store intercept surveys.

Table ‑: PY7 Smart Home Rebates Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Energy Savings (MWh/yr)** | **Energy Realization Rate (%)** | **Verified Gross Energy Savings (MWh/yr)** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Appliances | 2,562 | 0.99 | 2,546 | 0.03 | 1% |
| HVAC | 4,696 | 1.41 | 6,625 | 0.61 | 12% |
| Standard CFLs | 44,960 | 1.32 | 59,251 | 0.35 | 11% |
| Specialty CFLs | 6,460 | 1.32 | 8,513 | 0.35 | 11% |
| Standard LED | 29,798 | 1.04 | 30,892 | 0.11 | 1% |
| Specialty LED | 53,997 | 1.21 | 65,555 | 0.24 | 4% |
| **PROGRAM TOTAL** | **142,472** | **1.22** | **173,382** | **N/A** | **4%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Cross-sector bulb sales also drove high realization rates for demand savings. As Table 2‑4 shows, the SHR total realization rate was 1.36, with lighting at 1.39 since the HOU for commercial building lamps is higher than residential. Non-lighting demand savings accounted for approximately 3.6 MW for PY7.

Table ‑: PY7 Smart Home Rebates Summary of Evaluation Results for Demand (With Line Loss)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW) [1]** | **Demand Realization Rate (%)** | **Verified Gross Demand Savings (MW) [1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Appliances | 0.4 | 0.84 | 0.4 | 0.86 | 35% |
| HVAC | 2.7 | 1.19 | 3.2 | 0.42 | 8% |
| Standard CFLs | 5.8 | 1.59 | 9.2 | 0.35 | 11% |
| Specialty CFLs | 0.8 | 1.59 | 1.3 | 0.35 | 11% |
| Standard LED | 3.9 | 1.07 | 4.1 | 0.11 | 1% |
| Specialty LED | 7.0 | 1.39 | 9.7 | 0.24 | 4% |
| **PROGRAM TOTAL** | **20.6** | **1.36** | **28.0** | **N/A** | **4%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 2‑5 and Table 2‑6 present the nonresidential installation rates, verified energy savings (MWh), and verified demand reduction (MW) by bulb type. The evaluation team conducted the cross-sector analysis twice: once using the responses of all bulb purchasers (Table 2‑5), and once using only the responses of program bulb purchasers (Table 2‑6). The analysis revealed that the nonresidential installation rate, energy savings, and demand reduction were similar regardless of analysis method. This is not surprising, as the evaluation team speculated that there should be no expected difference in the nonresidential installations of program bulbs installations as compared to non-program bulbs. The results support the theory that program incentives do not greatly influence the proportion of bulbs that customers purchase for their homes versus their businesses. It is also worth noting that nonresidential installation of CFLs are greatly influenced by a single customer who purchased 12 program bulbs that were to be installed in the common areas of an apartment building.

Table 2‑5: Nonresidential Installation Rate and Verified Energy and Demand Savings for All Bulb Purchases

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bulb Type** | **Business Respondents** | **Business Bulbs** | **Installation Rate** | **Energy Savings (MWh)** | **Demand Reduction (MW)** |
| CFL | 7 | 33 | 9.8% | 19,580 | 3.7 |
| LED (Standard) | 3 | 11.5 | 1.8% | 2,035 | 0.4 |
| LED (Specialty) | 7 | 21.5 | 4.7% | 9,882 | 1.9 |
| **ALL BULB TYPES** | **17** | **66** | **6.2%[1]** | **31,496[2]** | **6.0** |

[1] Total nonresidential installation rate is a weighted average of the bulb-level weights using the final program bulb sales, by type, as the weight.   
[2] The total savings values are not equal to the sum of the savings per bulb type due to weighting. The total nonresidential savings were calculated as the product of the total program savings and the sales-weighted average of the three bulb types’ nonresidential install percentages rather than the summing of the energy savings associated with each bulb type.

Source: Navigant analysis

Table 2‑6: Nonresidential Installation Rate and Verified Energy and Demand Savings Analyzed by Program Bulb Purchases Only

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Bulb Type** | **Business Respondents** | **Business Bulbs** | **Installation Rate** | **Energy Savings (MWh)** | **Demand Reduction (MW)** |
| CFL | 2 | 16 | 11.0% | 21,977 | 4.2 |
| LED (Standard) | 2 | 5.5 | 1.3% | 1,469 | 0.3 |
| LED (Specialty) | 5 | 16.5 | 7.3% | 15,348 | 2.9 |
| **ALL BULB TYPES** | **9** | **38** | **7.3%[1]** | **38,795** | **7.3** |

[1] Total nonresidential installation rate is a weighted average of the bulb-level weights using the final program bulb sales, by type, as the weight.

Source: Navigant analysis

## Impact Evaluation Net Savings

This section describes the methods for calculating the PY7 NTG values for both lighting and non-lighting.

### Net Verified Savings Methodology

The evaluation team used several data sources in its evaluation of net impacts across the lighting and non-lighting end uses.

1. **Intercept surveys.** Navigant based the sample of retail stores for the intercept surveys on the proportion of total PY7 program bulb sales by retail channel, subject to permission from individual store managers and retail chains to collect data in their stores. From a strict program compliance standpoint, the target sample size for completed in-store intercept surveys with program bulb purchasers was 76 based on an evaluation objective of meeting 85/15 confidence/precision for a customer self-reported NTG. The evaluation team planned to complete 360 intercept surveys with program bulb purchasers—800 surveys in total—to enable analysis at the bulb type level (standard LEDs, specialty LEDs, and CFLs).[[12]](#footnote-13) However, as shown in Table 2‑7, the team was only able to complete 198 surveys with program bulb purchasers—330 surveys in total—due to less-than-expected store traffic and store scheduling issues.
2. **Shelf surveys.** Navigant conducted most shelf surveys in the same stores as the intercept surveys. The evaluation team collected data for all CFL, LED, incandescent, and halogen bulbs, including bulb model number, manufacturer, bulb type, specialty type, wattage, baseline equivalent wattage, lumens, location in the store, approximate number of packages, price, original price (if discounted), and source of discount (if discounted). The shelf survey was conducted in tandem with the in-store intercept surveys. In total, the evaluation team conducted shelf surveys in 17 stores. By retailer, these stores included Home Depot (7), Lowe’s (3), Walmart (2), Denney Electric (2), Sam’s Club (1), Target (1), and Goodwill (1).
3. **Non-lighting participant surveys.** The evaluation team stratified the non-lighting population of participants by end-use category–appliances and HVAC—and drew a sample of 100 participants from each strata. The team asked these participants a battery of NTG questions to inform the final calculations (Table 2‑7).

Table ‑: Smart Home Rebates Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Assumed CV or Proportion in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame  [1] Contacted to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\A897C9E8.xlsx#RANGE!_ftn1) |
| Appliances | 15,181 | 1.00 | 85/15 | 100 | 100 | 100 |
| HVAC | 10,304 | 1.00 | 85/15 | 100 | 100 | 100 |
| Lighting | 3,614,906 | 0.92 | 85/15 | 79 | 330 | N/A |
| **PROGRAM TOTAL** | **3,640,391** | **N/A** | **85/15** | **279** | **542** | **N/A** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The primary objective of the net savings analysis was to determine the program's net effect on customers’ electricity usage. Navigant derived net program impacts by estimating a NTG ratio that quantifies the percentage of the gross program impacts that can reliably be attributed to the program. For lighting measures, Navigant pursued enhanced rigor through customer self-reported data collected via the in-store intercept surveys, supported by demand modeling based on data from both the in-store intercepts and shelf inventory surveys. For non-lighting measures, Navigant pursued a basic level of rigor using self-reports from the participant telephone survey.

Free ridership is defined as those participants who would have purchased the equipment anyway, without the program rebate. The key questions determining free ridership focus on the influence of key program interventions such as discounted prices, program information regarding efficient products, and placement of program-discounted products in the store, as well as the customer’s perception of what they would most likely have done in the absence of the program. The free ridership section of the in-store intercept survey was structured based on guidance from the Energy Trust of Oregon (ETO) NTG methodology. Using this methodology, customers were asked if they would have purchased all, some, or none of the same program bulbs in the absence of the program; they were also asked to rate the influence of several key program elements in their decision to purchase program bulbs.[[13]](#footnote-14) The program elements that customers were asked to rate on a 0 to 10 scale, where 0 meant “Not at all influential” and 10 meant “Extremely influential” included the discount offered by the program, the placement of program bulbs in the store, and the program information provided in the store. Using the customers’ responses to the free ridership questions, the evaluation team calculated a non-program score and a program influence score, which could each have a value between 0 and 0.5 and when added together made up the overall free ridership score. Using this approach, free ridership can take on values ranging from 0.0 to 1.0 for each respondent and for the program overall. High free rider scores are associated with survey respondents who reported they would have purchased all of the same program bulbs in the absence of the program and who rated the influence of the program on their decision-making as very low or zero.

Spillover is defined as those participants who were influenced by the program to purchase and install additional energy efficient equipment that saves electricity without a rebate. The evaluation team analyzed the participant responses to a battery of spillover questions. The intent of these questions was to identify what types and amounts of equipment customers purchased and installed on their own to inform a quantitative estimate of program spillover within the overall NTG calculation. Spillover was estimated from the intercepts based on the quantity and type of efficient lighting equipment purchased without a rebate, the degree of self-reported influence of the program on the decision to purchase the efficient lighting equipment, and confirmation via the intercepts data, the shelf survey data, the program tracking data, and online lookups that the measure was not rebated. The participant spillover rate was calculated by summing the spillover adoptions over all intercept respondents and then dividing it by the total number of program bulbs in the baskets of intercept respondents.

The evaluation team used Equation 2‑1 to calculate NTG:

Equation ‑: Total NTG Ratio

*NTG Ratio = 1 – Free Ridership Rate + Spillover Rate*

Consistent with the PY7 evaluation plan for lighting measures, the evaluation team ran a revealed preference demand model to serve as additional perspective to the customer self-report NTG approach. However, the final NTG values came from the customer self-report approach for PY7.

### Net Verified Savings Results

Free ridership, spillover, and NTG values for lighting measures from the in-store intercept surveys are shown by program bulb type in Table 2‑8. Free ridership was lowest for LEDs at 0.4 and higher for CFLs at 0.6. In general, residential lighting has inherently high free ridership, as many bulb purchasers are familiar with the benefits of energy efficient models and the EISA of 2007 phased out many inefficient bulb options over the past few years. For spillover, CFLs yielded a spillover rate of 0.01 and LEDs yielded a spillover rate of 0.04. For non-lighting, the NTG result was 0.31 for HVAC customers and 0.43 for appliance customers (Table 2‑8).

Table ‑: PY7 Smart Home Rebates Summary of Evaluation Results for Lighting NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Estimated Free Ridership** | **Estimated Participant Spillover** | **NTG Ratio** | **Observed CV or Proportion** | **Relative Precision** |
|
| Appliances | 0.57 | 0.01 | 0.43 | 0.46 | 9% |
| HVAC | 0.69 | 0.00 | 0.31 | 0.37 | 12% |
| Standard CFL | 0.61 | 0.01 | 0.40 | 1.01 | 18% |
| Standard LED | 0.38 | 0.04 | 0.66 | 0.80 | 7% |
| Specialty LED | 0.42 | 0.04 | 0.62 | 0.93 | 8% |
| **PROGRAM TOTAL** | **0.49** | **0.03** | **0.54** | **0.28** | **7%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Process Evaluation

Navigant employed a number of data collection methods for both lighting and non-lighting measures as part of the PY7 process evaluation. The team interviewed program staff from PECO and the CSP, conducted in-store shelf and intercept surveys, surveyed program participants, and spoke with HVAC installation contractors to gather feedback regarding the state of the SHR program.

### Process Evaluation Methodology

The PECO staff and CSP interviews, conducted in March 2016, allowed Navigant to collect information regarding program structure, program marketing, tracking data issues, and progress relative to program goals. The lighting-focused in-store intercept and shelf surveys collected information on customer awareness, satisfaction, purchase intentions, and shelf bulb mixes. The non-lighting participant surveys queried customers on their satisfaction with PECO and the SHR program, as well as the types of efficiency upgrades they would have done in the absence of the program.

Navigant also interviewed 11 HVAC contractors and installers across PECO’s territory who installed equipment as part of the SHR program in PY7. The evaluation team wanted to understand how the program operated from a trade ally perspective given that a number of SHR-rebated measures require professional installations (e.g., air conditioners, heat pumps, etc.).

Table 2‑9 shows target sample sizes and achieved sample sizes for each data collection method where sampling was employed.

Table ‑: Smart Home Rebates Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Stratum | Population Size | Assumed Proportion or CV in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | [Percentage of Sample Frame Contacted to Achieve Sample](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\A897C9E8.xlsx#RANGE!_ftn1) | Used For Evaluation Activities (Impact, Process, NTG) |
| Appliance Participants | 15,181 | 1.00 | 85/15 | 100 | 100 | 100 | Process evaluation |
| HVAC Participants | 10,304 | 1.00 | 85/15 | 100 | 100 | 100 | Process evaluation |
| Participant In-Store Intercept Survey | 3,614,906 | 0.92 | 85/15 | 800 | 530 | 66% | Process evaluation |
| Program Manager Interview | 1 | N/A | N/A | 1 | 1 | 100% | Process evaluation |
| CSP Interview | 1 | N/A | N/A | 1 | 1 | 100% | Process evaluation |
| Participant HVAC Installer Interviews | 614 | 1.00 | 85/15 | 12 | 11 | 92% | Process evaluation |
| PROGRAM TOTAL | **3,641,007** | **N/A** | **N/A** | **1,014** | **755** | **N/A** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Findings and Recommendations

The process evaluation yielded several findings and potential program improvements. Below are specific recommendations and the associated process evaluation findings on which the recommendations are based.

1. **Finding:** The evaluation team’s review of the PY7 lighting tracking data found a number of inconsistencies and data gaps, which were communicated in an interim report delivered to PECO in June 2016. These included zeroed out savings for some records, different lumen ranges appearing for the same bulb model number, and inconsistencies in data tracking fields. Ultimately, these issues were minor and did not affect evaluation results; thus, Navigant was able to find correct information for its analysis.
   1. **Recommendation:** Navigant recommends that the PECO program managers and CSP continue to monitor the SHR lighting data and conduct regular QC checks to minimize these errors.
2. **Finding:** The review of the non-lighting tracking system data identified differences between reported and verified savings for central air conditioners and ENERGY STAR room air conditioners. Gaps in the tracking system data for unit-specific information (e.g., SEER or EER values) caused the discrepancies for both technology types.
3. **Recommendation:** PECO and the CSP must capture all unit-specific data relating to energy savings estimates in the tracking data for all projects.
4. **Finding:** Approximately 12% of PY7 lighting participant customers were identified as low income via the income qualification battery seen in Appendix C. Costs are a significant concern for all bulb purchasers, but especially those low-income purchasers. While no energy and demand savings from these participants are being claimed as low-income savings, this is an important finding for PECO to consider for future program implementation.
   1. **Recommendation:** If additional low-income savings are needed by PECO, provide low-income customers with mail-in rebate incentives on LEDs. Mail-in rebates in the form of coupons can educate and motivate participation.
5. **Finding:**  The shelf surveys indicate that increasing shelf space occupied by LEDs has corresponded with decreasing shelf space occupied by CFLs. As a result, the total proportion of lighting shelf space dedicated to efficient bulbs has remained approximately unchanged at 45% over the past 5 years of the lighting portion of the SHR program, as shown in Figure 2‑1.

Figure ‑: Lighting Shelf Space by Lamp Type, PY2 and PY5-PY7

Source: Navigant analysis of shelving stock, PY2 and PY5-PY7

1. **Finding:** Customers relayed outdated perceptions and confusion about LEDs during the in-store intercept surveys. Survey responses also indicated confusion about PECO’s role in providing bulb discounts.

The customer in-store intercept surveys found that of the 109 respondents purchasing program bulbs who indicated they knew they were receiving a discount, 71% said they were aware the discount was provided by PECO. Compared to PY5 results for the same question (86%), it appears that customer awareness has declined in the past few years (see Table 2‑10). This indicates that confusion exists for some customers during their lighting selection experience.

Table ‑: In-Store Participant Awareness of PECO as Source of Lighting Discounts (n = 109)

|  |  |  |
| --- | --- | --- |
| Where you aware that PECO provided the lighting discount? | PY5 | PY7 |
| Yes | 86% | 71% |
| No | 14% | 29% |
| TOTAL | **100%** | **100%** |

Source: Navigant analysis of in-store intercept surveys

Those who were aware the discount was coming from PECO indicated that they had first learned of the PECO program from a variety of sources. By far the most common source, as shown in , was seeing the PECO sticker on the lighting shelf alongside the discounted bulb price (65% of responses). These included seeing additional marketing materials in the store, learning from a store employee, or having seen a retail lighting demonstration in the store.

Table ‑: Source of First Learning of PECO’s Lighting Discounts (n = 77)

|  |  |
| --- | --- |
| Where did you first learn of the PECO program? | Percentage of Respondents |
| PECO sticker on the shelf | 65% |
| PECO representative | 11% |
| Store employee made me aware of the discount | 11% |
| Saw marketing materials in the store | 3% |
| Friend | 3% |
| Read about it in my bill from PECO | 2% |
| Prior experience with program | 2% |
| Other | 2% |
| Internet | 1% |
| Saw a retail lighting demonstration | 0% |
| TOTAL | **100%** |

Source: Navigant analysis of in-store intercept surveys

Customers who indicated they had the intention to buy some kind of light bulb upon entering the store were asked what type of bulbs they were intending to buy. As shown in Table 2‑12, the most common answers were LEDs (43%) and non-energy efficient bulbs (43%).

Table ‑: Customer Light Bulb Purchase Intentions

|  |  |  |
| --- | --- | --- |
| What type of bulb do you intend to purchase today? | PY5  (n=569) | PY7 (n=396) |
| CFL | 43% | 12% |
| LED | 15% | 47% |
| Non-EE | 42% | 41% |

Source: Navigant analysis of in-store intercept surveys

Respondents who indicated they were aware of energy efficient bulb types but had not purchased them were asked why they chose not to purchase CFLs or LEDs. Table 2‑13 shows responses. Perceived high costs (“too expensive”) were cited by most for LEDs and second most for CFLs. Additionally for CFLs and LEDs, respondents said they needed a specialty bulb, implying that they did not think a CFL or LED existed to fit their needs.

Table ‑: Reasons Cited for Not Purchasing Energy Efficient Bulb Types

|  |  |  |
| --- | --- | --- |
| Why did you choose not to purchase a CFL or LED bulb? | Percentage of Responses for CFLs[1] (n=164 respondents) | Percentage of Responses for LEDs[1] (n=187 respondents) |
| Need other specialty bulb | 19% | 21% |
| Too expensive | 13% | 34% |
| Accustomed to incandescent bulbs | 11% | 9% |
| Don’t like the way bulbs fit or look in fixtures | 10% | 10% |
| Don’t know enough about them | 9% | 8% |
| Dislike the light quality/color | 9% | 7% |
| Already have enough / don’t need any | 8% | 6% |
| Not aware of them before today | 4% | 2% |
| They have mercury / are dangerous | 4% | 0% |
| Need 3-way bulbs | 3% | 3% |
| Need dimmable bulbs | 2% | 4% |
| Burn out too quickly | 3% | 0% |
| Waiting for technology to go mainstream | 0% | 1% |
| Technology is too complicated | 0% | 2% |
| Other | 2% | 2% |

[1] Multiple responses allowed; columns show percentage of responses.

Source: Navigant analysis of in-store intercept surveys.

* 1. **Recommendation:** Use focused marketing efforts to improve the perceptions of LEDs and overcome confusion hindering LED adoption. Focused marketing can highlight the benefits of efficient lighting, educate customers on LED capabilities, and help customers understand how to navigate the range of options. Marketing outside of the store (web-based, emails, etc.) may help overcome confusion.
  2. **Recommendation:** Continue to engage customers at store locations. Use direct, in-person interactions to educate and motivate customers to adopt energy efficient products. This can also help overcome confusion that may arise from the wide variety of products in the market.
  3. **Recommendation:** Monitor LED acquisition costs on a quarterly basis to identify when to fully transition incentive dollars from CFLs to LEDs to make them competitive with halogen and other non-energy efficient bulbs.

1. **Finding:** Non-lighting SHR participants reported little change in satisfaction across the three program years, and satisfaction with PECO overall remains strong at an average of 4.3 out of 5. The light teal bars in Figure 2‑2 show the results of these questions for PY7 and compares the results to PY5 and PY6.The questionnaire used a scale of 0 to 5, where 5 is “Extremely satisfied” and 0 is “Extremely dissatisfied.”

Figure ‑: Smart Home Rebates Non-Lighting Average Customer Satisfaction Responses (n=200)

Source: Navigant analysis of in-store intercept surveys

1. **Finding:** HVAC contractors and installers are the key point of contact for SHR participants who purchase non-lighting equipment. The evaluation team asked participants about how they came to learn about the SHR program. Figure 2‑3 provides the results, split out by participants who installed new HVAC equipment through an installation contractor and those purchasing a rebated appliance. For HVAC participants, the overwhelming majority (71%) learned of the program from a contractor/installer/home builder, indicating that HVAC installers have a major impact on how the non-lighting aspect of SHR is promoted throughout PECO’s territory.

Figure ‑: Smart Home Rebates Non-Lighting Participant Knowledge of Program (n=250)

Note: The survey allowed for multiple responses.

Source: Navigant analysis of participant survey

1. **Finding:** Changes in program activity, either seasonal or PECO-initiated, affects HVAC installers. Navigant asked installers about their involvement with the SHR program in general. Almost half of the interviewees (45%) reported having limited interactions with program personnel, but all installers said that any interactions they did have were positive. Two installers (18%) mentioned they felt as though the larger installation companies were pushing out the smaller, “mom and pop” businesses. Analysis shows that downturns in the number of installations, either from seasonal shifts or from PECO scaling back the program, affects these smaller HVAC installation companies much more than the more established firms.
   1. **Recommendation:** Leverage strong working relationships with HVAC contractors and installers to increase participation in the non-lighting aspect of SHR.
2. **Finding:** The evaluation team asked about HVAC equipment sales over the last year, including what percentage of those sales came from high efficiency equipment. Six of the 11 installers (55%) reported an increase in overall sales during that time, three installers (27%) said their sales stayed the same, and two installers (18%) were unsure. Installers also reported that 45% of their equipment sales met high efficiency standards.[[14]](#footnote-15) This percentage is down from the 63% of high efficiency sales reported in PY6;[[15]](#footnote-16) however, this is likely because the total number of participants installing high efficiency HVAC equipment through the SHR program dropped from over 13,000 in PY6 to just over 9,000 in PY7. PECO intentionally ramped down program participation in PY7 to meet efficiency targets.
3. **Recommendation:** Focus education and marketing efforts on HVAC installers for the non-lighting aspect of SHR in Phase III as the program ramps back up and invites new installation companies to the program.

## Status of Recommendations for Program

Table ‑: Smart Home Rebates Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1: PECO program managers and the CSP should continue to monitor the SHR lighting data and conduct regular QC checks to minimize errors. | **Being Considered:** PECO is working with implementation CSP and tracking system CSP to ensure errors are caught before placed into the tracking system. |
| Recommendation 2: PECO and the CSP must capture all unit-specific data relating to energy savings estimates in the tracking data for all projects. | **Implemented:** In Phase III, we have done a complete review of data inputs and will ensure that all relevant data points are captured in the tracking system. |
| Recommendation 3: If additional low-income savings are needed by PECO, provide low-income customers with mail-in rebate incentives on LEDs. Mail-in rebates in the form of coupons can educate and motivate participation. | **Being Considered:** PECO is already offering a targeted retail lighting program that is bringing LED bulbs in retail stores that may be non-traditional lighting in heavy low-income areas. These LEDs have greater discounts applied. |
| Recommendation 4:   * 1. Use focused marketing efforts to improve the perceptions of LEDs and overcome confusion hindering LED adoption. Focused marketing can highlight the benefits of efficient lighting, educate customers on LED capabilities, and help customers understand how to navigate the range of options. Marketing outside of the store (web-based, emails, etc.) may help overcome confusion.   2. Continue to engage customers at store locations. Use direct, in-person interactions to educate and motivate customer adoption of energy efficient products. This can also help overcome confusion that may arise from the wide variety of products in the market.   3. Monitor LED acquisition costs on a quarterly basis to identify when to fully transition incentive dollars from CFLs to LEDs to make them competitive with halogen and other non-energy efficient bulbs. | **Being Considered/Implemented:**   1. Will work with ICF to develop more education and focused marketing around LED benefits and technologies. 2. We continue to have our retail field team for outreach and customer engagement. We are looking to supplement the staffing with additional resources. 3. By the end of 2016, we will phase CFLs out of this program and are carefully monitoring the acquisition cost of the LEDs. |
| Recommendation 5: Leverage strong working relationships with HVAC contractors and installers to increase participation in the non-lighting aspect of SHR. | **Implemented:** We are working with distributors and manufacturers to help communicate program offers and education to contractors in addition to continuing the relationships with contractors. |
| Recommendation 6: Focus education and marketing efforts on HVAC installers for the non-lighting aspect of SHR in Phase III as the program ramps back up and invites new installation companies to the program. | **Implemented:**  We are working closer with contractors to help them increase efficient products in the market place. We expect challenges due to the lower rebate levels in Phase III, however are leveraging our relationships to promote non-lighting products. |

Source: Navigant analysis

## Financial Reporting

For the third year of Phase II, the SHR program exceeded its expected TRC of 1.3. This is due primarily to the low and reducing costs of efficient bulbs and the shift of the program to more efficient and longer lifetime LEDs. The program also maintained stable administrative and overhead costs, even as activities ramped up in PY7. A breakdown of SHR program finances is presented in the following table.

Table ‑: Summary of Smart Home Rebates Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| Row # | Cost Category | Actual PYTD  Costs | Actual Phase II  Costs |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 70,112 | 150,864 |
| 2 | EDC Incentives to Participants | 18,604 | 39,227 |
| 3 | EDC Incentives to Trade Allies | 0 | 0 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 51,509 | 111,638 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10 ) | 3,957 | 11,262 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance**[1]** | 3,420 | 10,337 |
| 8 | Marketing**[2]** | 537 | 925 |
| 9 | EDC Evaluation Costs | 0 | 0 |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs |  |  |
|  | | | |
| 12 | Total TRC Costs[3] (Sum of Rows 1, 5, and 11) | 74,069 | 162,126 |
| 13 | Total NPV Lifetime Energy Benefits | 162,306 | 307,751 |
| 14 | Total NPV Lifetime Capacity Benefits | 13,312 | 26,373 |
| 15 | Total NPV TRC Benefits[4] | 187,505 | 362,999 |
|  | | | |
| 16 | TRC Benefit-Cost Ratio[5] | 2.53 | 2.24 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart House Call Program

PECO’s Smart House Call (SHC) program is a two-tiered home audit program where PECO residential electric customers are eligible for a general home assessment (assessment level), and PECO residential electric heat customers and customers with central air conditioning (CAC) are eligible for a more comprehensive audit (audit level). The SHC program’s objectives are to educate PECO residential customers about their current energy use, inform customers of ways they can reduce their energy use, and encourage and facilitate the adoption of energy efficient technology, including through other PECO programs. The program offers all SHC participants direct install (DI) measures during their home visit; audit participants are offered PECO rebates on additional, contractor-installed measures. DI measures include ENERGY STAR CFL bulbs, ENERGY STAR light-emitting diode (LED) lamps, LED nightlights, low-flow faucet aerators, low-flow showerheads, and smart strip plug outlets. Contractor-installed measures include air source heat pump (ASHP) duct sealing, ASHP maintenance, air sealing, attic insulation, and wall insulation.

PECO hired a CSP, CLEAResult, to implement and market the program throughout PECO’s service territory. The CSP was responsible for hiring and training the energy advisors who performed the in-home energy assessments and audits, employing the customer service staff who responded to program inquiries and performed intake interviews, and maintaining a list of program-approved contractors. The CSP also managed the program marketing, rebate process, contractor invoicing, and provided biweekly program participation data that feeds into PECO’s Smart Ideas Database System (SIDS).

PECO customers living in single-family homes or multifamily dwellings with three or fewer units are eligible for the program. Customers participating at the assessment level pay $50 and receive a walkthrough of their home during which an energy advisor installs appropriate DI measures and provides a set of additional verbal recommendations for the homeowner to consider on a non-incentivized basis. Customers participating at the audit level of the program pay $100, receive the assessment-level walkthrough and DI measure installation, and a more in-depth home review that includes blower door and combustion safety tests. Audit-level participants also receive a report that provides the full cost, incentive amount, and discounted cost for recommended contractor-installed measures, as well as recommendations to consider on a non-incentivized basis.

## Program Updates

Starting June 1, 2015, PECO expanded the PY7 SHC audit offering to customers with CAC; previously only residential heat rate customers had been eligible. CAC audit participants are eligible for contractor-installed measure incentives on air sealing, duct sealing on CAC units, and wall and attic insulation.

### Definition of a Participant

At the beginning of Phase II, PECO defined SHC participants as being a combination of unique premise number and invoice number; however, in PY7 both the evaluation team and PECO identified several cases where this definition did not provide an accurate count of participants. The evaluation team and PECO worked together to develop a new participant definition where the participant count is equal to the count of unique project numbers, excluding all measure installation project numbers denoted as “other installation” projects in program tracking data, by program year and confirmed that this updated operational definition successfully distinguishes unique participants.

## Impact Evaluation Gross Savings

The total SHC program verified energy savings for Phase II were 10,566 MWh, verified gross demand savings were 1.5 MW, and total incentives paid to customers were $921,070. Table 3‑1 shows the Phase II savings and incentive results for the SHC program.

Table ‑: Phase II Smart House Call Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW)[2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW)[2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 12,047 | 10,566 | 1.5 | 10,521 | 1.5 | $918 |
| Residential (Low-Income) **[3]** | 54 | 0 | 0.0 | 45 | 0.0 | $3 |
| Small C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Large C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| GNI | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| **PHASE II TOTAL** | **12,101** | **10,566** | **1.5** | **10,566** | **1.5** | **$921** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.

[3] The evaluation team verified the percentage of customers participating in the program that were low-income qualified through participant surveys. The survey results were used to estimate program savings and incentives paid that went to low-income customers.

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

**Source: Navigant analysis**

### Gross Verified Savings Methodology

The evaluation team employed several methods to verify the reported savings values. This verification work served to measure the level of agreement between program tracking data and available independent documentation, as well as to gauge the proportion of program measures still in place relative to what was reported in the tracking data.

1. **Invoice reviews.** The evaluation team conducted a comprehensive review of CSP invoices and compared them against quarterly program tracking data. During this review, the evaluation team compared the number and date of assessments and audits performed and the program costs associated with that work between the two data sources.
2. **Desk reviews.** The evaluation team verified that all measure calculations complied with the 2015 TRM. This review included all records in the program tracking database, as shown in Table 3‑2. For both energy and demand savings, the evaluation team applied algorithms as specified in the TRM and parameter values from a combination of TRM default inputs and customer-specific values as provided in the tracking data. The evaluation team compared reported savings and TRM-verified savings for each record, measure, and for the program overall.
3. **Verification interviews (phone).** The evaluation team conducted telephone interviews with a stratified random sample of 130 program participants to verify if program-incentivized measures (as recorded in the program tracking data) were still installed and functioning.[[16]](#footnote-17) Stratification was based on whether customers had participated at the assessment level or the audit level and, within the audit level, whether the program tracking data indicated customers had installed one or more of the contractor-installed major measures. For each measure type where tracking data indicated the participant had one or more measures installed, the evaluation team asked the respondent to verify the number of program measures that remained installed and whether they remained functioning. In cases where participants reported uninstalling measures, the evaluation team asked for the reason why. As part of the phone verification, the evaluation team reviewed the program files for all 130 interviewees and compared the materials in each participant’s file against the tracking data to verify the measures installed in each home.

Final targeted and achieved sample sizes for verification activities involving sampling are shown in Table 3‑2.

Table ‑: Smart House Call Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| All Program Participants | 6,479 | N/A | 6,479 | 6,479 | TRM verification of savings calculations |
| Assessment | 2,813 | 85/15 | 52 | 52 | Phone interview and file review |
| Audit Only | 1,609 | 85/15 | 47 | 47 | Phone interview and file review |
| Audit + Install Major Measures | 284 | 85/15 | 31 | 31 | Phone interview and file review |
| **PROGRAM TOTAL** | **4,706** | **85/15** | **130** | **130** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The evaluation team did not conduct onsite inspections for this program, which is consistent with the evaluation plan.

### Gross Verified Savings Results

The evaluation team calculated verified savings based on the combined realization rate from the activities described in Section 3.2.1. Hence, each of these activities is described below as yielding a partial realization rate (i.e., the realization rate from that specific evaluation activity), and the combination of these partial realization rates yields the overall program-level realization rate. Therefore, the evaluation team calculated realization rates by project type and overall.

For energy savings, the TRM-based recreation of savings calculations matched to within 1% of reported savings for all program measures except for air sealing, which had verified savings that were 2% greater than reported savings. This difference was attributed to the fact that reported savings for air sealing measures invoiced in PY7 but installed during PY6 were generated by the CSP’s proprietary building energy modeling software, while the verified savings were calculated based on the savings algorithm defined in the 2016 TRM IMP. (Based on a recommendation from the PY6 evaluation, the PY7 evaluation used the algorithms in the IMP.) The evaluation team also noted that PECO used a per unit savings value of 25 kWh/unit to calculate savings for LED nightlight measures, whereas the 2015 PA TRM deemed per unit savings for LED nightlights as 25.49 kWh/unit.

The verification interviews yielded partial realization rates for assessments, audits, and contractor-installed major measures of 0.98, 0.98, and 0.99, respectively. These were driven by customer reports of removing a total of seven CFLs, 17 LEDs, one smart power strip, three low-flow shower heads, one low-flow faucet aerator, and three smart strip outlets.[[17]](#footnote-18) Reasons cited for removals included dissatisfaction with bulb light quality, burnout of bulbs, another bulb type preference, disruption of normal appliance functioning by the power strips, and inadequate water flow with low-flow devices in place.

The evaluation team did not find any discrepancies between the measures listed in the participant files and the tracking data, so the file review yielded energy savings realization rates of 1.0 for each stratum.

As mentioned above, the evaluation team calculated the full realization rate for verified energy savings as the combination of the partial realization rates for each evaluation activity. Table 3‑3 summarizes the verified energy savings and final realization rates by project type and for the overall program. The overall program’s achieved relative precision was 1% at the 85% confidence interval.

Table ‑: PY7 Smart House Call Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Energy Savings (MWh/yr)** | **Energy Realization Rate (%)** | **Verified Gross Energy Savings (MWh/yr)** | **Observed Coefficient of Variation (CV) or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Assessment | 2,567 | 0.98 | 2,510 | 0.09 | 2% |
| Audit Only | 1,724 | 0.98 | 1,692 | 0.07 | 1% |
| Audit + Install Major Measures | 2,451 | 0.99 | 2,438 | 0.04 | 1% |
| **PROGRAM TOTAL** | **6,742** | **0.98** | **6,640** | **N/A** | **1%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Similar to energy savings, the TRM-based recreation of demand savings calculations matched to within 1% of reported savings for all program measures except air sealing, which had verified demand savings 2% below reported demand savings. The demand savings discrepancy for air sealing is rooted in the same issue of reported savings generated by the CSP’s building energy modeling software, while the evaluation team calculated savings using algorithms defined in the IMP.

The verification interviews yielded partial demand realization rates for assessments, audits, and contractor-installed major measures of 0.98, 0.98, and 0.99, respectively. These were driven by the removal of some measures, as noted above. As previously described, the evaluation team did not find any discrepancies between the measures listed in the participant files and the tracking data, so the participant file review yielded demand savings realization rates of 1.0 for each stratum.

The evaluation team calculated the full realization rate for verified demand savings as the combination of the partial realization rates for each evaluation activity. Table 3‑4 shows the verified demand savings and the final demand realization rate by project type and for the overall program. The overall program’s achieved relative precision was 1% at the 85% confidence interval.

Table ‑: PY7 Smart House Call Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW)[1]** | **Demand Realization Rate (%)** | **Verified Gross Demand Savings (MW)[1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Assessment | 0.3 | 0.98 | 0.3 | 0.09 | 2% |
| Audit Only | 0.2 | 0.98 | 0.2 | 0.06 | 1% |
| Audit + Install Major Measures | 0.4 | 0.99 | 0.4 | 0.02 | 0% |
| **PROGRAM TOTAL** | **1.0** | **0.99** | **0.9** | **N/A** | **1%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Savings Verification Findings and Recommendations

During PY7 the evaluation team identified several issues with the tracking data, which the team has communicated with the data management team at PECO. A summary of these issues is provided below.

The evaluation team observed duplicate tracking data records for six projects that were reclassified from an audit to a CAC audit. In each of these six cases, the customers claimed to have electric heating when they called to schedule an audit; however, during the home visit the energy advisor found that the participant should instead be classified as a CAC audit. After these projects were reclassified the original audit records were not deleted; thus, they were sent to the evaluation team as duplicate records. PECO is updating their tracking system to avoid this issue in the future.

Additionally, negative savings were erroneously entered into the tracking database for CFLs and LEDs that energy advisors installed in empty sockets. The evaluation team previously determined that the negative savings should be zeroed out in these cases.[[18]](#footnote-19) The negative savings values were zeroed out for lighting measures in the Measures tab but not in the Projects tab of the tracking data workbook, resulting in a 557 kWh and 0.0604 kW difference between the two tabs. Thus, the evaluation team accepted the savings values reported in the Measures tab.

Finally, energy advisors did not collect the correct Seasonal Energy Efficiency Ratios (SEERs) and Heating Seasonal Performance Factors (HSPFs) for the ASHP maintenance measures. In PY6, the SWE noted that the SEER and HSPF values that were collected onsite for the program’s ASHP maintenance measures were only applicable to newly installed units and not to maintained units. In PY7, the CSP did not make an adjustment to its data collection and tracking data to collect the unit-specific SEER and HSPF during the ASHP maintenance service calls; rather, it continued using the less precise 2015 PA TRM default values to calculate energy savings.

## Impact Evaluation Net Savings

Once gross program impacts have been estimated, net program impacts are calculated by multiplying the gross impact estimate by the NTG ratio. The NTG ratio is equal to one minus the percentage of free riders plus spillover for this program. The methodology used to calculate free ridership and spillover for SHC in PY7 are described in Section 3.3.1, which is followed by the results in Section 3.3.2.

### Net Verified Savings Methodology

The evaluation team used a customer self-report approach to estimate free ridership and spillover. Free ridership was estimated based on responses provided during participant phone interviews, and spillover was estimated based on responses to both participant phone interviews and follow-up calls conducted to discuss spillover in depth. The sample frame for the interviews and spillover follow-up calls was the program’s PY7 participant population as of April 2016, when the interviews began. The final frame consisted of the 4,706 participants included in the Q1-Q3 tracking data that PECO made available to the evaluation team and that had operable phone numbers.

For the phone interviews, the evaluation team developed a random, stratified interview sample of participants for which phone numbers were available. Interviewers then worked through the sample file by calling each participant, starting at the top and moving down the list, until each stratum quota was reached. The evaluation team then completed spillover follow-up calls with 27 of 33 interview respondents who reported that they had installed spillover measures and agreed to an additional call.

The evaluation team designed interview quotas to provide free ridership estimates consistent with gross savings estimate requirements for 85% confidence with 15% precision at the program level, as shown in Table 3‑5.

Table ‑: Smart House Call Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Stratum Boundaries** | **Population Size** | **Assumed CV or Proportion in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame[1] Contacted to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\C7A6F7DF.xlsx#RANGE!_ftn1) |
| Assessment | N/A | 2,813 | 1.00 | 85/15 | 52 | 52 | 28% |
| Audit Only | N/A | 1,609 | 1.00 | 85/15 | 47 | 47 | 55% |
| Audit + Install Major Measures | N/A | 284 | 1.00 | 85/15 | 31 | 31 | 41% |
| **PROGRAM TOTAL** | **N/A** | **4,706** | **N/A** | **85/15** | **130** | **130** | **37%** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The evaluation team structured the free ridership section of the phone interviews based on guidance from the ETO NTG methodology.[[19]](#footnote-20) Participants were asked a series of questions to target how many of the program measures they would have installed in the absence of the program and to rate the influence of five key program elements on a scale of 1 to 5, where 1 meant that the program was “Not at all influential” and 5 meant that the program was “Extremely influential” on their decision to install the program measures. The five program elements included the following:

* Program incentives
* Change in energy bills associated with having the efficient equipment installed
* Information provided by the energy advisor
* Fact that free energy efficient equipment was directly installed in their home
* Any additional specific program element that the participant reported had influence on their decision to install energy efficient equipment through the program

Using this approach, free ridership can take on values ranging from 0.0 to 1.0 for each respondent and for the program overall. Customers received a score of 0.0 when they said that they would not have installed any of the same measures in the absence of the program and rated at least one of the program elements with a score of 5 (“Highly influential”) for having impacted their decision to install the program measures. Conversely, the evaluation team assigned respondents a score of 1.0 when they said that they would have installed all of the same measures in the absence of the program and said that no aspect of the program influenced their decision to install the program measures (the respondent gave all program elements a score of 1). Customers who received a free ridership score between 0.0 and 1.0 said that they would have installed at least some of the same measures in the absence of the program and/or reported that at least one program element had some influence on their decision to install the program measures (program influence scores of 2 or more).

The phone interviews also included a spillover section in which the evaluation team asked customers if they installed additional energy efficiency measures that had not been discounted or incentivized by participating in the SHC program, and if they had, what kind of measures were installed. The customers who reported spillover were also asked to participate in a follow-up interview to help the evaluation team gather more information about the spillover measures they installed in their homes. Evaluation team interviewers attempted to contact all 33 of the participants who agreed to the follow-up interview and completed 27 interviews. During the follow-up calls the interviewer verbally verified the installation of the spillover measures reported, including the type, location, and quantity. Customers were then asked to measure the program’s influence on their decision to install the spillover measures on a 0 to 5scale, where 0 meant that the program was “Not at all influential” and 5 meant that the program was “Extremely influential.” The evaluation team then calculated energy and demand savings for each reported spillover measure based on home specifications from the customer files provided by CSP and spillover measure details from the customer files and the spillover follow-up interviews. To determine the amount of spillover savings to attribute to the program, the team divided the program influence score by five and applied the resulting percentage to the savings calculated for each spillover measure.

### Net Verified Savings Results

Free ridership in PY7 was low overall (0.13), as well as among the three strata groups individually. In addition, participants reported low program spillover, at 0.07, overall. The resulting weighted average NTG for the whole program, weighted by kilowatt-hour savings across all respondents, was 0.94.

The PY7 free ridership rate was calculated using the same method that derived the PY5/PY6 rate of 0.19 but is lower primarily because 52% of PY7 respondents received a free ridership score of 0.0 compared to 34% in PY5, as shown in Figure 3‑1.[[20]](#footnote-21) Overall, in PY7 the participants who were assigned a score of 0.0 or 0.25 represented the majority of respondents and energy savings in the survey sample. No participants were scored as full free riders, and the highest free ridership score in the sample was 0.75.

Figure ‑: Smart House Call Distribution of Free Ridership Scores in PY5 vs. PY7

Source: Navigant analysis of participant survey responses

It is not surprising that free ridership for the SHC program is low given that the majority of the customers reported that they participated in the program to learn about the efficiency of their homes and ways in which they can save more energy.

Out of the 33 participant telephone survey respondents who reported spillover, 27 provided clear enough responses where a determination of the presence or absence of spillover could be made. Of these, 18 participant responses indicated evidence of program spillover. Among participants who implemented spillover measures, the average attribution score for program influence on their actions was 92%.

In addition to the overall free ridership, spillover, and NTG score, Table 3‑6 details the strata-level scores calculated based on participants’ self-reported data.

Table ‑: PY7 Smart House Call Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Estimated Free Ridership** | **Estimated Participant Spillover** | **NTG Ratio** | **Observed CV or Proportion** | **Relative Precision** |
|
| Assessment | 0.10 | 0.09 | 0.99 | 0.36 | 7% |
| Audit Only | 0.18 | 0.04 | 0.85 | 0.30 | 6% |
| Audit + Install Major Measures | 0.13 | 0.01 | 0.87 | 0.23 | 6% |
| [**PROGRAM TOTAL**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\DF578A03.xlsx#RANGE!_ftn1) | **0.13** | **0.07** | **0.94** | **0.40** | **5%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Process Evaluation

The PY7 process evaluation leveraged the 130 SHC participant phone interviews as well as in-depth interviews with the program manager and the CSP, CLEAResult. The evaluation team also conducted a materials review that was based on a representative sampling of program marketing materials provided to the team by the program manager and the CSP.

### Process Evaluation Methodology

The evaluation team conducted phone interviews in April and May 2016 with a stratified sample of 130 total program participants, including 52 assessment participants, 47 audit participants who had not installed major measures at the time of the interview, and 31 audit participants who had contractors install major measures at the time of the interview. The evaluation team also conducted in-depth interviews with the PECO program manager and the CSP, in April 2016. The objective of these interviews was to collect information about the program structure, customer satisfaction, program marketing, tracking data issues, progress relative to program goals, and areas of interest for the evaluation itself. Table 3‑7 shows the sampling strategy for each of the process evaluation activities conducted for PY7.

Table ‑: Smart House Call Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Assumed Proportion or CV in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame Contacted to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\DF578A03.xlsx#RANGE!_ftn1) | **Used for Evaluation Activities (Impact, Process, NTG)** |
| Program Participants | **4,706** | 1.16 | 85/15 | 130 | 130 | 37% | Process evaluation |
| Program Manager | 1 | N/A | N/A | 1 | 1 | 100% | Process evaluation |
| Program CSP | 1 | N/A | N/A | 1 | 1 | 100% | Process evaluation |
| **PROGRAM TOTAL** | **4,708** | **N/A** | **N/A** | **132** | **132** | **N/A** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### **Proces**s **Findings and Recommendations**

The process evaluation yielded several findings and potential program improvements. Below are specific recommendations and the associated process evaluation findings on which the recommendations are based.

1. **Finding:** Customer satisfaction was high in PY7 and 96% of participants noted that they would recommend the SHC program to others. When asked to rate several elements of the program on a scale of 1 to 5, where 1 is “Not satisfied” and 5 is “Extremely satisfied,” program participants reported high rates of customer satisfaction with the SHC program, as shown in Figure 3‑2.

Figure ‑: Customer Satisfaction with Elements of the SHC Program (n=130)

Source: Navigant analysis of participant survey responses

While overall satisfaction with the program and its individual components was high, there is potential value to be gained from exploring specific areas of low satisfaction. The evaluation team asked participants who gave a rating of 3 or less to explain their reason for the low rating, and the primary reasons that participants provided included the following:

* Several customers did not like how much their water pressure declined after low-flow faucet aerators and low-flow showerheads were installed. Additionally, participants complained that the low-flow faucet aerators sprayed water on their countertops, creating a mess.
* Participants noted that CFLs and LEDs did not reach full brightness fast enough, and some mentioned that the bulbs did not work well with dimmers.
* Customers complained that their TVs and other entertainment electronics did not function properly when they were all plugged into the same smart strip plug outlet.
* Several participants reported that they did not see energy savings on their bill as a result of several measures, including ASHP maintenance, ASHP duct sealing, attic/wall insulation, and air sealing.
* Several customers felt like the information they received did not have enough depth and that they did not learn anything new. Several other customers noted that they felt like the energy advisor did not do a thorough job during the home visit and follow up.

Additionally, nearly all audit-level interview respondents were satisfied with the audit report that they received following their home visit. With the exception of a handful of respondents, those who received the audit report reported that they found it to be useful and that they felt like the energy advisors explained the results of the audit “extremely well.” Participants reported a number of reasons why they thought the audit report was useful, but noted that the primary benefits were the energy savings recommendations (59%, n=130) and estimated energy losses and uses throughout their homes (36%, n=130).

* 1. **Recommendation:** Maintain the high rates of customer satisfaction as well as the rapport that energy advisors have built with customers through preserving the personalized nature of the program and by providing a learning experience to customers with varying degrees of knowledge about energy efficiency
  2. **Recommendation:** Develop and implement an energy advisor checklist that includes each of the actions an energy advisor must take to complete a successful site visit. Example items to include:
     1. Provide thorough home visits with insightful information offered to participants
     2. Install measures that are compatible with customers’ homes and test installations
     3. Send audit report to all audit participants
     4. Follow up with customers to check on installed measures and encourage additional action.

1. **Finding:** Nearly all respondents reported that their energy advisor recommended one or more ways to improve the energy efficiency of their homes beyond the DI measures. Energy advisors are trained to make recommendations including installing SHC-incentivized major measures, installing measures that are incentivized through other Smart Ideas programs, and practicing energy- and money-saving habits or actions not incentivized by a program. Participants recalled receiving the recommendations focused on installing additional energy efficient measures and practicing energy-saving habits, but they did not commonly cite having been referred to other Smart Ideas programs for which they may be eligible.

* **Recommendations included in the audit report:** Audit participants were asked if the audit report they received during their home visit included recommendations for additional ways to improve the energy efficiency in their homes, and 96% said yes (n=78).
* **Participation in other Smart Ideas programs recommended:** Respondents were asked if their energy advisor recommended other Smart Ideas programs that they may be eligible for and 61% said no, 18% said yes, and the remaining respondents didn’t know or refused to respond (n=130).
* **Energy-saving habits or actions recommended:** Respondents were asked if the energy advisor recommended actions to reduce their energy use, such as turning down the furnace thermostat a few degrees or making sure to turn off electronic devices when not in use, and 71% said yes, 19% said no, and the remaining respondents didn’t know (n=130).

Participants were also asked if they planned to follow through with any of the recommendations provided by their energy advisor. Many respondents reported they have already implemented or plan to implement many of the recommendations that the received. Among the participants who received recommendations to participate in other Smart Ideas program recommendations, 72% (n=25) said that they had either already participated or planned to participate in one of the recommended programs. Similarly, 74% (n=130) of participants reported that they had already implemented at least some of the recommended energy-saving habits. The most common actions that participants implemented after participating in the program were turning off appliances and lights when not in use and turning down or reprogramming their thermostats to be more efficient. However, nearly two-thirds of respondents (n=130) reported that they did not plan to utilize any recommended energy efficient equipment not yet installed in their home.

* 1. **Recommendation:** Train the energy advisors to tailor the experience to the customer and how informed that are about the energy efficiency of their homes. Well-informed customers will look to the energy advisor to provide additional depth to what they already know, while less-informed customers are seeking guidance from their energy advisors. The advisors should be prepared to adjust their guidance and information to meet the customer’s needs.

1. **Finding:** PECO reduced SHC expenditures in PY7; however, after interviewing program participants, the evaluation team identified two examples of program changes that could affect customer satisfaction going forward. Based on anecdotal reports, customers found the LED installations to be one of most valuable components of the program and preferred LEDs over CFLs. However, in a cost-cutting adjustment PECO continued to install CFLs in customers’ homes to reduce the lighting budget. Furthermore, in Phase III PECO is shifting the marketing responsibility and associated budget from the Solution CSP to a marketing CSP. The impacts of this is unclear, but PECO and the marketing firm should be aware that a small group of customers recommended increasing marketing to improve the visibility of the program (8%, n=130).
2. **Recommendation:** Do not let goals for improving TRC compromise positive customer experience and satisfaction.
   * 1. Discontinue CFL installations and install 100% LEDs. The price of LEDs has come down significantly, and the program plans to install value LEDs in Phase III, which are nearly 1:1 in terms of cost ratio with CFLs.
     2. Continue to market the program using past strategies that have proven to be effective and test new targeted marketing tactics to continue to reach the program’s core audience while expanding the reach of the program to customers in other demographics.
3. **Finding:** Respondents generally described having heard about the SHC program through several channels, but 8% (n=130) recommended increasing marketing to improve the visibility of the program. The top three channels respondents reported were bill inserts (48%), mailers (16%), and word of mouth (10%). Participants noted that once they learned about the program, they were primarily driven to schedule an audit or assessment to reduce their energy use and energy bills.

PECO continued to implement the marketing tactics that were successful in PY6, and successfully tested new targeted marketing strategies, including the following:

* **Discounts on the home visit:** PECO offered audits and assessments to customers at a discounted price, including to those who previously declined to participate in the program due to cost or those who had previously participated in the SHR program for non-lighting measures.
* **Targeted marketing:** The program staff reviewed the program data each week to identify participation trends that could be used to inform the marketing strategy. PECO sent mailers to customers in the top 20 ZIP codes of historical participation, as well as to other customers who were likely to participate based on the characteristic trends of past participants. In PY7, PECO also sent smaller batches of mailers more frequently than to previous program years to stabilize the incoming flow of customers.
* **HOA partnership promotion:** PECO sponsored a block party for a homeowner’s association (HOA) whose residents were interested in saving energy in their homes. During the event PECO representatives promoted the SHC program and provided residents with information. The block party was a successful marketing event and resulted in 200 participants from the HOA community.
* **Cross-promotion:** The SHC program was advertised in the materials that customers received when they participated in other Smart Ideas programs.

Since implementing the program discounts and targeted marketing strategies, PECO staff have observed an increase in SHC participation. The program manager noted that the 50% limited time discounts have been particularly successful in increasing customers’ interest in assessments and program participation.

1. **Recommendation:** Build on PY7’s successful marketing tactics to maintain impacts among core demographics through smaller, more frequent direct mail events.
2. **Recommendation:** Implement targeted marketing to engage new demographic groups at higher rates and expand the reach of the program.
3. **Finding:** PECO envisions the SHC program as a gateway to other Smart Ideas programs since the energy advisors have an opportunity to interact with customers during the home assessments and recommend additional energy efficiency upgrades incentivized by other PECO programs. PECO staff also mentioned that energy advisors provide program participants with a packet that includes marketing materials and offers for other programs in the Smart Ideas portfolio. However, only 19% of PY7 interview respondents (n=130) recalled having other Smart Ideas programs recommended to them and only 11% (n=130) said that they planned to participate in another program. These low awareness rates of other program recommendations indicated that there is an opportunity to offer more cross-program marketing.
4. **Recommendation:** Shape the SHC program as a gateway to the Smart Ideas portfolio of programs. Engage more effectively in cross-program promotion by improving the ability of energy advisors to educate customers.

## Status of Recommendations for Program

The evaluation team’s recommendations for the SHC program are provided in Table 3‑8. Navigant based these recommendations on the results of the PY7 evaluation and PECO’s vision for the program moving forward into Phase III.

Table ‑: Smart House Call Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1: Continue to maintain the high rates of customer satisfaction and rapport that energy advisors have built with customers, through the following:   1. Maintaining the personalized feel of the program 2. Providing a learning experience to customers with varying degrees of knowledge about energy efficiency | 1. **Implemented** 2. **Implemented** |
| Recommendation 2:   * 1. Maintain relationships with customers and keep them open by marketing PECO and other program opportunities.   2. Develop and implement an energy advisor checklist that includes each of the actions an energy advisor must take to complete a successful site visit; items that may be included: * Provide thorough home visits with insightful information offered to participants * Install measures that are compatible with customers’ homes; test installations * Send audit report to all audit participants * Follow up with customers to check on installed measures and encourage additional action | 1. **Implemented** 2. **Implemented** |
| Recommendation 3: Do not let goals for improving TRC compromise positive customer experience and satisfaction.   1. Discontinue CFL installations and install 100% LEDs 2. Continue to market the program using past strategies that have proven effective and test new targeted marketing tactics | 1. **Being Considered:** Working with CSP to find alternative solutions in the lighting market to provide LED solutions that fall within the designed budget for Phase III. 2. **Implemented** |
| Recommendation 4:   * 1. Build on PY7’s successful marketing tactics to maintain impacts among core demographics. * Smaller, more frequent direct mail events yielded a steady flow of participants * Word of mouth is strong and growing   1. Implement targeted marketing to engage new demographic groups at higher rates. | 1. **Being Considered:** We are working with the EEMF to try additional marketing tactics that yield same results at a lower cost. However, the core marketing tactics deemed valuable are still part of the overall marketing plan. 2. **Implemented** |
| Recommendation 5: Shape the SHC program as a gateway to the Smart Ideas portfolio of programs. Engage more effectively in cross-program promotion by improving the ability of energy advisors to educate customers. | **Implemented** |

Source: Navigant analysis

## Financial Reporting

The SHC program continues to underspend its budget allocation but exceed the planned program savings. During PY7 the program yielded a savings acquisition cost in line with the PY7 plan. Based on total budget expenditures for the program, approximately 8% of the program budget is spent on incentives to customers while 51% and 16% goes to program administration and marketing, respectively. PECO put considerable effort into reducing the program expenditures in PY7 through working with vendors to negotiate lower prices on DI measures, centralizing the call center, and streamlining marketing efforts and administrative tasks. The program’s steady growth throughout PY7 and streamlined spending yielded favorable acquisition costs.

In PY5 and PY6, the program was below its TRC goal; however, in PY7 the program achieved a TRC of 0.94, which brought the Phase II TRC to 0.72. This is above the Phase II TRC goal of 0.61, which is laid out in the March 2014 revision of the Phase II Energy Efficiency and Conservation Plan. A breakdown of the program finances (by cost category) is presented in Table 3‑9.

Table ‑: Summary of Smart House Call Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| **Row #** | **Cost Category** | **Actual PY7 Costs** | **Actual Phase II Costs** |
| **($1,000)** | **($1,000)** |
| **1** | Incremental Measure Costs | 2,428 | 3,750 |
| **2** | EDC Incentives to Participants | 667 | 988 |
| **3** | EDC Incentives to Trade Allies | 0 | 0 |
| **4** | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 1,761 | 2,762 |
|  | | | |
| **5** | Program Overhead Costs | 5,075 | 10,936 |
| **6** | Design and Development | 0 | 0 |
| **7** | Administration, Management, and Technical Assistance**[1]** | 3,938 | 8,387 |
| **8** | Marketing[2] | 1,137 | 2,549 |
| **9** | EDC Evaluation Costs | 0 | 0 |
| **10** | SWE Audit Costs | 0 | 0 |
|  | | | |
| **11** | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| **12** | Total TRC Costs[5] | 7,503 | 14,686 |
| **13** | Total NPV Lifetime Energy Benefits | 6,289 | 9,470 |
| **14** | Total NPV Lifetime Capacity Benefits | 457 | 698 |
| **15** | Total NPV TRC Benefits[6] | 7,034 | 10,622 |
|  | | | |
| **16** | TRC Benefit-Cost Ratio | 0.94 | 0.72 |
| **Notes:**  Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 TRC Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart Appliance Recycling Program

PECO’s Smart Appliance Recycling (SAR) program removes and recycles operating, inefficient refrigerators and freezers from residential and nonresidential customer sites at no cost to participants. The program intends to offer PECO customers a convenient and environmentally friendly alternative to reselling an old appliance or taking it to a landfill. Thus, SAR offers participants a financial incentive for recycling up to two appliances per household per year. Unlike some low-income appliance recycling programs, SAR provides no replacement appliance. Customers sign up by scheduling an appointment for pickup with the independent CSP that operates the program. The CSP handles all of the application and pickup processes, collects data about participants and their appliances, and physically recycles the retrieved appliances at a regional facility. JACO Environmental, Inc. (JACO) implemented the program until the second quarter of PY7, when it became insolvent. Thereafter, Appliance Recycling Centers of America (ARCA) collected any outstanding units and will continue to implement SAR in Phase III. After collecting the appliance, the implementer mails the customer a check 4-6 weeks after they retrieve a customer’s unit.

## Program Updates

The SAR program operated in accordance with the Phase II plan until November 16, 2015, when JACO abruptly ceased daily operations and subsequently declared bankruptcy. JACO did not have sufficient funds at the time it ceased operation to cover outstanding incentive payments to some PECO customers, leaving approximately 800 customers without a rebate and as many as 1,000 customers with a rebate check that would bounce when deposited.

In addition, approximately 750 PECO customers had scheduled an appliance pickup appointment during the weeks leading up to the closure and had no one show up to their home. To rescue these stranded units, PECO secured an interim recycler, ARCA, on February 26, 2015. In March, April, and May ARCA contacted each of the 750 customers whose appliances were previously scheduled for pickup and also scheduled new pickup appointments with customers who had been waitlisted between November and February. After a temporary contract to do this work through the end of PY7, PECO hired ARCA to begin fully implementing the program during Phase III. For six customers extraordinarily inconvenienced by JACO failing to pick up their appliance, SAR staff arranged for an appliance retailer to come out and remove their appliances earlier than ARCA could.

After its closure JACO was not able to identify exactly which of the impacted PECO customers had received rebates and which had not. Working with a temporary rebate processor, Ecova, PECO contacted 2,818 customers to ensure they received and successfully deposited their rebate checks. These 2,818 customers were composed of two groups: those successfully served by JACO whose outstanding checks bounced or would have bounced if deposited, and those whose appliances were picked up in the month before JACO’s bankruptcy but that may or may not have received a rebate. Among these, 126 customers were unwilling to wait for PECO to reissue a check, so PECO issued gift cards to cover the rebate—$50 per appliance—as well as the $20 bounced check bank fees.

### Definition of Participant

Each customer who schedules a pickup for one or more units is considered a single participant, unless the customer initiates more than one order in the same day. In that case, even if a customer initiates more than one order in the same day, they are only counted as one participant. This participant definition held in PY7 for every customer whose appliance(s) were successfully recycled by either JACO or ARCA. If a customer withdrew their participation after JACO failed to pick up their unit, they are not considered a participant. Every participant received a rebate or a gift card.

## Impact Evaluation Gross Savings

JACO’s bankruptcy in the second quarter of PY7 curtailed the program’s energy savings impacts. While ARCA did contribute some savings toward the end of PY7, the program was essentially suspended from November 16, 2015 until the end of the program year. During PY7 the SAR program served 9,693 participants, and Navigant verified energy and demand savings of 8,843 MWh and 1.2 MW, respectively. For the entirety of Phase II, the SAR program served 28,224 participants, and Navigant verified energy and demand savings of 24,212 MWh and 3.4 MW, respectively. Table 4‑1 presents both the reported and verified Phase II savings results for the SAR program. It also presents the gross reported energy and demand savings for the SAR program by customer sector. As the table demonstrates, more than 99% of program activity occurs in the residential sector, while the rest is distributed between the C&I and GNI sectors.

Table ‑: Phase II Smart Appliance Recycling Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh)[2]** | **Reported Gross Demand Reduction (MW)** | **Verified Gross Energy Savings (MWh)[2]** | **Verified Gross Demand Reduction (MW)** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 27,067 | 25,539 | 3.6 | 23,227 | 3.3 | $1,244 |
| Residential (Low-Income) **[3]** | 882 | 0 | 0.0 | 721 | 0.1 | $37 |
| Small C&I | 224 | 243 | 0.0 | 218 | 0.0 | $12 |
| Large C&I | 16 | 15 | 0.0 | 13 | 0.0 | $0 |
| GNI | 35 | 37 | 0.0 | 33 | 0.0 | $2 |
| **PHASE II TOTAL** | **28,224** | **25,834** | **3.7** | **24,212** | **3.4** | **$1,295** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
[3] The evaluation team verified the percentage of customers participating in the program that were low-income qualified through participant surveys. The survey results were used to estimate program savings and incentives paid that went to low-income customers.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

Navigant determined the SAR program’s gross verified savings by performing an algorithm review of 98% of units in the tracking database to verify correct application of Pennsylvania TRM algorithms used to calculate gross reported savings.[[21]](#footnote-22) Residential units make up 98% of the appliances recycled by the program and 98% of the energy savings. The remaining 2% of units are recorded as nonresidential in the tracking database and were not part of the algorithm review. Navigant applied the verified savings realization rate for residential units to compute the overall gross verified savings. The TRM algorithms under review use default values provided by the PA TRM for each EDC to calculate the annual unit energy consumption (UEC) average for refrigerators and freezers in the EDC’s territory. This UEC is then multiplied by a part-use factor that represents the percentage of the year an average unit is in use—96.9% for refrigerators and 98.5% for freezers. This yields a savings value per unit that can be multiplied by the number of units recycled during the program year. In the 2013 and 2014 PA TRMs, gross savings values were awarded if a participant replaced their recycled unit with another refrigerator or freezer and whether that replacement was standard efficiency or ENERGY STAR-certified. In contrast, the 2015 PA TRM makes no distinction between standard efficiency and ENERGY STAR if the participant replaced a unit. By default in the 2015 PA TRM, if a refrigerator is recycled it is worth 959 kWh and if a freezer is recycled it is worth 866 kWh.[[22]](#footnote-23) The 2014 TRM governs 4% of units recycled through the SAR program during PY7, while the remaining 96% of units recycled through the SAR program during PY7 are governed by the 2015 TRM.

Navigant also took into account the characteristics of the PY7 appliance stock: average age, number of cubic feet, and configuration, among others, to develop a more accurate estimate of savings. The evaluation team multiplied these characteristics by the PA TRM refrigerator and freezer regression coefficients to determine each appliance’s average UEC. These regression-based UECs, multiplied by the TRM default part-use factors, represent the verified savings per unit. The verified savings per unit is divided by the reported savings per unit to calculate a realization rate for both refrigerators and freezers.[[23]](#footnote-24) Navigant applied the residential sector realization rate to units from the C&I and GNI sectors.

To review PECO’s application of TRM algorithms to estimate program savings, Navigant reviewed all the residential units in the program tracking data. These residential units represent 99% of all program units. To verify the stock characteristics found in the tracking data, Navigant conducted a telephone survey of 200 PY7 participants. The sample frame was limited to residential customers who participated in Q 1 and Q2, which represented over 80% of the program year’s savings. The team randomly selected customers to fulfill several stratum, as outlined in Table 4‑2. Navigant targeted a precision of 15% at the 85% confidence level for five strata: refrigerator participants, freezer participants, participants whose rebates may have been delayed, and those who withdrew their participation. Navigant based its target sample size on its predicted response rate of 155 participants. This stratum’s population size was larger than initially estimated.

Table ‑: Smart Appliance Recycling Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| Refrigerators | 6,479 | 85/15 | 70 | 70 | Verification, NTG, and satisfaction |
| Freezers | 1,143 | 85/15 | 70 | 70 | Verification, NTG, and satisfaction |
| Rebate Delayed | 2,818 | 85/15 | 25 | 25 | Satisfaction, due diligence |
| Withdrew Participation | 623 | 85/15 | 25 | 25 | Satisfaction, NTG |
| Pickup Delayed | 293 | 85/15 | 10 | 10 | Satisfaction, due diligence |
| **PROGRAM TOTAL** | **9,693** | **85/15** | **200** | **200** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Navigant conducted no onsite inspections for the PY7 SAR program evaluation, per the evaluation plan.

### Gross Verified Savings Results

Navigant verified gross energy and demand savings of 8,843 MWh and 1.2 MW, respectively. The regression analysis calculated a lower UEC for both refrigerators and freezers, hence energy and demand realization rates of 0.96 and 0.86, respectively. The overall PY7 realization rate is 0.95, which is comparable to the PY5 realization rate of 0.99 and the PY6 realization rate of 0.89. Navigant’s algorithm review found no errors in the application of the 2014 and 2015 TRMs to determine PECO’s reported savings. Based on the participant telephone survey, the evaluation team made no changes to the appliance stock inputs used in the regression analysis.

Table 4‑3 presents a summary of the verified energy savings at the measure level. As mentioned previously, the 2014 TRM, which distinguished between recycled units and units recycled but replaced, only applies to the small number of appliances recycled in June 2015. Thus, the majority of savings are lumped as either refrigerator or freezer retirements.

Table ‑: PY7 Smart Appliance Recycling Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Energy Savings (MWh/yr)** | **Energy Realization Rate (%)** | **Verified Gross Energy Savings (MWh/yr)** | **Observed CV or Proportion in Sample Design[1]** | **Relative Precision at 85% Confidence Interval** |
|
|
| Refrigerator Retired | 7,077 | 0.96 | 6,820 | N/A | 0% |
| Freezer Retired | 1,218 | 0.86 | 1,047 | N/A | 0% |
| Refrigerator Replacement, Non-ENERGY STAR | 178 | 0.95 | 170 | N/A | 0% |
| Refrigerator Replacement, ENERGY STAR | 646 | 0.96 | 620 | N/A | 0% |
| Freezer Replacement, Non-ENERGY STAR | 22 | 0.84 | 18 | N/A | 0% |
| Freezer Replacement, ENERGY STAR | 27 | 0.83 | 22 | N/A | 0% |
| Nonresidential Measures | 153 | 0.95 | 145 | N/A | 0% |
| **PROGRAM TOTAL** | **9,322** | **0.95** | **8,843** | **N/A** | **0%** |

[1] Because the verified savings of SAR units are based on a census of all residential units and not just a sampling of them, SAR does not need a CV or percent precision to quantify the uncertainty of a sample.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 4‑4 presents a summary of the verified demand savings at the measure level.

Table ‑: PY7 Smart Appliance Recycling Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW)[1]** | **Demand Realization Rate (%)** | **Verified Gross Demand Savings (MW)[1]** | **Observed CV or Proportion in Sample Design[2]** | **Relative Precision at 85% Confidence Interval** |
|
|
| Refrigerator Retired | 1.0 | 0.96 | 0.9 | N/A | 0% |
| Freezer Retired | 0.2 | 0.86 | 0.1 | N/A | 0% |
| Refrigerator Replacement, Non-ENERGY STAR | 0.0 | 0.95 | 0.0 | N/A | 0% |
| Refrigerator Replacement, ENERGY STAR | 0.1 | 0.96 | 0.1 | N/A | 0% |
| Freezer Replacement, Non-ENERGY STAR | 0.0 | 0.84 | 0.0 | N/A | 0% |
| Freezer Replacement, ENERGY STAR | 0.0 | 0.83 | 0.0 | N/A | 0% |
| Nonresidential Measures | 0.0 | 0.95 | 0.0 | N/A | 0% |
| **PROGRAM TOTAL** | **1.3** | **0.95** | **1.2** | **N/A** | **0%** |

[1] All reported and verified demand savings in this report include line losses as required.

[2] Because the verified savings of SAR units are based on a census of all residential units and not just a sampling of them, SAR does not need a CV or percent precision to quantify the uncertainty of a sample.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Impact Evaluation Net Savings

Whereas gross savings represents what energy was saved, net savings estimates what portion of that savings are attributable to the program instead of savings that would have occurred naturally. Once gross program impacts have been verified, the evaluation team calculates net program impacts by multiplying the gross impact estimate by the NTG ratio. For SAR, the PY7 NTG ratio is 0.48 for refrigerators and 0.62 for freezers.

### Net Verified Savings Methodology

Per the 2015 TRM and 2014 SWE Common Method,[[24]](#footnote-25) Navigant calculated a net savings per refrigerator or freezer based on a battery of questions asked during the participant telephone surveys. Participants were separated into one of four categories: the small subset who were induced to replace their appliance by the SAR program, those who would have kept their unit in lieu of the program, those who would have transferred the appliance to a second party, and those who would have destroyed the appliance. In the Common Method terminology, these four categories correspond to Scenario A, Scenario B, Scenario C, and Scenario D. See Figure 2‑1 and Figure 2‑2 in Section 4.3.2 for flow charts depicting the distribution of participants within these categories. Table 4‑5 summarizes the level of precision in each phone survey sample strata relevant to the NTG research.

Table ‑: Smart Appliance Recycling Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Stratum Boundaries** | **Population Size** | **Assumed CV or Proportion in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame Contacted to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\36459843.xlsx#RANGE!_ftn1)**[1]** |
| Refrigerators | N/A | 8,237 | 0.50 | 85/15 | 70 | 70 | 100% |
| Freezers | N/A | 1,456 | 0.50 | 85/15 | 70 | 70 | 100% |
| **PROGRAM TOTAL** | **N/A** | **9,693** | **N/A** | **85/15** | **140** | **140** | **100%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The PY7 NTG calculation was enhanced by primary data collected by ARCA while attempting to schedule appointments with customers stranded by the JACO closure. Of the 529 customers ARCA was able to reach, 244 said they were uninterested in scheduling another pickup. Navigant leveraged the reasons these customers gave for not wanting to reschedule as a way to understand what nonparticipants might do with their old refrigerators and freezers in the absence of the SAR program. Of the 244 respondents, 97 indicated they transferred their appliance by selling or giving it away, 128 indicated they destroyed their appliance, and 19 indicated they decided to keep their appliance. The evaluation team weighted these nonparticipant actions against how refrigerator and freezer survey participants reported they would have acted in lieu of the program. Table 4‑6 and Table 4‑7 show the weighting applied to each data source and the portion of units each source reported were transferred versus destroyed. These proportions of discards are only used to refine the percentage of SAR program participants who report they would have discarded their appliance. The percentage of program participants who said they would have kept their appliance comes solely from the participant survey.

Table ‑: Smart Appliance Recycling Refrigerator Discard/Keep Proportions

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Discard/ Keep | Proportion of Participant Sample | Sample | Discard Scenario | No. of Participants | Standard Error | Weight | Proportion of Discards | Overall Proportion |
| Discard | 72% | Participant | Transfer | 14[1] | 0.09 | 49.5% | 50% |  |
| Destroy | 14[2] | 50% |
| Nonparticipant | Transfer | 97 | 0.03 | 50.5% | 43% |
| Destroy | 128 | 57% |
| Weighted Average | Transfer |  | | | 47% | 33% |
| Destroy | 53% | 38% |
| Keep | 28% |  | | | | | | 28% |

[1] This represents the number of refrigerator participants classified as Scenario C.

[2] This represents the number of refrigerator participants classified as Scenario D.

Note: The remainder of participants are Scenario A or B, or those that could not be classified.

Source: Navigant analysis

Table ‑: Smart Appliance Recycling Freezer Discard/Keep Proportions

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Discard/ Keep | Proportion of Participant Sample | Sample | Discard Scenario | No. of Participants | Standard Error | Weight | Proportion of Discards | Overall Proportion |
| Discard | 43% | Participant | Transfer | 5[1] | 0.11 | 58.3% | 23% |  |
| Destroy | 17[2] | 77% |
| Nonparticipant | Transfer | 97 | 0.03 | 41.7% | 43% |
| Destroy | 128 | 57% |
| Weighted Average | Transfer |  | | | 31% | 13% |
| Destroy | 69% | 30% |
| Keep | 57% |  | | | | | | 57% |

[1] This represents the number of refrigerator participants classified as Scenario C.

[2] This represents the number of refrigerator participants classified as Scenario D.

Note: The remainder of participants are Scenario A or B, or those that could not be classified.

Source: Navigant analysis

### Net Verified Savings Results

Navigant estimated a NTG ratio of 0.48 for refrigerators and 0.61 for freezers. This is based on the overall proportions of participants who would keep their unit or discard it as described above. Navigant used those overall proportions, along with the verified UEC of PY7 appliances, to estimate the net savings of each scenario. Figure 4‑1 and Figure 4‑2 show how the savings of each scenario, multiplied by the proportion of PY7 participants who would have followed that scenario if SAR did not recycle their appliance and minus any induced replacement appliance purchases, determine the net savings per unit. The net savings per refrigerator is 444 kWh per year.

Figure ‑: Smart Appliance Recycling Refrigerator Net Savings Calculation



Source: Navigant analysis

As shown in Figure 4‑2, once induced replacement is deducted, the net savings per freezer becomes 458 kWh per year. This amount expressed as a ratio of the verified savings per freezer yielded the NTG ratio of 0.61.

Figure ‑: Smart Appliance Recycling Freezer Net Savings Calculation



Source: Navigant analysis

Table 4‑8 shows the statistical precision of these NTG ratios. Navigant was unable to reach the target precision level of 15% at an 85% confidence level because of a large number of “don’t know” responses. The SWE recommended using a question such as, “*If the appliance pickup program was not available, which one of the following alternatives would you have most likely done with your [appliance] when you were ready to dispose of it? Would have: a. Sold it, b. Given it away for free*, etc.” Navigant’s instrument used a similarly phrased question that did not list the possible disposal options to survey respondents. This increased the number of “don’t know” responses, which prevented differentiation between those who would have *transferred* their unit from those who would have *destroyed* their unit. This technique ensured only respondents with a clear plan to discard their unit were used to estimate NTG, but reduced the classifiable number of responses by 26 (of 140 total). Additionally, a programming error on this same question prevented the surveyors from recording a verbatim response if the respondent chose “other,” preventing Navigant from classifying another 20 responses.

Table ‑: PY7 Smart Appliance Recycling Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Estimated Free Ridership** | **Estimated Participant Spillover** | **NTG Ratio** | **Observed CV or Proportion** | **Relative Precision** |
|
| Refrigerators | 0.52 | 0.00 | 0.48 | 52% | 24% |
| Freezers | 0.39 | 0.00 | 0.61 | 39% | 16% |
| [**PROGRAM TOTAL**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\36459843.xlsx#RANGE!_ftn1) | **0.50** | **0.00** | **0.50** | **N/A** | **21%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Process Evaluation

Navigant found the program operated effectively in PY7 Q1 and Q2. It generated greater savings each month than in PY5 and PY6 and had high customer satisfaction. The interruption caused by JACO’s closure had a major impact on Q3 and Q4 savings, though customer satisfaction among those affected remained high.

### Process Evaluation Methodology

Navigant performed the process evaluation using the following methods:

* Interviewing the PECO program managers
* Projecting PY7 Q1-Q2 activity through Q3-Q4
* Comparing the SAR NTG methodology to other NTG methodologies
* Surveying (via phone) 200 PECO customers

Due to JACO’s closure and the timing of ARCA’s contractual agreement with PECO, Navigant was unable to interview a CSP for the PY7 evaluation.

For its review of NTG methodologies, Navigant examined the NTG methods in Maryland, Illinois, and California, as well as the application of the Pennsylvania TRM at another utility, Duquesne Light.

Table 4‑9 shows how the 200 completed surveys were distributed among regular program participants—the refrigerator and freezer strata—and customers affected by JACO’s closure. Customers with an impacted experience included participants whose rebates were delayed because their checks did not arrive or bounced when deposited, customers who withdrew their participation by declining a rescheduled appointment with ARCA, and participants who were stranded by the JACO closure but did eventually have their appliance successfully picked up and recycled by ARCA.

Table ‑: Smart Appliance Recycling Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Assumed Proportion or CV in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame[1] Contacted to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\36459843.xlsx#RANGE!_ftn1) | **Used for Evaluation Activities (Impact, Process, NTG)** |
| Refrigerators | 6,479 | 0.26 | 85/15 | 70 | 70 | 100% | Process, NTG |
| Freezers | 1,143 | 0.18 | 85/15 | 70 | 70 | 100% | Process, NTG |
| Rebate Delayed | 2,818 | 0.50 | 85/15 | 25 | 25 | 50% | Process |
| Withdrew Participation | 623 | 0.50 | 85/15 | 25 | 25 | 86% | Process |
| Pickup Delayed | 293 | 0.50 | 85/15 | 10 | 10 | 77% | Process |
| **PROGRAM TOTAL** | **9,693** | **N/A** | **85/15** | **200** | **200** | **N/A** | **N/A** |

[1] Sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Findings and Recommendations

Based on the process research described in the previous section and on the impact evaluation results, the evaluation team developed several recommendations.

1. **Finding:**  It is likely that JACO’s closure is solely responsible for SAR failing to reach its PY7 and Phase II goals. Though PY5 and PY6 had also fallen short of their savings goals, the activity level of PY7 Q1 and Q2, if sustained through the latter half of the year, would have been sufficient to exceed Phase II targets. JACO’s closure also interfered with the delivery of participant rebates. This emphasizes the vulnerability of SAR and other programs that have a single CSP.
   1. **Recommendation:** PECO should monitor the financial health of their CSP to avoid program interruptions in Phase III. To this end, PECO developed a cost-of-service arrangement with ARCA that should allow them to continue operating even if global scrap prices remain low during Phase III.
   2. **Recommendation:** PECO should develop response plans for programs relying on a single CSP. These plans should define the protocol for data transfers between a departing CSP and PECO.
2. **Finding:** On average, the regular program participants who participated prior to the program interruption in Q1 and Q2 rated the program 4.7 on a scale of 1 to 5, where 5 is “highly satisfied.” Navigant also found that despite the inconvenience of JACO’s closure, satisfaction was not significantly reduced in impacted customers. Among the customers whose rebates were delayed, average satisfaction was only 4% lower than regular participants. Customers in this strata actually reported higher satisfaction with the speed of the rebate due to their perception of PECO working on their behalf. Among the customers whose units were picked up months after originally scheduled, average satisfaction was 10% lower than regular participants. These customers exhibited the greatest decrease in satisfaction with the speed of the rebate, as they had to wait the longest. These decreases in satisfaction suggest PECO’s response to the emergency was successful and its customer communication strategy should be shared with other programs that may need to suspend program operations suddenly.
   1. **Recommendation:** PECO’s response to JACO’s closure can inform the response plans of other programs reliant on a turnkey CSP.

Figure ‑: Smart Appliance Recycling Regular Customer vs. Impacted Average Customer Satisfaction

Regular Participants (n=140), Rebate Delayed (n=10), and Pickup Delayed (n=21)  
Source: Navigant analysis of participant surveys

1. **Finding:** Table 4‑10 summarizes the NTG methods in other Exelon territories and California. It shows that NTG results are comparable between regions using the Unified Methods Protocol[[25]](#footnote-26) that defines how the PA TRM evaluates appliance recycling. Navigant’s research suggests a different methodology, such as that used in California in its last evaluation, would create different net savings results.
   1. **Recommendation:** PECO should engage in statewide discussions to develop a more robust method for estimating net savings.

Table ‑: Net-to-Gross Method Benchmarking

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Region | Utilities Covered | Method | Refrigerator NTGR | Freezer NTGR |
| Pennsylvania | PECO | UMP | 0.48 | 0.61 |
| Duquesne Light | 0.49 | |
| Maryland | BGR, Pepco, Delmarva Power, PE, SMECO | 0.54 | 0.55 |
| Illinois | ComEd, Ameren | 0.52 | 0.58 |
| California | PG&E, SCE, SDG&E | DNV GL | 0.68 | 0.75 |

Sources: Navigant, Duquesne Light Residential Energy Efficiency Programs – PY6 Process Evaluation, November 16, 2015; Cadmus, EmPower Maryland Evaluation Year 6 Appliance Recycling Program, May 13, 2016; Illinois Energy Efficiency Stakeholder Advisory Group, Ameren\_PY8\_NTGR\_Recommendations, May, 4, 2015; Illinois Energy Efficiency Stakeholder Advisory Group, ComEd\_NTG\_History\_and PY8\_Recommendations, Feb., 24, 2015; DNV GL, California Public Utility Commission Appliance Recycling Program Impact evaluation, October 24, 2014

## Status of Recommendations for Program

Table 4‑11 summarizes the recommendations stemming from Navigant’s evaluation findings.

Table ‑: Smart Appliance Recycling Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1:   * 1. PECO should monitor the financial health of their CSP to avoid program interruptions in Phase III.   2. PECO should develop response plans for programs relying on a single CSP. These plans should define the protocol for data transfers between a departing CSP and PECO. | 1. **Implemented:** PECO is monitoring the financial health of the CSP to avoid program interruptions in Phase III. 2. **Being Considered** |
| Recommendation 2: PECO’s response to JACO’s closure can inform the response plans of other programs reliant on a turnkey CSP. | **Being Considered** |
| Recommendation 3: PECO should engage in statewide discussions to develop a more robust method for estimating net savings. | **Being Considered** |

Source: Navigant analysis

## Financial Reporting

SAR spending was 18% under budget for Phase II due to the program interruption caused by JACO’s closure. Table 4‑12 breaks this spending into 11 cost categories. Rows 12-16 present the results of Navigant’s TRC analysis and show that PY7 had 4.78 more benefits than costs; Phase II overall had 4.26 times more benefits than costs. For comparison, the PY5 TRC was 4.75 and PY6 was 3.59. The cost-effectiveness of the program may decrease in Phase III due to a cost-of-service arrangement with ARCA, which is more expensive per unit.

Table ‑: Summary of Smart Appliance Recycling Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| **Row #** | **Cost Category** | **Actual PY7 Costs** | **Actual Phase II Costs** |
| **($1,000)** | **($1,000)** |
| **1** | Incremental Measure Costs | 0 | 0 |
| **2** | EDC Incentives to Participants | 0 | 0 |
| **3** | EDC Incentives to Trade Allies | 0 | 0 |
| **4** | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 0 | 0 |
|  | | | |
| **5** | Program Overhead Costs | 1,381 | 4,101 |
| **6** | Design and Development | 0 | 0 |
| **7** | Administration, Management, and Technical Assistance**[1]** | 869 | 2,587 |
| **8** | Marketing[2] | 511 | 1,514 |
| **9** | EDC Evaluation Costs | 0 | 0 |
| **10** | SWE Audit Costs | 0 | 0 |
|  | | | |
| **11** | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| **12** | Total TRC Costs[5] | 1,381 | 4,101 |
| **13** | Total NPV Lifetime Energy Benefits | 6,168 | 16,262 |
| **14** | Total NPV Lifetime Capacity Benefits | 438 | 1,210 |
| **15** | Total NPV TRC Benefits[6] | 6,606 | 17,471 |
|  | | | |
| **16** | TRC Benefit-Cost Ratio | 4.78 | 4.26 |
| **Notes:**  Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 TRC Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart Usage Profile Program

The primary goal of PECO’s Smart Usage Profile (SUP) program is to achieve cost-effective energy savings by helping residential customers understand their energy use and adopt energy efficient behavior changes. Additionally, PECO uses the program as a tool to enhance customer engagement and encourage participation in other PECO energy efficiency programs. The SUP program is an opt-out program in which the CSP, Opower, enrolls participants in the program based on a randomized control trial (RCT) program design. Enrolled customers can opt out of the program by calling or emailing the CSP.

The SUP program influences behavior change in customers by providing information in the form of a printed home energy report (HER) mailed bimonthly to participants. The HERs provide participants with information about their recent energy use and compare the usage to that of similar homes. The HERs also provide participants with energy-saving tips, some of which are tailored to the participants’ circumstances. In addition to the printed reports, the program also sends abbreviated email reports to participants for whom PECO has an email address and who have not opted out of receiving email communication. All participants also have access to an online web portal where they can track changes in their usage over time, establish energy-saving goals, and review tips for saving energy and money. The web portal is also available to nonparticipant PECO customers who sign up to access their bill online.

Energy savings are the primary metric for gauging program success and are determined via a regression analysis performed on the billing records of participant households. Savings from behavioral programs such as the SUP program are typically considered to have a 1-year lifetime for as long as the reports are being delivered. Section A.2.c.2 of the Commission’s Phase II Final Implementation Order[[26]](#footnote-27) indicates that savings are only counted for those measures for which the useful life is not expired at the end of the phase. Therefore, only savings from the SUP program in PY7 will count toward PECO’s compliance goals for Phase II; program savings from PY5 and PY6 will not count toward the compliance goals.

## Program Updates

PECO launched this program in PY5 and has not made any major changes to the program offerings outlined in the Phase II plan. The program added a wave of customer participants at or near the beginning of each program year during Phase II. As such, three waves of customer participants are included in the PY7 evaluation of the SUP program.

### Definition of Participant

A key feature of the SUP program is the use of an RCT design, in which eligible customers are randomly assigned to treatment and control groups. Due to random assignment, any difference in usage between treatment participants and control customers is a result of participation in the program. PECO defines participation based on the number of customer households assigned to the treatment group. One treatment group home equals one participant. To ensure the program achieves the highest amount of savings possible, PECO defines target SUP program customers as high-use, residential customers that receive electricity from PECO.[[27]](#footnote-28) As of this report, 8% of the SUP program target population includes low-income customers so that the target population is representative of PECO’s aggregate low-income customer base.[[28]](#footnote-29)

Prior to the launch of each program year participant wave, Opower selected a representative sample of target customers and randomly assigned them into either a treatment group or control group; treatment group customers receive the HERs and control group customers do not.[[29]](#footnote-30) Customers assigned to the treatment/participant group may opt out if they no longer want to receive the HERs. The evaluation, measurement, and verification (EM&V) industry considers this RCT strategy to be the best way to enable accurate evaluation of the impacts of behavioral programs.[[30]](#footnote-31) The RCT strategy also aids the CSP and PECO in monitoring progress toward program goals.

In August 2013, the CSP enrolled 44,795 PECO customers in the first wave treatment group (Wave 1). In June 2014, the CSP enrolled an additional 44,983 customers in a second wave treatment group for PY6 (Wave 2). In June 2015, the CSP enrolled a third wave of 69,298 participants for PY7 (Wave 3).

## Impact Evaluation Gross Savings

As mentioned, because this behavior program is assumed to have a 1-year measure life, savings that accrue to this program are reported and verified each year but decay to zero at the completion of the program year. Therefore, only savings from the SUP program in PY7 will count toward PECO’s compliance goals for Phase II. During PY7 the program significantly exceeded its Phase II savings target of 20,000 MWh of gross energy savings. During PY7, and therefore during Phase II, the SUP program achieved verified savings of 39,041 MWh. The savings results for the entirety of Phase II are summarized in Table 5‑1.

Table ‑: Phase II Smart Usage Profile Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW)[2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW)[2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 132,289 | 36,690 | 0.00 | 39,041 | 0.00 | $0 |
| Residential (Low-Income) | 0 | 0 | 0.00 | 0 | 0.00 | $0 |
| Small C&I | 0 | 0 | 0.00 | 0 | 0.00 | $0 |
| Large C&I | 0 | 0 | 0.00 | 0 | 0.00 | $0 |
| GNI | 0 | 0 | 0.00 | 0 | 0.00 | $0 |
| **PHASE II TOTAL** | **132,289** | **36,690** | **0.00** | **39,041** | **0.00** | **$0** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings are zero for the SUP program due to the nature of the HERs and how the corresponding energy savings are estimated. The program does not claim any reported demand savings, and demand savings were not verified by Navigant.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

The impact evaluation of the SUP program compares actual energy usage against the estimated energy that participating households would have used in the absence of the program.The program utilized an RCT experimental design, meaning that households were randomly allocated to the control and treatment groups. This eliminated the issue of selection bias that complicates the evaluation of many behavioral programs. The random assignment of households means the control group should serve as a robust baseline against which the energy use of the treatment households can be compared to estimate savings from enrollment in the SUP program.

Navigant estimated program savings through the use of a linear fixed-effects regression (LFER) analysis. In the LFER model, average daily consumption (ADC) of kilowatt-hours by participant and nonparticipant *k* in billing period *t*, denoted by ADCkt, is a function of three terms:

* The binary variable Treatment, taking a value of 0 if household k is assigned to the control group, and 1 if household k is assigned to the participant group
* The binary variable Post, taking a value of 0 if bill t is before the household’s program start date and 1 if the bill is received on or after the program start date
* The interaction between these variables, Post Treatment

This is referred to as a one-way fixed-effects model because it includes a household-specific fixed-effects term. Equation 5‑1 formally presents the equation for this model. [[31]](#footnote-32)

Equation ‑: One-Way Fixed-Effects Regression Model

Where,

|  |  |
| --- | --- |
| ADCkt = | The average daily use in kilowatt-hours for participant or nonparticipant *k* during billing cycle *t*. This is the dependent variable in the model. |
| Postt = | A binary variable indicating whether bill cycle *t* is in the post-program period (taking a value of 1) or in the pre-program period (taking a value of 0). |
| Participantk = | A binary variable indicating whether household *k* is in the participant group (taking a value of 1) or in the nonparticipant group (taking a value of 0). |
| = | The household-specific fixed effect (constant term) for household *k*. The fixed effect controls for all participant- or nonparticipant-specific effects on energy consumption that do not change over time, such as the number of household members or the size of the dwelling. |
| = | Regression parameters corresponding to the independent variables. |

The coefficient α0k is the household-specific fixed effect that implicitly captures all participant-specific and nonparticipant-specific effects on electricity use that do not change over time. The calculation of the fixed effect term does not require knowledge of which characteristics at each household are unchanged; the regression model uses billing data to implicitly estimate the aggregate impact upon energy use of all characteristics that are unchanged over time. Second, α1 captures the average effect among nonparticipants of being in the post-treatment period. In other words, it captures the effects of exogenous factors, such as economic conditions, that affect all nonparticipants in the program period but not in the pre-program period. Third, α1 + α2 captures the average effect among participants of being in the post-program period, and so the effect directly attributable to the SUP program is captured by the coefficient α2. In other words, this coefficient captures the difference-in-difference (DID) in average daily kilowatt-hour use between the participants and nonparticipants across the pre-program and treatment periods. Consequently, the DID statistic is considered the best indicator of program effects in a program evaluation. The evaluation team generated average savings for PY7 by multiplying the estimate of household average daily savings (α2) by the average number of post days per participant.

The one-way fixed-effects model is the preferred model used for reporting savings. As a check on the robustness of the savings estimates, Navigant also modeled SUP program savings utilizing a post-only model. Due to the experimental design of the program, the two models should generate similar results. The second model uses post-enrollment program observations only and replaces the household fixed effect with the household’s energy use in the same calendar month of the pre-program year to account for household-level variation in energy use. Navigant refers to this model as the post-program regression (PPR) model. Formally, defining as household *k*’s energy use in month *t* and letting denote the fixed effect for month *t*, the model takes the form shown in Equation 5‑2.

Equation ‑: PPR Model with Monthly Fixed Effects

Participants and nonparticipants that moved out of PECO territory during the course of the program (PY5, PY6, or PY7) were omitted from the regression analysis to estimate program effects but were included in the estimate of total program savings for the time prior to when they moved away from PECO territory. Navigant assumed that until a participant moved out, their program savings were equal to savings over the same period for participants that remained in the program for the program’s duration. Table 5‑2 summarizes the sampling strategy for the PY7 evaluation.

Both regression models utilize billing data from all treatment and control households enrolled in the SUP program. Thus, the sampling strategy is a census approach where data from all households is utilized in the analysis, as shown in Table 5‑2.

Table ‑: Smart Usage Profile Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision[1]** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| Wave 1 | 44,795 | N/A | All | All | Billing analysis |
| Wave 2 | 44,983 | N/A | All | All | Billing analysis |
| Wave 3 | 69,298 | N/A | All | All | Billing analysis |
| **PROGRAM TOTAL** | **159,076** | **N/A** | **All** | **All** | **N/A** |

[1] There were no confidence and precision targets for the billing analysis since it utilized a census approach with records from all program participant treatment and control households.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The evaluation team did not conduct onsite inspections for the PY7 SUP program evaluation.

#### Double Counted Savings and Channeling Effects

One of the ways the SUP program encourages participants to reduce energy consumption is by channeling them into other energy efficiency programs offered by PECO, notably the SAR, SHC, SHR, and Smart Multi-Family (SMF) programs. Navigant investigated the effect of the SUP program on increasing participation in these four programs in order to account for the possibility of double counted savings (DCS) as well as to understand the SUP’s ability to channel participants into other programs.

For each wave of customers enrolled in the SUP program, Navigant compared the change in the rate of participation in the other Smart Ideas programs for the treatment group and the control group in the 12 months prior to program enrollment and PY6 via the DID statistic:

DID = (Treatment: Pre/Post change in no. of participants as % of total HER participants) –   
(Control: Pre/Post change in no. of participants as % of total control households)

The SHC and SMF programs did not exist prior to the start of the SUP program in PY5. Therefore, the rate of participation in the pre-program year is set to zero for the DID calculation for participant and control households enrolled during PY5. The evaluation team then multiplied the DID statistic by the number of treatment households to change participation in each of the five other PECO programs due to the SUP program. The change in participation in the other programs, referred to as uplift, was then multiplied by the average participant savings for each program to estimate the total DCS. The calculation of the DID statistic and the resulting program uptake was performed separately for each of the other five programs. From a theoretical standpoint, the DCS may be allocated to either the SUP program or to each of the other energy efficiency programs since the savings would not have occurred in the absence of either program. The industry standard is to subtract the amount of the DCS from the behavioral program’s savings. Navigant followed this approach in the SUP impact evaluation. Following the guidance given in Section 3.4.1 of the Phase II Evaluation Framework, if the 85% confidence interval around the estimated uplift includes zero, there is no evidence of uplift for a given program; thus, Navigant did not adjust for DCS. [[32]](#footnote-33)

#### Opt-Out Rate

The SUP program allows participants to opt out of receiving HERs. Participants that opt out are part of the original RCT design and, therefore, are not excluded from the regression analysis. Navigant’s analysis showed that 148 customers opted out of the SUP program during PY7, or approximately 0.1%. This rate is low compared to the evaluation team’s experience evaluating other opt-out programs.

After a participant opts out of receiving the HERs, they may continue to be influenced by their initial exposure to the program. Thus, any savings that persist after the opt out were counted in the regression analysis described in this report. Due to the RCT design, any savings by these opt-out customers are indeed attributable to the SUP program. In the likely event that savings decay after a participant opts out of receiving reports, this will lower the estimate of average savings.[[33]](#footnote-34) Total program savings are calculated by multiplying the average savings by the number of participants; although the average estimate of savings may be slightly lower, the number of participants includes both active participants and those that have opted out of receiving reports. Inclusion of opt-out participants in the calculation of program savings is consistent with the industry standard.

### Gross Verified Savings Results

The verified ex post energy savings for SUP in PY7 were 39,041 MWh. A summary of verified ex post SUP program savings is shown in Table 5‑3 and Table 5‑4.

Table ‑: PY7 Smart Usage Profile Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Energy Savings (MWh/yr)[1]** | **Energy Realization Rate (%)[1]** | **Verified Gross Energy Savings (MWh/yr)** | **Observed CV or Proportion in Sample Design[2]** | **Relative Precision at 85% Confidence Interval[2]** |
|
|
| Wave 1 | N/A | N/A | 6,847 | N/A | 0% |
| Wave 2 | N/A | N/A | 16,842 | N/A | 0% |
| Wave 3 | N/A | N/A | 15,352 | N/A | 0% |
| **PROGRAM TOTAL** | **36,690** | **1.06** | **39,041** | **N/A** | **0%** |

[1] Savings are reported at the program level and not by individual customer wave.

[2] The billing analysis approach utilized in the SUP program evaluation uses billing data from all program treatment and control customers, constituting a census design. As such, there is no sampling uncertainty and the CV is irrelevant.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Due to the nature of the delivered HERs, the SUP program does not report participant demand savings, nor are they verified as part of the program’s evaluation.

Navigant concluded that the SUP program successfully channels participants into the SHC program, but it does not appear to be an efficient marketing channel for any other PECO residential program. Table 5‑4 provides the channeling summary, shown as the percentage of participants channeled from all SUP participants. The programs included here are those that showed statistical significance in the double counting analysis. Compared to PECO’s typical direct mail return rate of 1%, these rates imply that the SUP reports are less effective at channeling participants into other programs than typical direct mail campaigns.

Table ‑: Share of SUP Participants Channeled into other PECO Programs

| **Other Residential  PECO Program** | **Share of Wave 1 SUP Participants Channeled into Program (n=44,795)** | **Share of Wave 2 SUP Participants Channeled into Program (n=44,983)** | **Share of Wave 3 SUP Participants Channeled into Program (n=69,298)** |
| --- | --- | --- | --- |
| Smart House Call | 0.2% | 0.6% | 0.8% |
| Smart Appliance Recycling | 0.1% | N/A (Not statistically different than zero) | 0.1% |
| Smart Home Rebates | 0.2% | N/A (Not statistically different than zero) | -0.1% |
| Smart Multi-Family | N/A (Not statistically different than zero) | N/A (Not statistically different than zero) | N/A (Not statistically different than zero) |

Source: Navigant analysis of program tracking data

## Impact Evaluation Net Savings

Due to the RCT design of the SUP program, free ridership and participant spillover are incorporated in the results of the regression analysis. Section 2.2.2 of the SEE Action protocol states:

*RCTs eliminate this free-rider concern during the study period because the treatment and control groups each contain the same number of free riders through the process of random assignment to the treatment or control groups. When the two groups are compared, the energy savings from the free riders in the control group cancel out the energy savings from the free riders in the treatment group, and the resulting estimate of program energy savings is an unbiased estimate of the savings caused by the program (the true program savings).*

… [Participant spillover], *in which participants engage in additional energy efficiency actions outside of the program as a result of the program, is also automatically captured by an RCT design for energy use that is measured within a household.*

However, the RCT design does not account for nonparticipant spillover. Section 2.2.2 of the SEE Action protocol continues:

[Nonparticipant spillover] *issues in which a program influences the energy use of non-program participants are not addressed by RCTs. In these cases in which non-participant spillover exists, an evaluation that relies on RCT design could underestimate the total program-influenced savings.*

### Net Verified Savings Methodology

As described in Section 5.3, Navigant incorporates free ridership and spillover into the results of the SUP regression analysis based on customer billing records. Nonparticipant spillover is not included in the regression analysis, but the industry standard approach is to assume that nonparticipant spillover is small for this program type. Nonparticipant spillover would be driven primarily by conversations that participants may have with nonparticipant PECO customers, which are expected to have a relatively small impact on nonparticipant energy savings. The conservative approach Navigant used is to assume that nonparticipant spillover is 0.00 and that the NTG ratio for the SUP program is 1.0. As a result, the net and gross savings estimates are the same for the SUP program. As such, there is no NTG sample for the SUP program.

### Net Verified Savings Results

As described in Section 5.3.1, net and gross savings estimates are the same for the SUP program. This is because the billing analysis approach already incorporates participant free ridership and spillover, and nonparticipant spillover is expected to be quite small. Therefore, Navigant conservatively assumed the NTG ratio to be 1.0, and did not perform any NTG research for the SUP program.

## Process Evaluation

Navigant performed a limited process evaluation for the SUP program during PY7. A thorough process evaluation, which included phone surveys with 450 participant treatment and control households, was performed as part of the PY6 evaluation. Since the program design has not changed since PY6, an additional process evaluation involving customer surveys was unnecessary in PY7. The PY7 process evaluation did include interviews with program managers and the CSP, Opower.

### Process Evaluation Methodology

Navigant conducted in-depth phone interviews with the PECO program manager and Opower’s program manager. The evaluation team developed interview guides using open-ended questions to allow for a free-flowing discussion between the interviewer and respondent and used experienced evaluation team members to conduct the interviews, allowing the interviewer to delve more deeply into pertinent issues based on the respondents’ knowledge of and experience with the program. Navigant did not develop any other process samples for the SUP program, as reflected in Table 5‑5.

Table ‑: Smart Usage Profile Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Target Group** | **Stratum Boundaries[1]** | **Population Size** | **Assumed Proportion or CV in Sample Design[1]** | **Assumed Levels of Confidence and Precision[1]** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame Contacted to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\EBEC6ABA.xlsx#RANGE!_ftn1) | **Used for Evaluation Activities (Impact, Process, NTG)** |
| Program Staff | N/A | 1 | N/A | N/A | 1 | 1 | 100% | Process: Staff interview |
| Implementer Staff | N/A | 1 | N/A | N/A | 1 | 1 | 100% | Process: Implementer interview |
| **PROGRAM TOTAL** | **N/A** | **2** | **N/A** | **N/A** | **2** | **2** | **100%** | **N/A** |

[1] The SUP process evaluation only included interviews with key program and CSP staff. No separate evaluation activity involving a sample was employed. As such, no stratification technique was required and no statistical targets were placed on these activities.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Findings and Recommendations

The process evaluation included detailed interviews with PECO and CSP management staff. The primary outcome of these interviews was to confirm that the SUP program is being implemented as intended and is consistent with the program theory and logic model established during program design. Based on these activities and the impact evaluation results, the evaluation team developed several recommendations. These are summarized here and discussed further subsequently.

1. **Finding:** PECO is planning to significantly increase the number of households receiving HERs during Phase III, and behavioral savings will represent a significantly greater percentage of the residential portfolio’s savings. HERs will also be sent to a broader group of customers with more diverse energy use profiles.
   1. **Recommendation:** Monitor the month-by-month progression of percentage savings from existing and new waves to optimize savings projections and program size in Phase III.
2. **Finding:** The SUP uplift analysis shows that program participants are being successfully channeled into the SHC program, but they are not successfully being channeled into other PECO residential energy efficiency programs. Additionally, relatively few household characteristics specific to each customer are utilized in tailoring the messaging and modules within the delivered reports. The relatively low number of channeling modules that were included in the HERs during PY7 corroborated this finding. This low rate was partly the result of implementation issues with the SAR program as well as the focus on transitioning the SUP program to its intended implementation during the upcoming Phase III. Nonetheless, there are opportunities to increase program channeling through micro-targeted report messaging to particular households and their characteristics and energy needs.   
     
   Some data providers are able to provide propensity scores for households that could indicate a tendency toward being green-conscious. Messaging to these customers could include references to the environmental and sociological benefits of energy efficiency, whereas other customers may respond better to messaging focused on the reduction in utility bills. Micro-targeting of messaging could have the added benefit of increasing program savings by providing households with energy-saving tips and recommendations that are more appropriate for each individual customer’s situation. For example, if PECO has data that indicates a customer is likely to be a renter or short-term occupant of a household, his/her HER might suggest they could save on the utility heating bill by installing window film. In contrast, if the data indicates a customer is a homeowner or long-term resident, the same recommendation could guide a customer toward attic insulation. The CSP could accomplish this messaging by including additional household data collected by PECO or through propensity data available from a third-party data provider.
   1. **Recommendation:** Acquire and apply more data on household characteristics, lifestyles, and propensities to increase engagement and program channeling.
3. **Finding:** A relatively low proportion of SUP program participants receive electronic HERs in addition to mailed reports. At the same time, data tracked by the CSP shows a higher rate of customer engagement and a lower rate of customer complaints to the PECO call center from participants that receive reports electronically. In particular, customers receiving electronic reports click through to the PECO website 1.5% of the time.  
     
   In reviewing program tracking data, Navigant noted the relatively low proportion of SUP program participants that received the abbreviated email HERs, juxtaposed against a seemingly higher rate of customer engagement (as measured through the tracking of click throughs) and lower rate of customer complaints to the PECO call center. Without having performed detailed customer surveys during PY7, the electronic delivery of HERs would seem to create a better overall customer experience for SUP program participants at a lower per unit cost to PECO. As such, Navigant recommends that PECO make a concerted effort to gather additional email addresses for program participants in order to further increase the number of treatment customers that receive electronic reports in addition to paper reports. This would provide PECO with another channel for engaging customers and channeling them to other PECO offerings. Navigant understands that an effort with this aim is already underway at PECO.
   1. **Recommendation:** Utilize other PECO customer points of contact to gather participant email addresses for the purposes of electronic report delivery.
   2. **Recommendation:** PECO should document clear intentions and metrics for the email and web portal components of the program, especially for Phase III, and set and track goals accordingly.

## Status of Recommendations for Program

Navigant’s recommendations for the SUP program, as well as PECO’s status for each recommendation, are listed in Table 5‑6.

Table ‑: Smart Usage Profile Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1: Monitor the month-by-month progression of percentage savings from waves to optimize savings projections and program size in Phase III. | **Implemented:** In Phase III, PECO plans to incorporate data analytics into program monitoring to help identify areas of opportunity and develop target channeling. |
| Recommendation 2: Acquire and apply more data on household characteristics, lifestyles, and propensities to increase engagement and program channeling. | **Implemented:** In Phase III, PECO plans to incorporate data analytics into program monitoring to help identify areas of opportunity in the area of customer personalization. |
| Recommendation 3:   1. Utilize other PECO customer points of contact to gather participant email addresses for the purposes of electronic report delivery. 2. PECO should document clear intentions and metrics for the email and web portal components of the program, especially for Phase III, and set and track goals accordingly. | **Being Considered:** PECO is working on developing a business intelligence and customer data analytics component of the program to advance its channeling and outreach pathways. |

Source: Navigant analysis

## Financial Reporting

As shown in Table 5‑7, the SUP program was a cost-effective means of generating savings for the PECO portfolio during Phase II. The program was significantly cost-effective during PY7 with a TRC ratio of 7.67. However, the results of PY7 required multiple years of implementation and costs during PY5 and PY6 without associated savings. As such, the TRC ratio for the SUP program for Phase II is 1.43.

Table ‑: Summary of Smart Usage Profile Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| **Row #** | **Cost Category** | **Actual PY7 Costs** | **Actual Phase II Costs** |
| **($1,000)** | **($1,000)** |
| **1** | Incremental Measure Costs | 0 | 0 |
| **2** | EDC Incentives to Participants | 0 | 0 |
| **3** | EDC Incentives to Trade Allies | 0 | 0 |
| **4** | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 0 | 0 |
|  | | | |
| **5** | Program Overhead Costs | 540 | 2,903 |
| **6** | Design and Development | 0 | 0 |
| **7** | Administration, Management, and Technical Assistance**[1]** | 540 | 2,902 |
| **8** | Marketing[2] | 0 | 1 |
| **9** | EDC Evaluation Costs | 0 | 0 |
| **10** | SWE Audit Costs | 0 | 0 |
|  | | | |
| **11** | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| **12** | Total TRC Costs[5] | 540 | 2,903 |
| **13** | Total NPV Lifetime Energy Benefits | 4,143 | 4,143 |
| **14** | Total NPV Lifetime Capacity Benefits | 0 | 0 |
| **15** | Total NPV TRC Benefits[6] | 4,143 | 4,143 |
|  | | | |
| **16** | TRC Benefit-Cost Ratio | 7.67 | 1.43 |
| **Notes:**  Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 TRC Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart Energy Saver Program

The PECO Smart Energy Saver (SES) program educates fifth through eighth grade students—and, by association, their families—about the benefits of energy efficiency through engaging information and energy-saving activities. PECO hired a CSP, Research Action Programs (RAP), to implement the program and distribute kits to participating teachers in schools throughout PECO’s service territory.[[34]](#footnote-35)

To achieve one of the program’s goals of energy education, the SES program offered classroom curriculum to help participating teachers instruct students on energy-saving approaches that students can implement in their homes.[[35]](#footnote-36) During each school year within the Phase II program calendar, the CSP worked with PECO to identify and recruit fifth grade teachers into the program and then distributed curriculum materials and take-home kits to the teachers, free of charge. Each participating student was then provided with a take-home kit that included low-cost, energy efficient measures and materials designed to raise awareness about how individual actions can create significant reductions in electricity and water consumption. The CSP also supplied a slimmed down version of the kit and the associated materials via the PECO Energizing Education Program (PEEP) to sixth through eighth grade classrooms within PECO’s territory.[[36]](#footnote-37)

In PY7, the CSP distributed 8,023 of the full SES take-home kits, which included four CFLs (two 13W, one 18W, and one 23W), a low-flow showerhead, a faucet aerator, and one LED nightlight, through the program. Additionally, in PY7 the program distributed 4,301 of the slimmed-down PEEP kits, which included two 13W CFLs and two LED nightlights.

The SES program achieves energy savings from the installation of the measures included in the take-home kits. Each of the kit measures corresponds to a deemed/partially deemed value in the 2015 PA TRM, and program savings are determined based on the installation rates for each measure as determined through the program evaluation. The SES program does not claim savings from behavioral changes that result from program activities.

## Program Updates

PECO launched the SES program in PY5. Slight changes were made to the program in PY6 due to the PY5 evaluation. These changes included offering an incentive to encourage parents to return the feedback surveys in the kits, changes to the questions asked in the student installation surveys, and updates to the inputs used in the ex ante calculations. PECO made additional slight changes to the program in PY7 as a result of the PY6 evaluation; these included the rewording and addition of questions to the student and teacher surveys to better understand details about the program implementation. None of the changes made for PY6 or PY7 resulted in notable divergence from the program as outlined in the Phase II plan.

### Definition of Participant

PECO defines participation in the SES program based on the number of take-home kits distributed. One kit is equal to one participant. For the full SES kit distribution, the program primarily targets fifth grade students at schools located within PECO’s service area. Based on its implementation experience across the country, RAP feels that fifth grade students are:

* Advanced enough to understand and absorb the lessons and activities central to the program
* Impressionable enough for the program to have an impact on their world view in terms of energy efficiency[[37]](#footnote-38)

The program also targets sixth through eighth grade students with the slimmed-down PEEP kits. By sending efficiency measures and information home with students, the program is—by extension—targeting the parents and guardians of these students as an additional audience.

## Impact Evaluation Gross Savings

For Phase II, the SES program served 37,827 participants, and Navigant verified energy and demand savings of 7,219 MWh and 0.80 MW, respectively. Table 6‑1 presents both the reported and verified Phase II savings results for the SES program.

Table ‑: Phase II Smart Energy Saver Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW) [2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW) [2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 37,827 | 9,017 | 0.9 | 7,219 | 0.8 | $0 |
| Residential (Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Small C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Large C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| GNI | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| **PHASE II TOTAL** | **37,827** | **9,017** | **0.9** | **7,219** | **0.8** | **$0** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

Navigant evaluated the gross savings impacts of the SES program based on the deemed values in the 2015 PA TRM. The TRM equation inputs were informed by the data captured via the student installation surveys, which was documented in the program tracking database. Through the student installation surveys, students provided information about how many and which of the take-home kit measures were installed in their home, as well as details about their homes including whether it is a single-family or multifamily home and whether their water heater uses gas or electricity. After the CSP received the student installation survey data from participating teachers, it provided the data to PECO for transfer to Navigant. Using this information, the evaluation team completed an installation rate calculation for each measure, which included quantifying installation rates and calculating savings for each measure as outlined in the 2015 PA TRM.

When calculating the verified program savings, Navigant updated some of the TRM-defined variables based on available installation survey data. The standard TRM values used in the ex ante calculations were only changed when the TRM dictated that data collection could be used to update values and when the evaluation team was confident in the data supplied by the installation survey.

The SES program does not claim low-income participation. While PECO and Navigant assume that some of the program kits are installed in low-income households, no data is collected as part of the program that could quantify this assumption. Therefore, all program savings are claimed under the residential sector and no low-income participation is claimed by the program.

Navigant verified that in PY7 RAP distributed 8,023 SES (full) kits and 4,301 PEEP (slimmed down) kits. The CSP distributed these 12,324 kits to 254 teachers across 124 schools. Of the 12,324 take-home kits distributed, the program received 3,710 (30%) of the student installation surveys back from participating teachers. In comparison, the overall survey return rate was 42% for PY5 and 32% for PY6. To evaluate the SES program, Navigant used the data from returned student installation surveys to determine an installation rate for each measure.[[38]](#footnote-39) The evaluation team then applied this installation rate to all of the measures distributed, even those for which student surveys were not returned. Table 6‑2 indicates how many of each measure the CSP distributed (in the “Population Size” column) and how many surveys students returned, which indicated whether the measure had been installed or not (in the “Achieved Sample Size” column).

Table ‑: Smart Energy Saver Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| 13W CFL | 24,648 | 85/15 | All | 6,835 | Installation rate calculation |
| 18W CFL | 8,023 | 85/15 | All | 2,418 | Installation rate calculation |
| 23W CFL | 8,023 | 85/15 | All | 2,369 | Installation rate calculation |
| LED Nightlight | 16,625 | 85/15 | All | 4,432 | Installation rate calculation |
| Low-Flow Showerhead | 8,023 | 85/15 | All | 2,483 | Installation rate calculation |
| Faucet Aerator | 8,023 | 85/15 | All | 2,450 | Installation rate calculation |
| **PROGRAM TOTAL** | **73,365** | **85/15** | **All** | **20,987** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The evaluation plan did not indicate onsite inspections, and the evaluation team would only be able to perform them for households where a parent or guardian returned the parent/guardian survey providing contact information. Only 91 parents/guardians returned these surveys, which would have led to a very limited sample; therefore, Navigant did not perform any onsite inspections for the SES PY7 evaluation.

### Gross Verified Savings Results

Navigant verified PY7 gross savings for the SES program as 2,413 MWh/year and 0.30 MW, as shown in Table 6‑3 and Table 6‑4. The PY7 energy realization rate attributed to this program was 0.87, as indicated in Table 6‑3; the peak demand realization rate attributed to this program was 0.90, as indicated in Table 6‑4.

Table ‑: PY7 Smart Energy Saver Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Energy Savings (MWh/yr)** | **Energy Realization Rate (%)** | **Verified Gross Energy Savings (MWh/yr)** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| 13W CFL | 739 | 1.00 | 740 | 1.00 | 0% |
| 18W CFL | 281 | 1.00 | 281 | 1.00 | 0% |
| 23W CFL | 393 | 1.00 | 394 | 1.00 | 0% |
| LED Nightlight | 121 | 0.56 | 67 | 0.56 | 2% |
| Low-Flow Showerhead | 891 | 0.70 | 621 | 0.70 | 2% |
| Faucet Aerator | 361 | 0.86 | 310 | 0.86 | 1% |
| **PROGRAM TOTAL** | **2,786** | **0.87** | **2,413** | **N/A** | **1%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table ‑: PY7 Smart Energy Saver Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW)[1]** | **Demand Realization Rate** | **Verified Gross Demand Savings (MW)[1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| 13W CFL | 0.1 | 1.00 | 0.1 | 1.00 | 0% |
| 18W CFL | 0.0 | 1.00 | 0.0 | 1.00 | 0% |
| 23W CFL | 0.1 | 1.00 | 0.1 | 1.00 | 0% |
| LED Nightlight | 0.0 | N/A | 0.0 | N/A | 0% |
| Low-Flow Showerhead | 0.1 | 0.70 | 0.1 | 0.70 | 2% |
| Faucet Aerator | 0.1 | 0.86 | 0.0 | 0.86 | 1% |
| **PROGRAM TOTAL** | **0.3** | **0.90** | **0.3** | **N/A** | **1%** |

[1] All reported and verified demand savings in this report include line losses as required.

Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The SES program realization rate was less than 1.0, which is attributable to the following factors:

* **LED nightlights:** The LED nightlight measure saw the greatest percentage difference between reported and verified energy savings. The savings difference occurs because the student installation surveys point to a difference from the assumed baseline conditions in the 2015 PA TRM. During the PY7 evaluation, the CSP collected detailed information about the baseline equipment/conditions that existed before the participant installed the kit nightlight. RAP began collecting this data in the PY7 student installation survey after the PY5 and PY6 evaluation results indicated that participants were not replacing existing incandescent nightlights with the LED nightlights, which is the baseline assumption for the TRM calculations. The PY7 installation survey determined that participants installed approximately two-thirds of the nightlights in a location where there was either no existing nightlight or, if there had been an existing nightlight, the participant moved it to a new location and it was still installed, as illustrated in Figure 6‑1.

Figure ‑: PY7 Smart Energy Saver Program Baseline Conditions for Installed Nightlights (n=3,710)

Source: Navigant analysis of student installation surveys

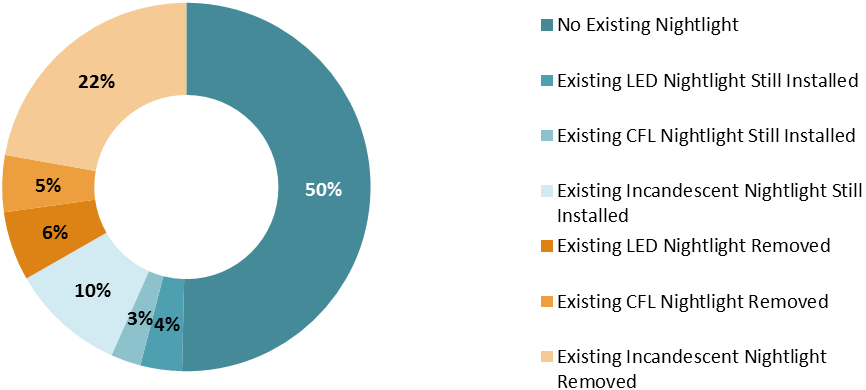
The results of the baseline conditions found in the PY7 student installation surveys greatly reduce the savings that Navigant could apply to the LED nightlight measure. Figure 6‑2 indicates the watts per unit savings (either increase or decrease) resulting from each of these baseline situations. The approximately two-thirds of nightlights that did not result in the replacement of any existing nightlight end up increasing wattage a small amount, while the situations where a nightlight was replaced result in a decrease in energy consumption based on the type of nightlight that was replaced.

Figure ‑: PY7 Smart Energy Saver Program Savings Associated with Installed Nightlights (n=3,710)

🡫 1.5

watts/unit

🡫 0.5 watts/unit



🡩 0.5

watts/unit

🡩 0.5

watts/unit

🡫 6.5

watts/unit

**Total Measure Savings**

Reported: 121 MWh

Verified: 67 MWh

56% RR

Source: Navigant analysis of student installation surveys

* **Low-flow showerheads:** The low-flow showerhead measure saw variation between the reported and verified energy savings because of differences in the findings from the PY7 student installation surveys and assumed calculation inputs. In particular, the percentage of low-flow showerheads reported to be installed by PY7 students was lower than previous years, at only 36% compared to the assumed 42% used in the reported savings calculations.[[39]](#footnote-40) The student installation survey also revealed a smaller percentage of homes with electric water heating (40% for single-family and 45% for multifamily) as compared to the assumed 50% used in the reported savings calculations.
* **Faucet aerators:** The differences between the reported and verified savings for the faucet aerator measure were similar to those found for the low-flow showerhead measure. The percentage of faucet aerators reported to be installed through the PY7 student installation survey was only 38%, which was lower than the 45% used in the reported savings calculations. Additionally, Navigant based the verified savings for faucet aerators on an approach that used a weighted average between aerators installed in bathrooms, kitchens, and other sinks, as compared to the reported savings that used straight averages of mixed inputs from the TRM.

## Impact Evaluation Net Savings

For reasons discussed in the following section, Navigant did not complete a NTG evaluation for the SES program in PY7; therefore, Navigant does not present NTG results.

### Net Verified Savings Methodology

In the context of the SES program, the evaluation team defines a free rider as a participant that would have purchased and installed the measures in their home even if they had not received the measures through the take-home kit. Free ridership should be verified by confirming whether the measures in the take-home kit were installed and whether the participating household was considering installing the measures prior to participating in the program. Ideally, the evaluation team would collect this information via either the student installation survey or the parent/guardian phone survey. As stated in the SWE guidance memo on the “Common Approach for Measuring Free-riders for Downstream Programs”: “where the respondent was not even considering the measures before being contacted by the program, the total free ridership score was set to 0.” Spillover, or the level of the program’s influence on energy-saving actions taken after participation in the program, should also be assessed via the student installation survey or the parent/guardian survey.

The evaluation team attempted to calculate net impacts for the SES program as part of the PY5 evaluation, but not enough parental surveys were returned to collect enough data to support the NTG calculations. Additional efforts were made during PY6 to increase the return rate of parental surveys, but return rates did not substantially increase. After the PY6 evaluation, the SWE recommended that Navigant include an evaluation of net impacts in the PY7 evaluation plan. However, after further discussion of this recommendation with the SWE, it was determined that the calculation of NTG for the SES program would be too costly and was unnecessary given that the program will not continue in Phase III. Therefore, the evaluation team did not complete NTG evaluation for the SES program in PY7.

### Net Verified Savings Results

As described in Section 6.3.1, the evaluation team did not complete NTG verification for the SES program as part of the PY7 evaluation.

## Process Evaluation

Navigant did not conduct specific process evaluation activities for the SES program during PY7. Because PECO targeted discontinuing the SES program following PY7, it was determined that completing a full process evaluation was unnecessary for the PY7 evaluation because any resulting recommendations would not have time to be implemented. The evaluation team completed process evaluation activities for the SES program in PY5 and PY6.

### Process Findings and Recommendations

Despite no specific process evaluation, the evaluation team did develop some process recommendations based on the findings of the impact evaluation, which are discussed below.

1. **Finding:** The nightlight measure resulted in minimal energy savings because the baseline conditions verified through the student installation surveys indicated that in approximately two-thirds of cases the kit nightlights were not replacing existing nightlights, which are an assumption of the TRM applied savings. Overall, the nightlight measure had an energy realization rate of 56%and only minimally increased the energy savings of the program as a whole.
   1. **Recommendation:** PECO should consider whether or not offering nightlights as an energy-saving device for non-DI programs is appropriate for the portfolio.
2. **Finding:** The teacher survey responses indicated that the SES program implementation deviates from the program plan, as more than half of student installation surveys are filled out in the classroom rather than at home and not all unused kits make it back to the program. Additionally, student installation survey return rates have continued to decrease over the course of Phase II despite the opposite expectation from the CSP and program efforts to increase participation. While these findings point to deviations in program implementation, they did not result in changes to the program savings in Navigant’s PY7 evaluation. However, there are situations where deviations in program implementation could have a significant effect on verified program savings.
   1. **Recommendation:** If program implementation deviates from program design, PECO should review the design assumptions to ensure that the program plan and corresponding program expectations are achievable. PECO may decide to update either the design assumptions or program implementation to meet expectations or align the program with the original design intent.

## Status of Recommendations for Program

Because PECO plans to discontinue the SES program at the end of Phase II, the PY7 SES program recommendations do not relate to specific program changes for the SES program; rather they include broad recommendations that may be applicable to other PECO programs or the portfolio as a whole. The recommendations as a result of the PY7 evaluation, along with PECO’s status for each recommendation, are listed in Table 6‑5.

Table ‑: Smart Energy Saver Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| **Recommendations** | **EDC Status of Recommendations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)** |
| **Recommendation 1:** PECO should consider whether or not offering nightlights as an energy-saving device for non-DI programs is appropriate for the portfolio. | **Being Considered:** PECO is considering if offering nightlights in non-DI programs/solutions makes sense in the next Phase. |
| **Recommendation 2:** If program implementation deviates from program design, PECO should review the design assumptions to ensure that the program plan and corresponding program expectations are achievable. PECO may decide to update either the design assumptions or program implementation to meet expectations or align the program with the original design intent. | **Not Applicable:** This program was morphed into another solution for the low-income and multifamily customer segments, and will be tracked according to the design assumptions to meet desired outcome. |

Source: Navigant analysis

## Financial Reporting

As Table 6‑6 demonstrates, the SES program continued to be cost-effective in PY7 and for Phase II as a whole, with a TRC ratio of 3.94 and 3.94, respectively.

Table ‑: Summary of Smart Energy Saver Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| **Row #** | **Cost Category** | **Actual PY7 Costs** | **Actual Phase II Costs** |
| **($1,000)** | **($1,000)** |
| **1** | Incremental Measure Costs | 0 | 0 |
| **2** | EDC Incentives to Participants | 0 | 0 |
| **3** | EDC Incentives to Trade Allies | 0 | 0 |
| **4** | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 0 | 0 |
|  | | | |
| **5** | Program Overhead Costs | 450 | 1,351 |
| **6** | Design and Development | 0 | 0 |
| **7** | Administration, Management, and Technical Assistance[1] | 450 | 1,351 |
| **8** | Marketing[2] | 0 | 0 |
| **9** | EDC Evaluation Costs | 0 | 0 |
| **10** | SWE Audit Costs | 0 | 0 |
|  | | | |
| **11** | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| **12** | Total TRC Costs[5] | 450 | 1,351 |
| **13** | Total NPV Lifetime Energy Benefits | 1,580 | 4,717 |
| **14** | Total NPV Lifetime Capacity Benefits | 98 | 260 |
| **15** | Total NPV TRC Benefits[6] | 1,775 | 5,327 |
|  | | | |
| **16** | TRC Benefit-Cost Ratio | 3.94 | 3.94 |
| **Notes:**  Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 TRC Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart Builder Rebates Program

PECO’s Smart Builder Rebates (SBR) program intends to accelerate the adoption of energy efficiency in the design, construction, and operation of new single-family homes by leveraging the US Environmental Protection Agency’s (EPA’s) ENERGY STAR Homes certification.[[40]](#footnote-41) The program provides rebates to builders for new homes that achieve ENERGY STAR certification, including a base rebate of $400 per home, plus $0.10 per kWh of savings achieved.

PECO hired a CSP, ICF International, to market and implement the program throughout PECO’s service territory. The CSP was responsible for recruiting and mentoring homebuilders and Home Energy Rating System (HERS) raters, and for conducting quality control activities to verify project compliance with program requirements. The CSP also managed the program marketing, rebate process, and program tracking data that feeds into PECO’s SIDS.

PECO’s SBR Program focuses on: offering education, financial incentives, mentoring and marketing support to participating home builders; leveraging a network of independent home energy rating system raters (raters) to guide builders through the program and submit project documentation; offering technical and sales training to builders, contractors, and raters; and educating potential homebuyers on the benefits of ENERGY STAR construction.

Key elements of the implementation strategy include the following:

* Builder and rater recruitment, outreach, enrollment, and orientation
* Rater or rating company enrollment
* Registration and tracking of committed homes
* Review, approval, and tracking of incentive applications for completed sites
* Education sessions for builders, raters, and the broader construction community
* A technical and procedural QA monitoring program

## Program Updates

There were no significant changes to the SBR program in PY7.

### Definition of Participant

The target market for participation in the SBR program is residential homebuilders. All newly constructed, residentially metered single-family homes in PECO’s service territory are eligible to participate. For reporting purposes, PECO defines a participant in the SBR program as a home that successfully achieved ENERGY STAR certification through the program.

## Impact Evaluation Gross Savings

For the entirety of Phase II, the SBR program served 248 participants, and Navigant verified energy and demand savings of 592 MWh and 0.2 MW, respectively. Table 7‑1 presents both the reported and verified Phase II savings results for the SBR program.

Table ‑: Phase II Smart Builder Rebates Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW)[2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW)[2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 248 | 590 | 0.2 | 592 | 0.2 | $154 |
| Residential (Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Small C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Large C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| GNI | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| **PHASE II TOTAL** | **248** | **590** | **0.2** | **592** | **0.2** | **$154** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

The PY7 SBR program impact evaluation consisted of desk reviews of project REM/Rate™ files and whole-building simulation modeling. Navigant used two main approaches for evaluating each project:

1. **Desk reviews.** Navigant reviewed a sample of project REM/Rate models and all prescriptive measure calculations (lighting and DHW) for compliance with the appropriate PA TRM.[[41]](#footnote-42) The evaluation team reviewed project tracking data, ex ante measure savings calculations, and REM/Rate model files submitted by raters for compliance with program requirements.
2. **Whole-building simulation modeling.** Navigant used EnergyGauge software to independently calculate energy and demand savings for a sample of project homes. EnergyGauge models were created with identical home characteristics (e.g., wall construction, roof construction, window U-factors, and window-to-wall area) from the sample of REM/Rate files. The evaluation team calculated annual energy and demand savings associated with the program homes as the difference between the baseline and as-built simulation results.

The PY7 sampling strategy used a random sample of projects from the population of program participants in the PY7 tracking database. The evaluation team conducted sampling after Q3 and Q4, when all projects completed in PY7 were captured in the tracking database. The team selected sampled projects based on builder volume to ensure the sample reflected the participant population. The impact evaluation sampling strategy is shown in Table 7‑2.

Table ‑: Smart Builder Rebates Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| All | 158 | 90/10 | 10 | 10 | Desk reviews and whole-building simulation modeling |
| **PROGRAM TOTAL** | **158** | **90/10** | **10** | **10** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Navigant did not conduct onsite inspections for the PY7 SBR program evaluation.

### Gross Verified Savings Results

The verified PY7 gross savings for the SBR program were 363 MWh and 0.2 MW, respectively. The energy savings realization rate attributed to this program was 0.99, as indicated in Table 7‑3. The high realization rate for the SBR program is attributed to the fact that ex ante and ex post savings estimates were both calculated using DOE-2-based modeling software with the same as-built conditions as documented by the rater.

Table ‑: PY7 Smart Builder Rebates Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Energy Savings (MWh/yr)** | **Energy Realization Rate (%)** | **Verified Gross Energy Savings (MWh/yr)** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| All | 365 | 0.99 | 363 | 0.03 | 2% |
| **PROGRAM TOTAL** | **365** | **0.99** | **363** | **N/A** | **2%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The peak demand savings realization rate for the SBR program was 0.76, as indicated in Table 7‑4. The lower realization rate for the SBR program is because the ex ante peak demand savings were not calculated using TRM methods. The TRM protocol specifies the use of a CF to derive coincident peak demand savings from non-coincident savings generated from REM/Rate models. However, the CSP calculated savings using a proprietary building simulation model that provides an 8,760 hourly simulation, from which the CSP can extract peak demand savings for just the Act 129 peak period. While the CSP’s method provides a more accurate result, the TRM protocol does not currently allow for use of this method. Therefore, the evaluation team followed the TRM protocol, resulting in a realization rate adjustment.

Table ‑: PY7 Smart Builder Rebates Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW)[1]** | **Demand Realization Rate** | **Verified Gross Demand Savings (MW)[1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| All | 0.1 | 0.76 | 0.1 | 0.46 | 22% |
| **PROGRAM TOTAL** | **0.1** | **0.76** | **0.1** | **N/A** | **22%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Impact Evaluation Net Savings

The following section describes the activities conducted for the net impact evaluation of the PY7 SBR program. The principal research activity contributing to this evaluation was participating builder telephone surveys to gauge free ridership and spillover.

### Net Verified Savings Methodology

Net savings represents the percentage of the gross program impacts that can reliably be attributed to the program. Navigant estimated net savings by applying a calculated NTG ratio to the verified gross savings. The NTG ratio is calculated as the sum of free ridership and spillover rates.

The evaluation team estimated free ridership and spillover rates based on data collected during participating builder telephone surveys. The team asked survey respondents a series of questions designed to identify the program’s influence on building practices. Responses were scored following the SWE’s Common Approach for Downstream Programs,[[42]](#footnote-43) which is designed to assess the following two elements of free ridership: 1) intention to build ENERGY STAR new homes without program funds, and 2) influence of the SBR program in the decision to build ENERGY STAR new homes. The total free ridership score is the sum of the intention and the program influence scores, resulting in a score ranging from 0 to 1.

The participating builder survey also included a battery of questions to assess spillover. The spillover battery attempted to quantify savings from additional non-incented ENERGY STAR new homes built after the respondent’s participation in the program. The spillover battery also included a question about the level of influence the program had on the respondent’s decision to build additional non-incented ENERGY STAR homes. The team assigned the influence rating a numerical value (0-1) that determined the proportion of the measure’s energy savings that were attributable to the program.

The NTG sampling strategy attempted to reach a census of program builders, and the evaluation team completed seven interviews. Table 7‑5 shows the sampling strategy for the PY7 NTG research.

Table ‑: Smart Builder Rebates Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Stratum Boundaries** | **Participating Builders** | **Assumed CV or Proportion in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame Contacted to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\6C563330.xlsx#RANGE!_ftn1) |
| All | All | 10 | N/A | N/A | Attempted census | 7 | 100% |
| **PROGRAM TOTAL** | **All** | **10** | **N/A** | **N/A** | **Attempted census** | **7** | **100%** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Net Verified Savings Results

Navigant’s NTG evaluation found that six of seven participating builders surveyed were already building to ENERGY STAR standards prior to joining the program. These six respondents also reported a low level of program influence on their decision to build to ENERGY STAR standards.

Of the seven participant builders surveyed, only two reported building additional non-incented ENERGY STAR homes. Neither of these participants were able to provide reliable estimates of the number of additional homes built or when they were built. Therefore, no spillover savings were attributed to the program.

Table 7‑6 shows the results from the NTG evaluation. The PY7 SBR NTG ratio was 0.50.

Table ‑: PY7 Smart Builder Rebates Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Estimated Free Ridership** | **Estimated Participant Spillover** | **NTG Ratio** | **Observed CV or Proportion** | **Relative Precision** |
|
| All | 0.50 | 0.00 | 0.50 | 0.48 | 17% |
| **PROGRAM TOTAL**[1] | **0.50** | **0.00** | **0.50** | **0.48** | **17%** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys. Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Process Evaluation

The following section describes the activities conducted as part of the SBR program’s PY7 process evaluation. The evaluation team conducted in-depth interviews with PECO program staff and CSP implementation staff as well as participating builder telephone surveys as the principal research activities for this process evaluation.

### Process Evaluation Methodology

The evaluation team used in-depth interviews with key PECO and CSP staff instrumental to the delivery of the SBR program to collect data regarding program implementation in PY7 and to discuss research areas of particular interest to program staff. The interviews focused on implementation strategies, data tracking, program management, and areas for program improvement.

The Navigant team also conducted telephone surveys with participating builders to better understand their perceptions of the program and to measure free ridership and spillover. Table 7‑7 provides a summary of the PY7 sampling strategy for each SBR process evaluation activity.

Table ‑: Smart Builder Rebates Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Target Group | Population Size | Assumed Proportion or CV in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | Percentage of Population Frame Contacted to Achieve Sample | Used for Evaluation Activities (Impact, Process, NTG) |
| Program Staff | 1 | N/A | N/A | 1 | 1 | 100% | Process |
| CSP Staff | 1 | N/A | N/A | 1 | 1 | 100% | Process |
| Participating Builders | 10 | N/A | N/A | 10 | 7 | 100% | Process, NTG |
| PROGRAM TOTAL | **12** | **N/A** | **N/A** | **12** | **9** | **100%** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Findings and Recommendations

The following section presents detailed findings from the PY7 process evaluation. There were no significant changes to SBR program processes in PY7. Marketing activities primarily focused on direct outreach to recruit new builders through in-person meetings and builder events. The program did not offer formal training in PY7, relying instead on participating raters to mentor participating builders directly. Navigant found that builders were very satisfied with most elements of the program, though opportunities exist to improve builder satisfaction and engagement.

1. **Finding:** Participating builders were generally very satisfied with the SBR program overall, with 80% of respondents rating it 8 or above on a scale from 1 to 10, as shown in Figure 7‑1. Builders reported highest satisfaction with their experience working with their rater and with CSP program staff. Participants reported lower satisfaction with marketing and training assistance, as well as the time it takes to receive a rebate. The surveys found that prompt payment of incentives is a high priority for builders, who reported lower satisfaction with the amount of time it took to receive incentives in PY7.

Figure ‑: Smart Builder Rebates Builder Satisfaction Ratings (1-10 Scale, n=7)

Source: Navigant analysis of builder surveys

1. **Finding:** Navigant analyzed rebate processing times recorded in the SBR program tracking system for perspective on builder satisfaction ratings. Figure 7‑2 shows each step of the rebate application process along with the responsible party and the duration to complete. It took an average of 131 days over the program year for builders to receive incentive payment after the project was completed. The new Phase III CSP has a different process, with a goal of 60 days for application approval and incentive payment to the builder.
   1. **Recommendation:** PECO should monitor incentive processing time on a monthly basis to ensure the CSP is meeting the Phase III goal of 60 days.

Figure ‑: Smart Builder Rebates Average Incentive Processing Duration

**ACTIVITY**

Duration (Days)

Responsible   
Party

Program Cycle Time

Average Total Duration

Phase III CSP Goals

**PROJECT   
COMPLETE;   
APPLICATION   
RECEIVED**

**APPLICATION APPROVED**

**PECO   
INVOICE**

**CSP   
PAYMENT**

**REBATE   
TO   
BUILDER**

22

53

6

25

25

Rater

CSP

CSP

PECO

CSP

109 Days

131 Days

35

15

10

Source: Navigant analysis of program tracking system

1. **Finding:** When asked to identify the greatest challenge their company faces when building homes to ENERGY STAR standards (Figure 7‑3), builders were divided between the additional cost (43%) and the lack of educated HVAC contractors (43%).

Figure ‑: Greatest Challenge in Meeting ENERGY STAR Standards (n=7)

Source: Navigant analysis of builder surveys

1. **Finding:** The evaluation team asked builders surveyed for this evaluation (n=7) to report several statistics related to the homes built by their company in PY7. As shown in Figure 7‑4, an average of 84% of all homes built by respondents in PY7 received a rebate through the SBR program. This reflects positively on the program but indicates little room for increasing market penetration among participating builders.

Figure ‑: Portion of Respondents’ Homes Participating in PY7 (n=7)

Source: Navigant analysis of builder surveys

One company who only built 20% of their homes to program standards skewed the average portion of homes that did not meet program standards (11%) in PY7. This company only built ENERGY STAR homes in communities that required the certification for all new homes, indicating that the program had little influence on this company’s decision-making.

Most builders surveyed for this evaluation (71%) indicated that their program activity (number of homes contributed) is forecast to increase or remain the same in PY8, as shown in Figure 7‑5. However, 29% expect a decrease in program activity in PY8 due to limited construction activity in PECO’s territory.

Figure ‑: Builder Forecast for PY8 Program Activity (n=7)

Source: Navigant Analysis of Builder Surveys

1. **Finding:** There is little room to improve market penetration among the existing network of participating builders. Navigant estimated the program’s PY7 market penetration, shown in Table 7‑8, based on US Census data for permits issued in the counties that make up PECO’s service territory. This estimate is likely to be conservative as not all permits result in completed homes during the program year.

Table ‑: Smart Builder Rebates PY7 Market Penetration

|  |  |  |  |
| --- | --- | --- | --- |
| County | 2015 Single-Family Permits | PY7 Units Rebated | Market Penetration |
| Philadelphia | 822 | 47 | 6% |
| Bucks | 905 | 15 | 2% |
| Chester | 814 | 29 | 4% |
| Delaware | 341 | 48 | 14% |
| Montgomery | 1,006 | 13 | 1% |
| TOTAL | **3,888** | **152** | **4%** |

Source: Navigant analysis of US Census Data

The program will need to increase outreach among the broader market of code-level builders. The CSP’s outreach among these builders in PY6 and PY7 found that incentive amounts offered for ENERGY STAR homes were not sufficient to overcome cost barriers to participation. The Phase III program design includes a new participation path (Code-Plus) targeted to these builders, with less stringent requirements and lower incremental costs. Recent outreach indicates that this new offering will motivate many of these code-level builders to participate in the program in PY8 and they may eventually be guided toward the ENERGY STAR participation level.

* 1. **Recommendation:** Conduct broader outreach among nonparticipating builders in Phase III using the Code-Plus participation option to recruit code-level builders.

1. **Finding:** Builders reported that finding and/or educating contractors was a key challenge with participating in the program. Builders also reported low satisfaction with training activities provided by the program.
   1. **Recommendation:** Program staff should provide builders support with recruiting and educating contractors in Phase III through program-sponsored training and outreach.

## Status of Recommendations for Program

Navigant’s recommendations for the SBR program, along with the PECO status for each recommendation, are listed in Table 7‑9.

Table ‑: Smart Builder Rebates Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1: Monitor rebate processing time on a monthly basis to ensure the CSP is meeting the incentive payment timing goals in Phase III. | **Implemented:** PECO is now monitoring rebate-processing time on a monthly basis to ensure the CSP is meeting the incentive payment timing goals. |
| Recommendation 2: Conduct broader outreach among nonparticipating builders in Phase III using the Code-Plus participation option to recruit code-level builders. | **Implemented:** PECO is conducting a broader outreach among nonparticipating builders. |
| Recommendation 3: Provide builders support with recruiting and educating contractors in Phase III through program-sponsored training and outreach. | **Being Considered:** Working with outside resources to develop and implement a plan to educate raters and builders alike to the benefits of building to energy-efficient standards, but also on how to effectively communicate it with customers/consumers. |

Sources: Navigant analysis

## Financial Reporting

As Table 7‑10 shows, the SBR program achieved a TRC ratio of 0.52 in PY7 and 0.40 for Phase II as a whole. The primary driver of this low TRC in PY7 was high program overhead, due in part to the higher outreach burden while gaining traction in a difficult market. Participant costs are also high relative to energy savings for gas-heated homes. In Phase III, gas benefits will be included in the TRC test, which should significantly improve the result.

Table ‑: Smart Builder Rebates Summary of Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| **Row #** | **Cost Category** | **Actual PY7 Costs** | **Actual Phase II Costs** |
| **($1,000)** | **($1,000)** |
| **1** | Incremental Measure Costs | 437 | 681 |
| **2** | EDC Incentives to Participants | 0 | 0 |
| **3** | EDC Incentives to Trade Allies | 100 | 158 |
| **4** | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 337 | 523 |
|  | | | |
| **5** | Program Overhead Costs | 404 | 1,054 |
| **6** | Design and Development | 0 | 0 |
| **7** | Administration, Management, and Technical Assistance**[1]** | 337 | 866 |
| **8** | Marketing[2] | 67 | 188 |
| **9** | EDC Evaluation Costs | 0 | 0 |
| **10** | SWE Audit Costs | 0 | 0 |
|  | | | |
| **11** | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| **12** | Total TRC Costs[5] | 840 | 1,736 |
| **13** | Total NPV Lifetime Energy Benefits | 356 | 574 |
| **14** | Total NPV Lifetime Capacity Benefits | 62 | 101 |
| **15** | Total NPV TRC Benefits[6] | 433 | 698 |
|  | | | |
| **16** | TRC Benefit-Cost Ratio | 0.52 | 0.40 |
| **Notes:**  Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 TRC Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Low-Income Energy Efficiency Program

PECO’s Low-Income Energy Efficiency Program (LEEP) serves income-eligible customers with a variety of initiatives and measures intended to reduce electricity costs. The LEEP program overcomes first-cost barriers to installing energy efficiency measures with free technical service and measure installation.

The LEEP program is delivered through four distinct components, each targeted to meet the different energy efficiency needs of individual households. While shell and HVAC measures may be provided through the program, most LEEP participants depend on natural gas as their heating fuel, limiting available measures for most customers to lighting, refrigerators, and water conservation devices. The target markets of individual LEEP Components overlap, as described in Table 8‑1 and in the text below. All component services are offered at no charge to eligible customers.

Table 8‑1: Low-Income Energy Efficiency Program Components

|  |  |  |
| --- | --- | --- |
| Component | Target Market[[43]](#footnote-44) | Measures |
| 1 | * Household income at or below 150% of the federal poverty level * Household usage exceeds 600 kWh per month for electric baseload (non-electric heat) customers * Household usage exceeds 500 kWh per month for Customer Assistance Program (CAP) rate customers * Household usage exceeds 1,400 kWh per month for electric heating customers | * Energy audits * Direct installation of efficient lighting, water conservation, and refrigerators * Electric heat customers eligible for thermal shell and HVAC measures, such as heat pumps |
| 2 | * Customers served by LIURP with household income at or below 150% of the federal poverty level, although the program accepts some customers with incomes ranging from 151% to 200% of the federal poverty level per PECO’s approved EE&C Plan. Only savings from participating households below 150% of federal poverty level are applied towards PECO’s low-income carve out. * Joint customers of both PECO and the Low-Income Energy Reduction Program (LIURP) | * LEEP supports installation of additional CFL bulbs, exceeding installation LIURP limits |
| 3 | * Household income at or below 150% of the federal poverty level | * CFL bulb distribution through PECO or other community-based program events |
| 4 | * Household income at or below 150% of the federal poverty level * Customers who may not be eligible for the comprehensive services of Components 1 or 2 | * Refrigerator replacement |

**Source: Navigant analysis**

Comprehensive home services are provided to customers through Components 1 and 2. While funded separately by PECO and LIURP, they are implemented consistently through CMC Energy Services (CMC), a CSP. CMC implements and markets the program throughout PECO’s service territory. CMC is responsible for hiring and training the energy advisors who performed the in-home energy audits, employing the customer service staff who responded to program inquiries and performed intake interviews, and installing DI and major measures. LEEP provides an onsite audit to identify efficiency opportunities, educate customers about their current energy use, and inform customers of ways they can reduce their energy use. The program offers all participants DI measures during their audit, including ENERGY STAR CFL bulbs, low-flow faucet aerators, and low-flow showerheads. Major measures identified for subsequent installation at no cost include refrigerator replacement, air sealing, attic insulation, wall insulation, ASHP duct sealing, and ASHP maintenance.

PECO partners with community organizations through Component 3 to distribute free CFL light bulbs directly to low-income households via community-focused events. Component 3 participants are limited to eight CFLs at no charge. Participants submit contact information and location of installation.

Component 4 replaces old, inefficient refrigerators with new ENERGY STAR models at no charge for customers who do not meet the requirements of the comprehensive Components 1 and 2. Removed refrigerators are recycled through an environmentally friendly alternative to reselling an old appliance or taking it to a landfill. CMC Energy Services implemented Component 4 for which PECO provides participants with a new ENERGY STAR-labeled appliance, at no charge.

## Program Updates

The following changes were made to the LEEP program in PY7:

* Insulation installation was expanded to floors during program year 7. A recommendation from the PY6 evaluation, CMC is insulating floors along with windows and walls, increasing household comfort and energy savings.
* Requirements for replacing refrigerators increased over the last year. In PY7, only refrigerators that are 20 years or older were replaced through LEEP. The impact of this change reduced eligible participants from 45% of PY6 customers to 15% of PY7 customers.

### Definition of Participant

For the purposes of achieving PECO’s 4.5% low-income savings requirement, only participants with income levels up to 150% of the Federal Poverty level as described in Table 8‑2 are reported as low-income. PECO defines a LEEP participant as a unique premise number, which may have multiple measures installed.

## Impact Evaluation Gross Savings

In Phase II, LEEP achieved verified energy savings of 54,607 MWh, verified demand savings of 6.2 MW, and served 737,371 PECO customers. A subset of households participating in LEEP had incomes ranging from 151-200% of the federal poverty level. These participants are reported in the Residential (Non-Low Income) sector, and do not contribute to PECO’s Residential (Low-Income) sector requirements. All other participants and savings for the program are from households earning incomes up to and including 150% of the federal poverty level, and have been attributed to the low-income sector, as shown in Table 8‑2.

Table ‑: Phase II Low-Income Energy Efficiency Program Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW)[2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW)[2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 755 | 215 | 0.0 | 215 | 0.0 | $0 |
| Residential (Low-Income) | 736,616 | 52,684 | 6.2 | 54,392 | 6.2 | $0 |
| Small C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Large C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| GNI | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| **PHASE II TOTAL** | **737,371** | **52,899** | **6.2** | **54,607** | **6.2** | **$0** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

Navigant conducted a TRM-based engineering review of the program tracking database, coupled with information gathered from telephone survey verifications, to calculate verified gross savings values. The evaluation team conducted the engineering review using the entire population of projects in the tracking database. The verification surveys were conducted on a sample of Component 1, 3, and 4 participants. Consistent with the evaluation plan, Component 2 participants were not surveyed, as they are primarily LIURP program customers.

For the PY7 evaluation, Navigant also conducted site visits for a non-statistical sample of 19 projects to validate phone survey results, actively engage with participants, identify potential additional measures, and observe the contractors’ interaction with the customers, the customers’ experiences, and whether the contractors performed their services in accordance with PECO’s plan.

Navigant accompanied the LEEP CSP on five Component 1 comprehensive home energy ride-along audits during which the team observed the audit process and recorded information about the project and the home. The five ride-along audits represented a qualitative sample, chosen by the CSP. The verification site visits were drawn from a subset of the Component 1 participant phone survey sample. Data collected included information about the overall condition of the home’s envelope, specifically the air sealing, windows, and doors.

In addition to observing the comprehensive audits, Navigant staff performed 14 separate Component 1 follow-up site visits to verify measure installation. One-half of these were in coordination with the CSP; the other seven were chosen from a sample of phone survey participants. The onsite visits validated the phone survey responses and verified the measure installations that were recorded by the CSP. Navigant visually inspected the measures that were installed and compared the findings to customer survey responses and CSP records. While onsite, Navigant also verified the quality of site visits that were performed and customers’ satisfaction with the program, representatives, and measures.

Table 8‑3 presents the sampling strategy for the verification surveys, audit observations, and follow-up site visits.

Table ‑: Low-Income Energy Efficiency Program Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| All | 222,711 | 85/15 | All | All | Tracking data |
| Component 1 | 222,711 | N/A | 5 | 5 | Ride-along audits |
| Component 1 | 222,711 | N/A | 16 | 14 | Verification site visits |
| **PROGRAM TOTAL** | **0** | **0** | **0.00** | **0** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Results

In PY7, LEEP achieved verified energy savings of 18,304 MWh and verified demand savings of 2.4 MW. The evaluation team reduced LEEP’s reported gross energy savings by 8%, principally due to an adjustment to the refrigerator savings calculation methodology. The savings adjustments for Components 1 and 4 are both due to this issue, which is discussed further later in this section.

As seen in Table 8‑4, which shows reported and verified savings by component, Component 3 continues to be the largest source of LEEP’s savings. CFL savings, largely driven by Component 3, contribute 76% of the program total savings.

Table ‑: PY7 Low-Income Energy Efficiency Program Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Energy Savings (MWh/yr)** | **Energy Realization Rate (%)** | **Verified Gross Energy Savings (MWh/yr)** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Component 1 | 7,435 | 0.86 | 6,419 | N/A | 0% |
| Component 2 | 943 | 1.00 | 944 | N/A | 0% |
| Component 3 | 10,151 | 1.00 | 10,152 | N/A | 0% |
| Component 4 | 1,272 | 0.62 | 790 | N/A | 0% |
| **PROGRAM TOTAL** | **19,801** | **0.92** | **18,304** | **N/A** | **0%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Consistent with the energy-saving s results, LEEP reported demand savings were also reduced by 8%, due to the same refrigerator savings calculation methodology adjustment mentioned earlier and discussed later in this section. The Components 1 and 4 demand adjustments are both due to this issue. Table 8‑5 shows reported and verified savings by component.

Table ‑: PY7 Low-Income Energy Efficiency Program Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW)[1]** | **Demand Realization Rate (%)** | **Verified Gross Demand Savings (MW)[1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Component 1 | 1.0 | 0.86 | 0.9 | N/A | 0% |
| Component 2 | 0.1 | 1.00 | 0.1 | N/A | 0% |
| Component 3 | 1.3 | 1.00 | 1.3 | N/A | 0% |
| Component 4 | 0.2 | 0.59 | 0.1 | N/A | 0% |
| **PROGRAM TOTAL** | **2.6** | **0.92** | **2.4** | **N/A** | **0%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

In nearly all cases, the onsite activities verified that equipment was installed and in operation. One site visit revealed that the CSP did not accurately record CFL installations. Other than this one instance of underreporting, the CSP records matched the onsite findings for product installation. Table 8‑6 summarizes these onsite verification discrepancies.

Table ‑: PY7 Low-Income Energy Efficiency Program Onsite Inspections Summary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measure | Inspection Firm | Number of Inspections Planned | Number of Inspections Conducted | Number of Sites with Discrepancies from Reports | Resolution of Discrepancies |
| CFL Bulb Installations | Navigant | 19 | 19 | 1 | CMC undercounted in one home |
| Showerhead Installations | Navigant | 19 | 19 | 0 | N/A |
| Aerator Installations | Navigant | 19 | 19 | 0 | N/A |
| Refrigerator Installations | Navigant | 19 | 19 | 0 | N/A |

Source: Navigant analysis

The telephone surveys did not match the onsite findings for three of the visits. In these cases, participants underreported installed measures through the phone survey; Navigant confirmed measures were installed per CSP records. Verified results were not adjusted due to these findings because the difference between phone survey and onsite verification was less than 10%, per the PY7 LEEP site visit plan.

As noted earlier, the evaluation team reduced verified program savings by 8% compared to reported savings due to an issue with refrigerator calculations. Reported savings from refrigerators were overestimated by PECO due to a 2015 TRM algorithm change that did not incorporate the replacement refrigerator energy use. Figure 8‑1 illustrates the deemed savings of the erroneous TRM algorithm used for program reporting, compared to the updated PY7 IMP algorithm Navigant used to verify savings. Because refrigerators were a significant driver of the PY7 LEEP energy and demand saving, refrigerator replacements contributed 28% of Component 1 savings and 100% of Component 4 savings. This adjustment resulted in an 8% reduction to total program savings.

Figure ‑: Refrigerator Measure kWh Savings

Source: Navigant analysis of PECO tracking data

The measure level realization rate is less than 0.6 for both energy and demand. The overall effect on the program realization rate was mitigated by the strong realization rate for CFL bulbs, which contribute over 76% of total verified LEEP savings.

## Impact Evaluation Net Savings

Historically, the evaluation team has assumed a NTG ratio of 1.0 for LEEP, reflective of participants’ limited ability to purchase energy efficiency measures. In the PY7 evaluation, Navigant included a battery of NTG questions in the participant survey for the first time to explore free ridership and spillover. The following sections discuss the methodology used for this research, and the analysis results.

### Net Verified Savings Methodology

The evaluation team conducted a phone survey of program participants in Components 1, 3, and 4. Consistent with the evaluation plan, Component 2 participants were not surveyed, as they are primarily LIURP program customers. Table 8‑7 illustrates the PY7 NTG research sampling strategy.

Table ‑: Low-Income Energy Efficiency Program Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Stratum Boundaries** | **Population Size** | **Assumed CV or Proportion in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame[1] Contacted to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\3CA41BA.xlsx#RANGE!_ftn1) |
| Component 1 | N/A | 10,012 | 0.50 | 85/15 | 35 | 35 | 88% |
| Component 2 | N/A | 4,060 | 0.50 | 85/15 | 20 | 20 | 88% |
| Component 4 | N/A | 1,439 | 0.50 | 85/15 | 35 | 35 | 72% |
| **PROGRAM TOTAL** | **N/A** | **15,511** | **N/A** | **85/15** | **90** | **90** | **86%** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The evaluation team structured the free ridership section of the LEEP phone interviews to be consistent with other PECO program evaluations, as this was the first time NTG has been assessed for LEEP research. Participants were asked a series of questions to target how many of the program measures they would have installed in the absence of the program and to rate the influence of key program elements on a scale of 1 to 5, where 1 meant that the program was “Not at all influential” and 5 meant that the program was “Extremely influential” on their decision to install the program measures.

Using this approach, free ridership can take on values ranging from 0.0 to 1.0 for each respondent and for the program overall. Customers received a score of 0.0 when they said that they would not have installed any of the same measures in the absence of the program and rated at least one of the program elements with a score of 5 (“extremely influential”) for having affected their decision to install the program measures. Conversely, the evaluation team assigned respondents a score of 1.0 when they said that they would have installed all of the same measures in the absence of the program and said that no aspect of the program influenced their decision to install the program measures (the respondent gave all program elements a score of 1). Customers who received a free ridership score between 0.0 and 1.0 said that they would have installed at least some of the same measures in the absence of the program and/or reported that at least one program element had some influence on their decision to install the program measures (program influence scores of 2 or more).

The phone interviews also included a spillover section in which the evaluation team asked customers if they installed additional energy efficiency measures that had not been available through the LEEP program, and if they had, what kind of measures were installed. Customers were then asked to measure the program’s influence on their decision to install the spillover measures on a 0 to 5 scale, where 0 meant that the program was “Not at all influential” and 5 meant that the program was “Extremely influential.”

### Net Verified Savings Results

The PY7 LEEP NTG research resulted an overall program free ridership estimate of 0.19. Most free ridership was related to the CFL measures; non-CFL measure free ridership was negligible (less than 0.03).

NTG-related findings included:

* The free nature of LIURP measures influenced decisions to install products.
* LEEP educational materials were influential in participant actions.
* Most (79%) of participants would not have installed the measures without the support of the program.

The NTG research also confirmed the existence of some spillover savings, predominantly behavioral changes. During the participant survey, program participants were asked if they had taken additional energy-saving actions after participating in LEEP. Slightly more than one-quarter (29%) of participants said that they had taken additional actions, which included unplugging appliances, turning off lights not in use, and reducing the use of air conditioning. Almost all of the reported actions were either no-cost behaviors or low-cost measure purchases. Figure 8‑2 presents the additional actions taken by the LEEP participants.

Figure ‑: Additional Actions Taken by LEEP Component 1 Participants (n=26)

Source: Navigant analysis of phone survey results

Because the savings from these participant-reported behaviors could not be quantified as part of this research, they were not included in the NTG results. Therefore, Navigant estimated participant spillover as zero.

The evaluation team calculated and applied NTG ratios at the measure level, and summarize the estimates and resulting NTG ratios by Component level in Table 8‑8.

Table ‑: PY7 Low-Income Energy Efficiency Program Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | **Estimated Free Ridership** | **Estimated Participant Spillover** | **NTG Ratio** | **Observed CV or Proportion** | **Relative Precision** |
|
| All | 0.19 | 0.00 | 0.81 | 0.20 | 7% |
| **PROGRAM TOTAL** | **0.19** | **0.00** | **0.81** | **0.20** | **7%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Impact Evaluation Findings and Recommendations

1. **Finding:** Overestimated refrigerator savings due to an erroneous TRM measure characterization significantly affected the LEEP realization rate.
   1. **Recommendation:** Collect existing refrigerator data from participants and use the PY8 IMP to estimate ex ante refrigerator savings.
2. **Finding:** The first-year In Service Rate (ISR) for Component 3 CFLs increased to 57% in PY7 from 47% in PY6. Incandescent bulbs are becoming less prevalent in LEEP participant homes.
   1. **Recommendation:** To increase penetration in individual customer homes, Navigant recommends that PECO replace inefficient light bulbs with LEDs instead of CFLs, particularly for specialty locations. Target distribution of free bulbs to households with incandescent bulbs.
3. **Finding**: CMC is accurately recording which measures it installs during home audits; customers are satisfied with the program. Navigant staff observed CMC auditors and found that they are installing all measures that fit PECO requirements and recording them correctly (with the exception of one unreported measure installation). CMC auditors are compensated on a measure-by-measure basis and are therefore incentivized the install and record as many measures as possible. Navigant’s evaluation found that CMC is not overstating the measures that are installed.

## Process Evaluation

The PY7 process evaluation included participant and program staff interviews, site visits, and a review of program materials. The following two sections provide details on the specific methodology and findings.

### Process Evaluation Methodology

Navigant’s process evaluation of LEEP included the following methods:

* Interviews with PECO and CSP program managers
* Site visits of 19 Component 1 participant homes, including a mix of audits and education and QA visits
* Phone survey of 90 program participants in Components 1, 3, and 4
* Review of program materials

The evaluation team conducted a participant survey for both verification (impact) and process purposes. The verification segments of the survey focused on whether the measures reported for each component were actually installed (Components 1 and 4) or were received (Component 3); this method is discussed further in Section 8.2.1. Participants were asked about several process topics as well, including satisfaction with the various program components, measures installed, program representatives, time to complete measures, etc. Table 8‑9 illustrates the sampling strategy for the surveys. Component 2 participants were not surveyed as they are primarily LIURP program customers, implementation tactics are very similar to LEEP Component 1 and both components use the same CSP.

Table ‑: Low-Income Energy Efficiency Program Sampling Strategy for Program Year 7

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Stratum Boundaries** | **Population Size** | **Assumed Proportion or CV in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame Contacted[1] to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\3CA41BA.xlsx#RANGE!_ftn1) | **Used for Evaluation Activities (Impact, Process, NTG)** |
| Component 1 | N/A | 10,012 | 0.5 | 85/15 | 35 | 35 | 88% | Process evaluation |
| Component 2 | N/A | 4,060 | 0.5 | 85/15 | 20 | 20 | 88% | Process evaluation |
| Component 4 | N/A | 1,439 | 0.5 | 85/15 | 35 | 35 | 72% | Process evaluation |
| CSP Interview | N/A | 1 | N/A | N/A | 1 | 1 | 100% | Process evaluation |
| Program Manager Interview | N/A | 1 | N/A | N/A | 1 | 1 | 100% | Process evaluation |
| **PROGRAM TOTAL** | **N/A** | **15,511** | **N/A** | **N/A** | **92** | **92** | **N/A** | **N/A** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The evaluation team also conducted a comprehensive review of LEEP educational materials as part of the process evaluation. The review consisted of 17 pages of flyers, a 32-page “Energy-Saving Tips” booklet, a PECO “Energy-Saving Tips” calendar, and an energy cost calculator.

### Process Findings and Recommendations

The process evaluation yielded several findings and potential program improvements. Below are specific recommendations and the associated process evaluation findings on which the recommendations are based.

1. **Finding:** As noted earlier, the evaluation team reduced verified program savings by 8% compared to reported savings due to an issue with refrigerator calculations.
   1. **Recommendation:** Collect existing refrigerator data from participants and use the PY8 IMP to estimate ex ante refrigerator savings.
2. **Finding:** The participant survey revealed that LEEP participants continue to be very satisfied with the program, both overall and with the individual components. Notably, 89% of participants stated that they were “extremely satisfied” with the program overall. Figure 8‑3 presents satisfaction results for the LEEP program overall and the various program components.

Figure ‑: Low-Income Energy Efficiency Program Participant Satisfaction (n=55)

Source: Navigant analysis of phone survey results

A small number of customers expressed dissatisfaction with the program. These limited instances of dissatisfaction were primarily due to customer misunderstandings of schedules and project next steps.

* 1. **Recommendation:** Ensure schedule expectations are clear and applied consistently across customers; consider follow-up with customers to encourage further action.

1. **Finding:** Historical participant surveys revealed that the first-year CFL ISR for Component 3 participants fell in PY6, compared to PY4 and PY5. The PY7 survey indicates ISRs increased slightly (Figure 8‑4). Consistent with participant responses from previous years, uninstalled bulbs were reported to be kept in storage and/or the participants were waiting for other bulbs to burn out before installing the program bulbs. This finding does not affect the program savings, due to a deemed 3-year ISR. The research also found that 57% of participants no longer have incandescent in their homes and that 60% of replaced bulbs were incandescent (Figure 8‑5 and Figure 8‑6). Taken together, these findings indicate that CFL socket saturation is increasing within the low-income community.
   1. **Recommendation:** Shift to LED light bulbs only, particularly for specialty bulb locations such as chandeliers, bathroom vanities, etc., to further increase penetration of efficient lighting products. Target distribution of free (Component 3) light bulbs to households with incandescent light bulbs.

Figure ‑: Low-Income Energy Efficiency Program Component 3 First-Year CFL In-Service-Rate

Source: Navigant analysis of phone survey results

Figure ‑: Low-Income Energy Efficiency Program Do You Currently Have Any Incandescent Light Bulbs Installed in Your Home? (n=14)

Source: Navigant analysis of phone survey results

Figure ‑: Low-Income Energy Efficiency Program: What Types of Bulbs Did You Replace When You Installed the Program Bulbs? (n=30)

Source: Navigant analysis of phone survey results

1. **Finding:** Overall, while participants who recalled the educational materials rated them as useful, the evaluation team found that the materials do not provide customers with prioritized next steps or a clear call to action. In addition, a majority of Component 3 survey respondents reported that they did not receive, or could not remember receiving, the materials. These same respondents were unaware of the LIURP program.
   1. **Recommendation:** PECO should consider developing targeted program materials that prioritize next steps for customers and guide customers to the most appropriate program component for services. Updated materials should be used to raise awareness of other program opportunities to reduce their energy consumption, particularly Component 3 participants.
2. **Finding:** LEEP comprehensive program (Components 1 and 2) outreach is targeted to PECO customers on the CAP rate tariff and eligible customers identified through customer service conversations. While LEEP is reaching some customers with critical needs (31% are on a payment plan for past due electric bills; 8% have had their electricity shut off in the last year), defining customers through the CAP rate tariff alone has the potential to miss eligible customers.
   1. **Recommendation:** Acquire and apply data on low-income household characteristics; tailor future program implementation strategies to identify and meet the needs of eligible customers.
3. **Finding**: Program educational materials are voluminous, dated and do not provide prioritized next steps. Component 3 participants are not consistently receiving educational materials, and those that do are not aware of PECO’s other programs to support low-income customers.
   1. **Recommendation:** Develop targeted program materials that prioritize next steps and direct customers to the most appropriate program component***.***
4. **Finding:** The majority of LEEP customers (55%) are served through Component 3 (free CFL giveaways); 76% of total LEEP program savings is through the distribution and installation of CFLs. Most LEEP participants are not benefiting from comprehensive savings.
   1. **Recommendation:** Increase number of customers benefiting from comprehensive program measures.
5. **Finding**: Program outreach activities are targeted at PECO customers participating in the CAP rate tariff; LEEP is not aware of potential customers outside of the CAP rate tariff. Researching and characterizing PECO’s nonparticipating low-income households will enable PECO to reach out and serve all eligible customers.
   1. **Recommendation:** Acquire and apply data on low-income household characteristics; tailor future program outreach and implementation strategies to overcome participant barriers and meet the needs of identified eligible customers.

## Status of Recommendations for Program

Table 8‑10 summarizes Navigant’s recommendations and their current status.

Table ‑: Low-Income Energy Efficiency Program Status Report on Process and Impact Recommendations

| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected, AND Explanation of Action Taken by EDC) |
| --- | --- |
| Recommendation 1: Collect existing refrigerator data from participants and use the PY8 IMP to estimate ex ante refrigerator savings. | **Implemented:** PECO’s CSP is collecting existing refrigerator data and using the PY8 IMP to estimate ex ante refrigerator savings. |
| Recommendation 2: Ensure schedule expectations are clear and applied consistently across customers; consider follow-up with customers to encourage further action. | **Implemented:** PECO is working with the CSP to ensure schedule expectations are clear and encouraging further actions by following up with customers. |
| Recommendation 3: Shift to LEDs only; target distribution of free bulbs to households with incandescent bulbs. | **Being Considered** |
| Recommendation 4: Develop targeted program materials that prioritize next steps and guide customers to the most appropriate program component. | **Implemented:** PECO is working with a Marketing firm to enhance current program materials, which would include next steps and guide customers to other programs. |
| Recommendation 5: Increase number of customers benefiting from comprehensive program measures. | **Being Considered** |
| Recommendation 6: Acquire and apply data on low-income household characteristics; tailor future program implementation strategies to meet the needs of eligible customers. | **Being Considered** |

Source: Navigant analysis

## Financial Reporting

In PY5, the program was above its TRC goal; it was below the TRC goal in PY6. In PY7, the program achieved a TRC of 1.54, which brought the Phase II TRC to 1.55. LEEP’s Phase II TRC goal was 1.51, laid out in the March 2014 revision of the Phase II plan. A breakdown of the program finances is presented in Table 8‑11.

Table ‑: Summary of Low-Income Energy Efficiency Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| Row # | Cost Category | Actual PYTD  Costs | Actual Phase II  Costs |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 0 | 0 |
| 2 | EDC Incentives to Participants | 0 | 0 |
| 3 | EDC Incentives to Trade Allies | 0 | 0 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 0 | 0 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10) | 8,088 | 23,453 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance**[1]** | 7,559 | 22,614 |
| 8 | Marketing**[2]** | 529 | 839 |
| 9 | EDC Evaluation Costs | 0 | 0 |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| 12 | Total TRC Costs[3] (Sum of Rows 1, 5, and 11) | 8,088 | 23,453 |
| 13 | Total NPV Lifetime Energy Benefits | 10,892 | 32,009 |
| 14 | Total NPV Lifetime Capacity Benefits | 735 | 1,961 |
| 15 | Total NPV TRC Benefits[4] | 12,435 | 36,409 |
|  | | | |
| 16 | TRC Benefit-Cost Ratio[5] | 1.54 | 1.55 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance. [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction.  Note: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart AC Saver: Residential

In the Smart AC Saver program, PECO remotely cycles or shuts down a customer’s CAC unit during times of peak demand. In return, participants receive financial incentives for allowing PECO to control their equipment. Conservation events are called during time periods that coincide with the highest peak demand.

A digital control unit (DCU) is installed on participating residential customer CAC units. Nearly all of these installations were completed in Phase I by the CSP. When activated by a control signal, the switches will not allow the equipment to operate for some predetermined portion of each hour. During a conservation event, the compressor is cycled off and on while the fan continues to operate. This allows cool air to be circulated throughout the home while the compressor is disabled. The operation of the DCU is controlled through a digital paging network. CAC units are controlled for the 4 months during the summer (i.e., June through September).

PECO hired Comverge as its CSP to implement the AC Saver program, including calling events, program marketing, call center, and equipment maintenance. PECO also hired two energy management companies, EnergyConnect and CPower, to enroll the demand response (DR) load with PJM.

Participation in the Smart AC Saver program varies month to month based on participants dropping from the program for a variety of reasons, including customer moves, requests from customers to drop from the program, etc. During PY7, PECO maintained a list of customers seeking to join the program and, when possible, backfilled with new customers as participants left the program. As of the end of PY7, PECO had 76,145 active DCUs representing 65,274 participating homes.

## Program Updates

PECO designed the Phase II Smart AC Saver program to call conservation events for fewer hours than in Phase I. In PY7, PECO called two test events that totaled approximately 3 hours. In PY7, PECO sold its residential AC Saver load to its energy management companies, CPower and EnergyConnect, to offset program costs. The Smart AC Saver program experienced a small drop in participation in PY7, amounting to approximately 5.5%.

### Definition of Participant

PECO defines participation for the Smart AC Saver program as a single address. One participant may have one or more DCUs installed at that address.

## Impact Evaluation Gross Savings

Because there are no peak demand reduction targets for the Phase II EE&C programs, Navigant relied on the PJM registrations to provide the reported gross savings value for PY7 of 49.6 MW. Navigant utilized the per-switch savings established in the load study conducted by Comverge in PY5 and weather-adjusted the results for the PY7 test event days to verify the PY7 savings. This resulted in verified gross savings of 40.5 MW in PY7. The average program participation was 69,077 people. Each participant was paid $20 per central air conditioner per month for the 4 summer months each year. Some households have more than one air conditioner, though the majority has only one. Table 9‑1 shows the total residential Smart AC Saver results reported for Phase II. The incentives paid are a sum of all incentives over the three program years, while the remaining results are calculated using an average across the 3 years.

Table ‑: Phase II Residential Smart AC Saver Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW)[2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW)[2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 69,077 | 0 | 58.6 | 0 | 55.5 | $20,153 |
| Residential (Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Small C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Large C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| GNI | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| **PHASE II TOTAL** | **69,077** | **0** | **58.6** | **0** | **55.5** | **20,153** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

PECO’s energy management companies registered 49.6 MW into the PJM Emergency DR program in PY7. Navigant used this value as the reported gross savings value. To calculate the verified gross savings value, the Navigant team utilized the per-switch savings established in the load study conducted by Comverge in PY5, weather adjusting the results for the PY7 test event days.

Navigant updated the Comverge load study report utilized in PY5 for the purposes of estimating verified savings in PY7. As part of the load study, Comverge utilized readings from a total of 94 M&V systems installed in participating PECO homes. As stated in the Comverge load study report, the M&V systems combine OEM hardware and a proprietary curtailment algorithm along with a Comverge DCU to provide energy demand data for analysis of energy curtailment events. Comverge used these readings in a regression analysis to develop the parameters that best fit the observed data using metered load as the dependent variable and observed temperature and hour of the day as the independent variables.

For the PY7 evaluation, Navigant used this same regression equation to estimate the verified savings during the PY7 program year. To calculate the results specific to PY7 using the regression developed in PY5, Navigant utilized actual weather observed during the two PY7 test event days as read at the KPHL weather station at Philadelphia International Airport. The regression was also updated to account for the actual number of participants that were enrolled in the program during the summer of PY7 and the rate of operability, as determined by the 2013 switch operability study.[[44]](#footnote-45) This rate was calculated to be 100%. The verified savings estimate determined for PY7 is a weighted average of these two test events, based on the number of switches that were called for each event.

EnergyConnect called three-quarters of the residential DCUs on its test event on June 25, 2015, and CPower called the remaining quarter of DCUs on its test event on August 12, 2015.

Navigant utilized the Comverge PY5 sample as the sample for PY7 analysis. The sample included 94 randomly selected homes in which M&V meters were installed. This sample was determined to meet the 85/15 confidence and precision level. Table 9‑2 shows the sampling strategy applied to the verified gross analysis for Smart AC Saver in PY7.

Table ‑: Residential AC Saver Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| All | 65,274 | 85/15 | 100 | 94 | PY5 load study applied to PY7 events |
| **PROGRAM TOTAL** | **65,274** | **85/15** | **100** | **94** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Navigant conducted no site visits for the Smart AC Saver program in PY7, as per the approved evaluation plan.

### Gross Verified Savings Results

Smart AC Saver is a demand-only program, and it claimed no energy savings in PY7. The program claimed 49.6 MW in reported savings and 40.5 MW of verified gross savings. Table 9‑3 shows the demand savings claimed in PY7.

Table ‑: PY7 Residential AC Saver Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Reduction (MW/yr)** | **Realization Rate (%)** | **Verified Gross Demand Reduction (MW/yr)** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Residential Participants | 49.6 | 0.82 | 40.5 | N/A | 100% |
| **PROGRAM TOTAL** | **49.6** | **0.82** | **40.5** | **N/A** | **100%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis Impact Evaluation Net Savings

Navigant did not conduct research to determine NTG for this program, as per the approved evaluation plan. Navigant assumes that none of the program participants would have curtailed load at the times PECO dispatched the program without the incentives that the CSPs paid to them for their load curtailment; thus, the free ridership value is zero.

## Process Evaluation

For the PY7 process evaluation, Navigant employed the following methods:

* Participant phone survey
* In-depth interview with PECO program manager
* Review of Smart AC Saver program marketing materials
* Review of the program tracking database and program finances

In its petition of the Pennsylvania PUC to continue the mass-market Direct Load Control (DLC) program (i.e., the Smart AC Saver program) in Phase II, PECO stated the program was designed to preserve the residential DLC measure as a DR resource and to retain existing participants. Furthermore, PECO wanted to maintain the population of active load control devices by replacing customers that exited the Smart AC Saver program during the course of Phase II.

### Process Evaluation Methodology

The Navigant team conducted a phone survey of residential participants to study program satisfaction and understand other aspects of the program participant experience. The team also conducted one in-depth interview with PECO program staff to understand the dates and durations of conservation events as well as PECO’s efforts to recruit new customers and utilize its back stock of hardware for these new installations. Furthermore, the team sought to understand the plan for the Smart AC Saver program in PY7, as well as potential design modifications to the program in Phase III of Act 129.

Table 9‑4 demonstrates the sampling strategies used by Navigant in the process evaluation activities. The sample size of 70 was selected in order to achieve 90% confidence and 10% relative precision (with an assumed CV of 0.5) for the quantitative results of the survey.

Table ‑: Residential AC Saver Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Assumed Proportion or CV in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame Contacted[1] to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\D7D4E509.xlsx#RANGE!_ftn1) | **Used for Evaluation Activities (Impact, Process, NTG)** |
| Residential Participants | 65,274 | 0.5 | 90/10 | 70 | 70 | 1% | Process |
| **PROGRAM TOTAL** | **65,274** | **0.5** | **90/10** | **70** | **70** | **1%** | **Process** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Findings and Recommendations

Through the program manager interviews, tracking system review, and participant interviews, Navigant identified several process findings relating to data availability, program satisfaction, participant perspectives on incentive levels and number of conservation events, and program channeling effects.

1. **Finding:** Phase III will require an enhanced level of impact analysis and verification. To date, insufficient advanced metering infrastructure (AMI) data has been provided to Navigant for the level of analysis needed in PY8 and beyond.
   1. **Recommendation:** PECO should ensure the program database contains necessary data to allow Navigant to calculate verified savings via comparison group analysis in Phase III.
   2. **Recommendation:** PECO should be prepared to quickly and securely transfer program database information to Navigant for verified savings analysis in Phase III.
2. **Finding:** Over 90% of participants report high satisfaction with the AC Saver program (rating of 4 or 5 on a scale of 1-5). This high satisfaction may be related to the relatively high incentive levels and low frequency of conservation events in PY7. As the program shifts in PY8, satisfaction could decrease due to an increase in length and frequency of events and a decrease in incentives.
   1. **Recommendation:** PECO should prepare for a possible drop in program satisfaction.
3. **Finding:** Participants do not know when conservation events are called. When asked how many events they experienced in PY7, the majority of respondents reported “don’t know” or “0.” However, one-third of participants reported a number of events they believed to have occurred, ranging from 1 to 11, when in fact PECO had only called 1 event. This finding indicates that participants are not aware of events that take place and are not checking the website for notification on conservation events.
   1. **Recommendation:** Consider running a pilot to test satisfaction impacts of notifying customers after conservation events.
4. **Finding:** Participants say they are motivated by incentive levels, with over one-third of participants reporting that they would no longer participate in the program if the incentive were cut by half. However, participants have not dropped out to date. A similar pattern was observed between PY4 and PY5, at the transition between Phase I and Phase II. Not surprisingly, participants reported an unwillingness to accept a lower incentive than they were already receiving. However, when the incentive did drop from $120 per summer to $80 per summer, very few participants did drop out of the program. These data indicate that participants are less likely to actively remove themselves from the program than they report in surveys, and PECO should not expect a significant decrease in program participants.
   1. **Recommendation:** If PECO is concerned that program participation is too high, consider paying low-performing customers to not participate in the program.
5. **Finding:** The AC Saver program appears to have channeling effects. 27% of survey respondents reported having participated in another PECO energy efficiency program due to their participation in the AC Saver program. Of those individuals, nearly half reported participating in two or more other energy efficiency program.
   1. **Recommendation:** Evaluate energy efficiency program participation rates within AC Saver as compared to general population.

## Status of Recommendations for Program

Based on the findings outlined in Section 9.3.2, Navigant makes several recommendations to PECO. These recommendations can be found in Table 9‑5.

Table ‑: Residential AC Saver Status Report on Process and Impact Recommendations

| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected, AND Explanation of Action Taken by EDC) |
| --- | --- |
| Recommendation 1:   * 1. PECO should ensure the program database contains necessary data to allow Navigant to calculate verified savings via comparison group analysis in Phase III.   2. PECO should be prepared to quickly and securely transfer program database information to Navigant for verified savings analysis in Phase III. | 1. **Implemented:** Interval data will be available; will have to collaborate with Navigant to define the format. 2. **Being Considered:** PECO will work with Navigant to extract AMI data as soon as it is available, which is at the earliest around 4 weeks after the event takes place. |
| Recommendation 2: Prepare for a possible drop in satisfaction. | **Implemented** |
| Recommendation 3: Consider notifying customers after events. | **Being Considered** |
| Recommendation 4: Consider running a pilot to test satisfaction impacts of notifying customers after conservation events. | **Rejected:** PECO will find a way to work around maintaining customer satisfaction. |
| Recommendation 5: Evaluate energy efficiency program participation rates within AC Saver as compared to general population. | **Being Considered:** PECO needs to assess how the AC program can leverage its participant interest to extend beyond DR. |

Source: Navigant analysis

## Financial Reporting

Program expenditures for the residential Smart AC Saver program in PY7 totaled approximately $6.6 million. Navigant calculated the TRC benefit-cost ratio of the residential Smart AC Saver program at 2.72. In PY7, the TRC benefits for the program were negatively affected by the relatively low temperatures that occurred on the PY7 test event days, leading to lower savings than those observed on the test events in PY5. The TRC benefits also include program cost offsets in the form of PJM payments. These payments increase the TRC value, as they are directly subtracted from program costs. Table 9‑6 shows a summary of the PY7 program finances.

Table ‑: Summary of Residential AC Saver Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| **Row #** | **Cost Category** | **Actual PY7 Costs** | **Actual Phase II Costs** |
| **($1,000)** | **($1,000)** |
| **1** | Incremental Measure Costs | 0 | 0 |
| **2** | EDC Incentives to Participants | 0 | 0 |
| **3** | EDC Incentives to Trade Allies | 0 | 0 |
| **4** | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 0 | 0 |
|  | | | |
| **5** | Program Overhead Costs | 6,754 | 20,598 |
| **6** | Design & Development | 0 | 0 |
| **7** | Administration, Management, and Technical Assistance**[1]** | 348 | 401 |
| **8** | Marketing[2] | 6,406 | 20,197 |
| **9** | EDC Evaluation Costs | 0 | 0 |
| **10** | SWE Audit Costs | 0 | 0 |
|  | | | |
| **11** | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| **12** | Total TRC Costs[5] | 6,754 | 20,598 |
| **13** | Total NPV Lifetime Energy Benefits | 15,673 | 46,015 |
| **14** | Total NPV Lifetime Capacity Benefits | 2,714 | 11,301 |
| **15** | Total NPV TRC Benefits[6] | 18,387 | 57,316 |
|  | | | |
| **16** | TRC Benefit-Cost Ratio | 2.72 | 2.78 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction.  Note: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart AC Saver: Commercial

In the Smart AC Saver program, PECO remotely cycles or shuts down a customer’s CAC unit during times of peak demand. In return, participants receive financial incentives for allowing PECO to control their equipment. Conservation events are called during time periods that coincide with the highest peak demand.

A thermostat is installed to control a participating commercial customer CAC units. Nearly all of these installations were completed in Phase I by the CSP. When activated by a control signal, the thermostat will not allow the equipment to operate for some predetermined portion of each hour. During a conservation event, the compressor is cycled off and on while the fan continues to operate. This allows cool air to be circulated throughout the building while the compressor is disabled. The operation of the thermostat is controlled through a digital paging network. CAC units are controlled for the 4 months during the summer (i.e., June through September).

PECO hired Comverge as its CSP to implement the AC Saver program, including calling events, program marketing, call center, and equipment maintenance. PECO also hired two energy management companies, EnergyConnect and CPower, to enroll the DR load with PJM.

Participation in the Smart AC Saver program varies month to month based on participants dropping from the program for a variety of reasons, including customer moves, requests from customers to drop from the program, etc. During PY7, PECO maintained a list of customers seeking to join the program and when possible, backfilled with new customers as participants left the program. As of the end of PY7, PECO had 3,063 active thermostats representing 1,686 participating businesses.

## Program Updates

PECO designed the Phase II Smart AC Saver program to call conservation events for fewer hours than in Phase I. In PY7, PECO called two test events that totaled approximately 3 hours. In PY7, PECO sold its residential AC Saver load to its energy management companies, CPower and EnergyConnect, to offset program costs.

### Definition of Participant

PECO defines participation for the Smart AC Saver program as a single address. One participant may have one or more control thermostats installed at that address.

## Impact Evaluation Gross Savings

Because there are no peak demand reduction targets for the Phase II EE&C programs, Navigant relied upon on the PJM registrations to provide the reported gross savings value for PY7 of 3.0 MW. Navigant utilized the per-switch savings established in the load study conducted by Comverge in PY5 and weather-adjusted the results for the PY7 test event days to verify the PY7 savings. The average program participation was 1,834 people. Each participant was paid $20 per central air conditioner per month for the 4 summer months each year. Some participants have more than one air conditioner, though the majority have only one. Table 10‑1 shows the total commercial Smart AC Saver results reported for Phase II. The incentives paid are a sum of all incentives over the three program years, while the remaining results are calculated using an average across the 3 years.

Table ‑: Phase II Commercial Smart AC Saver Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW)[2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW)[2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Residential (Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Small C&I | 1,834 | 0 | 2.3 | 0 | 1.5 | $876 |
| Large C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| GNI | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| **PHASE II TOTAL** | **1,834** | **0** | **2.3** | **0** | **1.5** | **$876** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

PECO’s energy management companies registered 3.0 MW into the PJM Emergency DR program in PY7. Navigant used this value as the reported gross savings value. To calculate the verified gross savings value, the Navigant team utilized the per-thermostat savings established in the load study conducted by Comverge in PY5 and weather-adjusted the results for the PY7 test event days.

Navigant updated the Comverge load study report utilized in PY5 for the purposes of estimating verified savings in PY7. As part of the load study, Comverge utilized readings from 91 M&V systems installed in participating PECO businesses. As stated in the Comverge load study report, the M&V systems combine OEM hardware and a proprietary curtailment algorithm, along with a Comverge DCU to provide energy demand data for analysis of energy curtailment events. These readings were then used in a regression analysis to develop the parameters that best fit the observed data using metered load as the dependent variable and observed temperature and hour of the day as the independent variables.

For the PY7 evaluation, Navigant used this same regression equation to estimate the verified savings during the PY7 program year. To calculate the results specific to PY7 using the regression developed in PY5, Navigant utilized actual weather observed during the two PY7 test event days as read at the KPHL weather station at Philadelphia International Airport. The regression was also updated to account for the actual number of participants that were enrolled in the program during the summer of PY7 and the rate of operability, as determined by the 2013 switch operability study.[[45]](#footnote-46) This rate was calculated to be 100%. The verified savings estimate determined for PY7 is a weighted average of these two test events, based on the number of switches that were called for each event.

EnergyConnect called zero commercial thermostats on its test event on June 25, 2015, and CPower called 802 commercial thermostats on its test event on August 12, 2015.

Navigant utilized the Comverge PY5 sample as the sample for PY7 analysis. The sample included 91 randomly selected participating businesses in which M&V meters were installed. This sample was determined to meet the 85/15 confidence and precision level. Table 10‑2 shows the sampling strategy applied to the verified gross analysis for Smart AC Saver in PY7.

Table ‑: Commercial AC Saver Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| Commercial Participants | 2,666 | 85/15 | 100 | 91 | PY5 load study applied to PY7 events |
| **PROGRAM TOTAL** | **2,666** | **N/A** | **100** | **91** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

*Source: Navigant analysis*

Navigant conducted no site visits for the Smart AC Saver program in PY7, as per the approved evaluation plan.

### Gross Verified Savings Results

Smart AC Saver is a demand-only program, and it claimed no energy savings in PY7. Smart AC Saver claimed 3.0 MW in reported savings and 0.6 MW of verified gross savings. Table 10‑3 shows the demand savings claimed in PY7.

Table ‑: PY7 Commercial AC Saver Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW)[1]** | **Demand Realization Rate (%)** | **Verified Gross Demand Savings (MW)[1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Commercial Participants | 3.0 | 0.18 | 0.6 | N/A | N/A |
| **PROGRAM TOTAL** | **3.0** | **0.18** | **0.6** | **N/A** | **N/A** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Impact Evaluation Net Savings

Navigant did not conduct research to determine NTG for this program, as per the approved evaluation plan. Navigant assumes that none of the program participants would have curtailed load at the times PECO dispatched the program without the incentives that the CSPs paid to them for their load curtailment; thus, the free ridership value is zero.

## Process Evaluation

For the PY7 process evaluation, Navigant employed the following methods:

* Participant survey
* In-depth interview with PECO program manager
* Review of Smart AC Saver program marketing materials
* Review of the program tracking database and program finances

In its petition of the Pennsylvania PUC to continue the mass-market DLC program (i.e., the Smart AC Saver program) in Phase II, PECO stated the program was designed to preserve the commercial DLC measure as a DR resource and to retain existing participants. Furthermore, PECO wanted to maintain the population of active load control devices by replacing customers that exited the Smart AC Saver program during the course of Phase II.

### Process Evaluation Methodology

The Navigant team conducted a phone survey of commercial participants to study program satisfaction and understand other aspects of the program participant experience. The team also conducted one in-depth interview with PECO program staff to understand the dates and durations of conservation events as well as PECO’s efforts to recruit new customers and utilize its back stock of hardware for these new installations. Furthermore, the team sought to understand the plan for the Smart AC Saver program in PY7, as well as potential design modifications to the program in Phase III of Act 129.

Table 10‑4 demonstrates the sampling strategies used by Navigant in the process evaluation activities. The sample size of 70 was selected in order to achieve 90% confidence and 10% relative precision (with an assumed CV of 0.5) for the quantitative results of the survey.

Table ‑: Commercial AC Saver Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Target Group | Population Size | Assumed Proportion or CV in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | [Percentage of Sample Frame Contacted[1] to Achieve Sample](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\258C1233.xlsx#RANGE!_ftn1) | Used for Evaluation Activities (Impact, Process, NTG) |
| Commercial Participants | 1,686 | 0.5 | 90/10 | 70 | 70 | 34% | Process |
| PROGRAM TOTAL | **1,686** | **0.5** | **90/10** | **70** | **70** | **34%** | **Process** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Evaluation Results

Through the program manager interviews, tracking system review, and participant interviews, Navigant identified several process findings relating to data availability, program satisfaction, participant perspectives on incentive levels and number of conservation events, and program channeling effects.

1. **Finding:** Phase III will require an enhanced level of impact analysis and verification. To date, insufficient AMI data has been provided to Navigant for the level of analysis needed in PY8 and beyond.
   1. **Recommendation:** PECO should ensure the program database contains necessary data to allow Navigant to calculate verified savings via comparison group analysis in Phase III.
   2. **Recommendation:** PECO should be prepared to quickly and securely transfer program database information to Navigant for verified savings analysis in Phase III.
2. **Finding:** Over 90% of participants report high satisfaction with the AC Saver program (rating of 4 or 5 on a scale of 1 to 5). This high satisfaction may be related to the relatively high incentive levels and low frequency of conservation events in PY7. As the program shifts in PY8, satisfaction could decrease due to an increase in length and frequency of events and a decrease in incentives.
   1. **Recommendation:** PECO should prepare for a possible drop in program satisfaction.
3. **Finding:** Participants do not know when conservation events are called. When asked how many events they experienced in PY7, the majority of respondents reported “don’t know” or “0.” However, one-third of participants reported a number of events they believed to have occurred, ranging from 1 to 11, when in fact PECO had only called 1 event. This finding indicates that participants are not aware of events that take place and are not checking the website for notification on conservation events.
   1. **Recommendation:** Consider running a pilot to test satisfaction impacts of notifying customers after conservation events.
4. **Finding:** Participants say they are motivated by incentive levels, with over one-third of participants reporting that they would no longer participate in the program if the incentive were cut by half. However, participants have not dropped out to date. A similar pattern was observed between PY4 and PY5, at the transition between Phase I and Phase II. Not surprisingly, participants reported an unwillingness to accept a lower incentive than they were already receiving. However, when the incentive did drop from $120 per summer to $80 per summer, very few participants did drop out of the program. These data indicate that participants are less likely to actively remove themselves from the program than they report in surveys, and PECO should not expect a significant decrease in program participants.
   1. **Recommendation:** If PECO is concerned that program participation is too high, consider paying low-performing customers to not participate in the program.

## Status of Recommendations for Program

Based on the findings outlined in Section 10.4.2, Navigant makes several recommendations to PECO. These recommendations can be found in Table 10‑5.

Table ‑: Commercial AC Saver Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| **Recommendations** | **EDC Status of Recommendations (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)** |
| **Recommendation 1:**   * 1. PECO should ensure the program database contains necessary data to allow Navigant to calculate verified savings via comparison group analysis in Phase III.   2. PECO should be prepared to quickly and securely transfer program database information to Navigant for verified savings analysis in Phase III. | 1. **Implemented:** Interval data will be available; will have to collaborate with Navigant to define the format. 2. **Being Considered:** PECO will work with Navigant to extract AMI data as soon as it is available, which is at the earliest around 4 weeks after the event takes place. |
| **Recommendation 2:** PECO should prepare for a possible drop in program satisfaction. | **Implemented** |
| **Recommendation 3:** Consider running a pilot to test satisfaction impacts of notifying customers after conservation events. | **Rejected:** PECO will find way to work around maintaining customer satisfaction. |
| **Recommendation 4:** If PECO is concerned that program participation is too high, consider paying low-performing customers to not participate in the program. | **Being Considered:** PECO needs to assess how the AC program can leverage its participant interest to extend beyond DR. |

Source: Navigant analysis

## Financial Reporting

Program expenditures for the residential Smart AC Saver program in PY7 totaled $313,000. Navigant calculated the TRC benefit-cost ratio of the residential Smart AC Saver program at 0.80. In PY7, the TRC benefits for the program were negatively affected by the relatively low temperature that occurred on the PY7 test event day, leading to lower savings than those observed on the test events in PY5. It also decreased due to the fact that only one-quarter of enrolled commercial participants were called during that test event. Table 10‑6 shows a summary of the PY7 program finances.

Table ‑: Summary of Commercial AC Saver Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| **Row #** | **Cost Category** | **Actual PY7 Costs** | **Actual Phase II Costs** |
| **($1,000)** | **($1,000)** |
| **1** | Incremental Measure Costs | 0 | 0 |
| **2** | EDC Incentives to Participants | 0 | 0 |
| **3** | EDC Incentives to Trade Allies | 0 | 0 |
| **4** | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 0 | 0 |
|  | | | |
| **5** | Program Overhead Costs | 313 | 932 |
| **6** | Design and Development | 0 | 0 |
| **7** | Administration, Management, and Technical Assistance**[1]** | 48 | 56 |
| **8** | Marketing[2] | 265 | 876 |
| **9** | EDC Evaluation Costs | 0 | 0 |
| **10** | SWE Audit Costs | 0 | 0 |
|  | | | |
| **11** | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| **12** | Total TRC Costs[5] | 313 | 932 |
| **13** | Total NPV Lifetime Energy Benefits | 214 | 648 |
| **14** | Total NPV Lifetime Capacity Benefits | 37 | 340 |
| **15** | Total NPV TRC Benefits[6] | 251 | 988 |
|  | | | |
| **16** | TRC Benefit-Cost Ratio | 0.80 | 1.06 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. Note: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart Equipment Incentives: C&I

PECO launched the Smart Equipment Incentives (SEI) program in Phase I and continued the program into Phase II. The program offers incentives for projects with prescriptive measures (e.g., lighting and variable frequency drives) and custom projects. A main goal of the SEI program in Phase II was to encourage the installation of efficient non-lighting equipment. PECO filed the SEI program with the Pennsylvania PUC as two programs targeting different nonresidential customer segments: C&I and GNI. This section focuses on the SEI C&I program.

PECO hired a CSP, DNV GL, to implement and market the program throughout the PECO service territory. DNV GL was responsible for employing the customer service staff to market and assist with program participation while developing and maintaining trade allies. DNV GL is also responsible for program marketing, contractor invoicing, rebate processing, reviews of ex ante savings, and provision of biweekly program participation data that feeds into PECO’s SIDS database.

PECO’s C&I customers that own or rent their space are eligible for the program. Participating customers first identify energy efficiency projects at their facility, including deemed, partially deemed, or custom measures. Next, the customer must submit a pre-application to DNV GL before completing the project. Once approved, the project is implemented by the customer’s selected contractor, and either the customer or the contractor submits the rebate paperwork to DNV GL. DNV GL completed 1,329 C&I retrofit projects in PY7. Notably, 67% of total SEI C&I PY7 energy savings came from lighting measures, including lighting controls.

## Program Updates

The SEI program launched a new trade ally program in PY6 that financially rewards trade allies for achieving energy savings targets. Trade allies can become silver-, gold-, or platinum-level trade allies, depending upon the number and size of projects they bring into the SEI program. They receive recognition at quarterly events and financial compensation for achieving each level. This program became more robust and popular in PY7. The SEI CSP implemented a “limited time offer” in which participants were eligible for additional incentive money if they completed the project before January 31, 2016. Communication between PECO and the CSP was also more consistent and transparent in PY7 compared to past program years. PECO also used their account managers in a more strategic role than previous years as advocates for the program with their large account customers.

### Definition of Participant

For the SEI program, PECO defines a participant by one completed project. Each project may include the installation of one or more measures, and each project can be of different measure types.

## Impact Evaluation Gross Savings

The SEI program achieved verified energy and demand savings of 238,518 MWh and 39.1 MW, respectively. The total reported energy savings for Phase II were 229,217 MWh, reported gross demand savings were 35.2 MW, and total incentives paid to customers were $17,325,607. Table 11‑1 shows the Phase II savings and incentive results for the SEI program for the C&I sector as well as the reported results for the SEI C&I program.

Table ‑: Phase II Smart Equipment Incentives (C&I) Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh/yr)** | **Reported Gross Demand Reduction (MW)[2]** | **Verified Gross Energy Savings (MWh/yr)** | **Verified Gross Demand Reduction (MW/yr)[2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Residential (Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Small C&I | 1,611 | 67,411 | 11.1 | 69,846 | 12.2 | $2,972 |
| Large C&I | 835 | 161,805 | 24.1 | 168,672 | 26.8 | $5,833 |
| GNI | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| **Phase II Total** | **2,446** | **229,217** | **35.2** | **238,518** | **39.1** | **$8,805** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

Navigant used three main approaches for evaluating the sampled projects: desk reviews, phone verifications, and onsite M&V. Navigant completed a desk review for all projects and carefully reviewed all project documentation and the SIDS for each sampled project. Navigant sampled the population of projects into four categories: municipal lighting, small, medium, and large projects. These projects were determined by the program categorization as well as their energy savings size. Small projects are those with fewer than 250,000 kWh in energy savings; medium projects are those between 250,000 kWh and 1,000,000 kWh in energy savings; and large projects are those with more than 1,000,000 kWh in energy savings.

1. **Desk review.** All 74 projects underwent a desk review and seven small strata projects only received a desk review due to difficulty contacting the customer. Navigant made use of project applications, associated calculations, and submitted invoices and specification sheets. Project documentation had to be complete to be used for measure verification. PECO provided project-specific analysis files, invoices, specification sheets, and other retrofit documents for the sampled projects so the evaluation team could conduct the desk reviews. Documentation included scanned files of hard copy application forms and supporting documentation from the applicant (e.g., ex ante impact calculations, invoices, and measure specification sheets), CSP inspection reports, photos of installed measures, and important email and memoranda.
2. **Phone verification.** Navigant supplemented the desk reviews by conducting verification phone calls for eight small and four municipal lighting projects. Navigant used the following criteria when determining which sites could be verified without visiting the site: 1) the project was a small, partially deemed project where the TRM or an IMP applied; 2) the project had relatively small savings (i.e., those in the small sample stratum); and 3) the project documentation was complete and could be used to verify that the measures were installed. The primary objectives of phone verification were to achieve verbal verification of installed measures and to collect the data identified in the site-specific M&V plan (SSMVP), including installed quantities and type, equipment nameplate data, operating schedules, and a careful description of site conditions.
3. **Onsite inspections.** Navigant conducted onsite verification for large and medium sample projects, and for small projects that did not meet certain requirements to supplement the desk reviews. Navigant visited 48 of the 74 C&I projects in the sample to verify measure installation. One threshold metering site could not be visited due to site issues, so Navigant verified the project using a billing regression analysis. The primary objectives of the visits were to achieve visual verification of installed measures and to collect the data identified in the SSMVP, including installed quantities and type, equipment nameplate data, operating schedules, and a careful description of site conditions. For 36 of the 48 visited sites, Navigant also installed data loggers to measure runtime hours and/or energy consumption, downloaded energy consumption data, or completed a billing analysis using utility meter data.

The sample design for PY7 SEI projects used stratified ratio estimation similar to the method used in PY5 and PY6. Based on a combined PY7 population of 1,329 C&I projects, the final verified sample size for the PY7 evaluation was 74 C&I projects, with samples allocated by participation from each quarter and by stratum. The evaluation team designed the final C&I sample to exceed the required 85/15 confidence and precision at the program level with coefficients of variation chosen to reflect the PY4, PY5, and PY6 achieved relative precision targets.[[46]](#footnote-47) Navigant also added extra sites to meet the SWE’s request to exceed 90/10 confidence and precision and to better ensure the results meet the required 85/15 confidence and precision.

The evaluation team defined strata boundaries based participation data, and included approximately the top 33% of reported kWh savings in the large stratum, the middle 33% of reported kWh savings in the medium stratum, and the lower 33% of reported kWh savings in the small stratum. This sampling strategy is shown in Table 11‑2.

Table ‑: Smart Equipment Incentives (C&I) Sampling Strategy for PY7

| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| --- | --- | --- | --- | --- | --- |
| C&I - Large | 16 | 85/15 | 11 | 11 | File review and impact verification |
| C&I - Medium | 84 | 85/15 | 24 | 31 | File review and impact verification |
| C&I - Small | 1,229 | 85/15 | 32 | 32 | File review and impact verification |
| **Program Total** | **1,329** | **85/15** | **67** | **74** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The evaluation team pulled the sample in three stages: after Q2 using both Q1 and Q2 data, after Q3, and after Q4. During each stage, the team reviewed the sample design and made adjustments as needed to ensure that the sample would meet the target confidence and precision. This process included reviewing the projects in the pipeline and estimating the number of projects that would be completed prior to the end of PY7. The percentage of total projects sampled during each stage was based on the number of completed projects in that stage as a proportion of the expected number of projects for the entire program year. Lastly, the team included all projects in the sample design, but only sampled from projects representing the top 98% of aggregate program savings. The team determined that sampling from the smallest projects representing the bottom 2% of aggregate program savings would be of limited value to the program evaluation. The team also worked to mitigate systematic uncertainty in the PY7 evaluation. The sources, examples, and strategies to mitigate systematic uncertainty are listed below.

* **Source:** Onsite metering

**Examples:** Uncertainty in the metering device itself, equipment placement, poor calibration

**Strategies to Mitigate:** Systematic uncertainty could have been found in the placement of lighting loggers. If the lighting loggers were not correctly placed, they may have been influenced by alternative lighting sources, including non-program-incentivized lighting or natural sunlight. To mitigate against this uncertainty, Navigant reviewed all logger data to ensure that it was reasonable. Navigant also decided to not use certain logger data if the information was not reasonably comparable with normal lighting use. Navigant ensured against systematic uncertainty in equipment by utilizing experienced field staff to deploy and ensure metering equipment was installed correctly.

* **Source:** Survey design

**Examples:** Incomplete information collected onsite, leading survey questions

**Strategies to Mitigate:** Systematic uncertainty could have been found in the collection of information while onsite. To prevent against any potential information lost, Navigant followed up with the customer on any uncertain items such as HOU, baseline questions, etc.

* **Source:** Human error during site visits

**Example:** Forgetting to complete a key field on the field form

**Strategies to Mitigate:** Systematic uncertainty could have been found in the information gathered while onsite. To prevent against this, Navigant trained field staff before completing onsite visits and also reviewed field forms to ensure that all proper information was collected from the field staff.

* **Source:** Sample design

**Examples:** Non-coverage errors, non-response bias, self-selection bias

**Strategies to Mitigate:** Navigant solicited the help of PECO to contact a few of the sampled sites. Navigant reviewed the sampled sites to ensure that it was representative of the entire population.

The evaluation team verified gross impacts for demand and energy through different approaches for the three categories of measures in this program: 1) deemed, 2) partially deemed, and 3) custom measures. The measures in these categories are defined by the TRM and IMP approved by the Pennsylvania PUC through the SWE team. The impacts for deemed measures were provided in the TRM or in an approved IMP. The evaluation approach for deemed measures was to verify both the installed quantity and that the installed measure matched the TRM-required specifications.

The TRM or approved IMP provided the algorithms and default assumptions for calculating the impacts and the variables to be verified for partially deemed measures. Depending on the complexity of the partially deemed measure, the evaluation team applied either a basic or enhanced level of rigor, as described in the applicable protocols and the Audit Plan. The evaluation team conducted an application and file review and developed a SSMVP for all partially deemed projects. The team completed site visits (or phone interviews if the criteria described above were satisfied) following the activities laid out in the SSMVP and calculated verified savings using the variables determined through the site visit or phone interview in accordance with the TRM or IMP.

For projects that included custom measures (defined as measures not included in the TRM or in an IMP, or measures that were initially reported as TRM measures but determined through the evaluation to be custom), the evaluation team conducted an application review, developed a SSMVP, and conducted a site visit. The primary difference was that there were no deemed variables and all custom measures followed an enhanced rigor level of effort.

The peak kW savings estimation methodology was consistent with the SWE’s requirements for each project.[[47]](#footnote-48) These requirements align with the PJM peak demand period defined as 2:00-6:00 p.m. on non-holiday weekdays during June, July, and August. The evaluation of PY7 projects included a review of program tracking data.

### Gross Verified Savings Results

In PY7, the program achieved a gross realization rate of 1.00 for energy. The program’s verified energy savings was 119,944 MWh/yr. The program-level relative precision was 11% at an 85% confidence interval, which meets the 15% relative precision goal for the program year. The large stratum achieved a realization rate of 0.87, the medium stratum a realization rate 1.22, and the small stratum a realization rate of 0.92. The summary of the energy evaluation results is presented in Table 11‑3.

Table ‑: PY7 Smart Equipment Incentives (C&I) Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Reported Gross Energy Savings  (MWh/yr) | Energy Realization Rate  (%) | Verified Gross Energy Savings  (MWh/yr) | Observed CV or Proportion in Sample Design | Relative Precision at 85% Confidence Interval |
| C&I - Large | 28,929 | 0.87 | 25,221 | 0.90 | 24% |
| C&I - Medium | 34,861 | 1.22 | 42,578 | 1.40 | 30% |
| C&I - Small | 56,155 | 0.92 | 51,779 | 0.34 | 9% |
| Program Total | **119,944** | **1.00** | **119,579** | **N/A** | **11%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Overall, the program achieved a gross realization rate of 1.07 for demand. The program’s verified demand savings was 18.4 MW. The program-level relative precision was 17% at an 85% confidence interval. The large stratum achieved a realization rate of 1.07, the medium stratum a realization rate 1.34, and the small stratum a realization rate of 0.90. The summary of the demand evaluation results is presented in Table 11‑4.

Table ‑: PY7 Smart Equipment Incentives (C&I) Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Reported Gross Demand Savings (MW)[1] | Demand Realization Rate (%) | Verified Gross Demand Savings (MW)[1] | Observed CV or Proportion in Sample Design | Relative Precision at 85% Confidence Interval |
| C&I - Large | 4.1 | 1.07 | 4.4 | 1.18 | 31% |
| C&I - Medium | 5.3 | 1.34 | 7.2 | 1.56 | 33% |
| C&I - Small | 8.9 | 0.90 | 8.0 | 1.02 | 26% |
| Program Total | **18.4** | **1.07** | **19.6** | **N/A** | **17%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Through Navigant’s gross evaluation, Navigant found one project that had major discrepancies after an onsite inspection. This discrepancy was the result of a customer installing a variable frequency drive (VFD) on a motor and operated the motor at a higher horsepower (HP) than the baseline case. Although the new motor is more efficient than the previous two-speed motor, it is run at a significantly higher HP due to having a VFD attached. This project received zero savings. Outside of this major discrepancy, Navigant found differences between the ex ante and ex post savings estimates that were the result of utilizing updated utility metered data and trend data and finding differences in fixture quantities and fixture HOU and CFs. Table 11‑5 indicates the total number of discrepancies across the onsite inspections.

Table ‑: PY7 Smart Equipment Incentives (C&I) Onsite Inspections Summary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measure | Inspection Firm | Number of Inspections Planned | Number of Inspections Conducted | Number of Sites with Discrepancies from Reports | Resolution of Discrepancies |
| Lighting | Navigant/Mondre | 19 | 18 | 0 | N/A |
| HVAC | Navigant/Mondre | 14 | 14 | 0 | N/A |
| Motors and Drives | Navigant/Mondre | 9 | 8 | 1 | N/A |
| Custom | Navigant/Mondre | 5 | 5 | 0 | N/A |
| Refrigeration | Navigant/Mondre | 2 | 2 | 0 | N/A |
| TOTAL |  | **49** | **48** | **1** | **N/A** |

Source: Navigant analysis

## Impact Evaluation Net Savings

After Navigant calculated gross program impacts, the team derived net program impacts by estimating a NTG ratio to quantify the percentage of the gross program impacts that can reliably be attributed to the program.

### Net Verified Savings Methodology

The evaluation team evaluated NTG for PY7. The final program NTG value was calculated using a weighting system that weighted customer NTG responses based on the total kWh savings contributed to the SEI program during the program year. Table 11‑6 shows the sample design for the PY7 NTG research and illustrates the need to weight the resulting NTG values due to oversampling the small strata and undersampling large and medium strata.

Table ‑: Smart Equipment Incentives (C&I) Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Stratum | Stratum Boundaries | Population Size | Assumed CV or Proportion in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | Percentage of Sample Frame Contacted[1] to Achieve Sample |
| C&I Large | >= 330,000 kWh Total Savings | 64 | 0.50 | 85/15 | Attempted census | 13 | 100% |
| C&I Small | < 330,000 kWh Total Savings | 469 | 0.50 | 85/15 | Attempted census | 38 | 100% |
| Program Total | **N/A** | **533** | **N/A** | **85/15** | **Attempted census** | **51** | **100%** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Once the evaluation team estimated free ridership, Navigant calculated the NTG ratios, as illustrated in the following equation.

Equation ‑: Total NTG Ratio

*NTG Ratio = 1 – Free Ridership Rate*

The team assessed free ridership using a customer self-report approach following the SWE’s Common Approach for Downstream Programs.[[48]](#footnote-49) This approach uses a survey designed to assess the likelihood that participants would have installed some or all of the energy efficiency measures incented by the program, even if the program had not existed. Based on the ETO methodology, the SEI free ridership analysis included the following two elements of free ridership: 1) intention to carry out the energy efficient project without program funds; and 2) influence of the program in the decision to carry out the energy efficient project.

The total free ridership score illustrated in Equation 11‑2 is the sum of the intention and the program influence scores, resulting in a score ranging from 0 to 100. This score is divided by 100 to convert it into a proportion for application to gross savings values.

Equation ‑: Total Free Ridership

#### Intention Score

The intention score was assessed through several brief questions used to determine how the upgrade or equipment replacement likely would have differed if the respondent had not received the program assistance. The initial question asked the respondent to identify, out of a limited set of options, the option that best described what most likely would have occurred without the program assistance. Note that program assistance often includes more than just the incentive—it may also include audits, technical assistance, etc. The offered response options (typically four or five, and preferably no more than six) captured the following four general outcomes:

* Would have canceled or postponed the project, upgrade, or purchase
* Would have done something that would have produced savings, but not as much as those achieved through the upgrade or equipment replacement as implemented
* Would have completed the upgrade or equipment replacement as implemented
* Don’t know

The algorithm does consider respondents who said they would have canceled or postponed the project as free riders in terms of intention (a score of 0 for the intention score). The approach did consider respondents who indicated they would have done something that would have resulted in less energy savings as partial free riders in terms of intention (free ridership ranging from 12.5 to 37.5 for the intention component in the case of nonresidential programs). The respondents that indicated they would have undertaken the project as implemented without the program received a score based on how they would have paid for the upgrade. “Don’t know” responses were assigned the midpoint score of 25 for the intention component.

#### Program Influence Score

To assess the program influence score on the participant’s decision to implement energy efficiency improvements, Navigant asked respondents how much influence—on a scale of 1 (no influence) to 5 (great influence)—various program elements had on the decision to implement the project. The elements used to influence customer decision-making included program information, program incentives, interaction with program staff (technical assistance), and interaction with program proxies, such as members of a trade ally network.

A participant’s program influence score was then set to the participant’s maximum influence rating for any program element. The rationale was that if any given program element had a great influence score on the respondent’s decision, then the program itself had that level of influence, even if other elements had less influence. The program influence score and free ridership have an inverse relationship: the greater the program influence, the lower the free ridership, and vice versa.

Equation 11‑2 summarizes both the intention score and program influence score calculations for the SEI program. The figure shows the possible response combinations to the questions described in the intention score section and the value assigned to each unique combination. In addition, it shows the program influence score and possible answers to the 5-point scale along with the “don’t know” answers.

Figure ‑: Phase II Free Ridership Algorithm



Source: Navigant analysis

Spillover occurs when there are reductions in energy consumption or demand caused by the presence of the energy efficiency program, but which the program does not directly influence. The evaluation team asked program participants a battery of questions to quantitatively assess spillover. Below are examples of the spillover questions:

* Since your participation in the program, did you install any additional energy efficiency measures at this facility that did not receive incentives through any utility or government program?
* To the best of your knowledge, do you know when you installed the additional energy efficient equipment?
* Could you describe the energy efficiency measure installed?
* Thinking of the additional measure(s) you installed on your own at this same facility, how do the energy savings compare to what you installed through the program? Were the savings lower, about the same, or higher? (Probe for percentage as compared to all incented projects.)
* Since participating in the program, have you installed any energy efficient measures in other facilities within PECO’s territory?
* Thinking of these additional measure(s) you installed on your own at other facilities, how does the quantity compare to what you installed through the program? Did you install more, less, or the same amount of measures? (Probe for percentage as compared to all incented projects.)
* Have or will these measures receive incentives through the program?
* What were the reasons that they did not receive an incentive?

The battery of questions attempted to quantify all the savings from additional non-incented equipment installed after the respondent’s participation in the program. Additionally, the evaluation team included a question about the level of influence the program had on the respondent’s decision to install the additional measures. An example of the question is below.

* On a 0 to 5 scale, with 0 meaning “Not at all influential” and 5 meaning “Extremely influential,” how influential was your experience with PECO's program in your decision to install the additional energy efficient equipment?

The team assigned the influence rating a value, which determined what proportion of the measure’s energy savings were attributed to the program:

* A rating of 4 or 5 = 1.0 (full savings attributed to the program)
* A rating of 2 or 3 = 0.5 (half of the savings attributed to the program)
* A rating of 0 or 1 = 0 (no savings attributed to the program)

Where applicable, Navigant calculated the savings for each additional measure installed per the TRM. For measures not included in the TRM, the evaluator may conduct a brief engineering analysis to assess savings or to identify an alternative source and methodology for assessing savings.

Navigant calculated spillover for measures reported as the product of the measure savings, number of units, and influence score, as illustrated in Equation 11‑3. Navigant calculated all spillover estimates using customer self-reported data and did not conduct follow-up interviews or site visits.

Equation ‑: Spillover Savings from Installed Measures

For each of the above categories, the evaluators then totaled the savings associated with each program participant, to give the overall participant spillover savings reflected in Equation 11‑4.

Equation ‑: Overall Participant Spillover

*Participant SO = ΣMeasure SO*

The team then multiplied the mean participant spillover savings for the participant sample by the total number of participants to yield an estimated total participant spillover savings for the program. Equation 11‑5 shows the algorithm used to calculate spillover for the program.

Equation ‑: Spillover Savings for the Program

Population *N*

Finally, the team divided the total savings by the total program savings to yield a participant spillover percentage, as shown in Equation 11‑6

Equation ‑: Participant Spillover Percentage

100

### Net Verified Savings Results

The SEI C&I NTG evaluation research in PY7 resulted in lower confidence and precision than planned, due to a low survey response rate among larger participants. Several of the largest participants failed to respond to the NTG survey, despite repeated requests from the evaluation team. This issue was compounded by the fact that several surveys were completed by contractors as opposed to decision makers, which resulted in those responses being omitted from the sample. This issue has been observed in previous evaluations as well, and is further discussed in Section 11.4 below.

In PY7, the Navigant team analyzed the responses of the online survey through which spillover was identified based on participant responses. Navigant designed the spillover survey questions to identify those cases where spillover was possible and to quantify the self-reported energy and demand savings from the spillover equipment installation.

As shown in Figure 11‑2, the Navigant team determined that of the 51 participants surveyed, 21 reported installing additional energy efficient equipment. Out of the 21 participants, 14 participants either could not verify that the spillover projects were developed during PY7 or did not give enough information to estimate energy savings.

While the spillover evaluation revealed a high percentage of self-reported activity, only five participants provided enough information to quantify spillover; the spillover calculated was 0.01.

Figure ‑: Smart Equipment Incentives (C&I) Spillover Results Illustration

14% of sample had qualified spillover

Source: PY7 NTG participant surveys

Table 11‑7 shows the results of the PY7 NTG research.

Table ‑: PY7 Smart Equipment Incentives (C&I) Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Estimated Free Ridership | Estimated Participant Spillover | NTG Ratio | Observed CV or Proportion | Relative Precision |
|
| C&I Large | 0.39 | 0.01 | 0.62 | 0.48 | 20% |
| C&I Small | 0.22 | 0.02 | 0.80 | 0.28 | 7% |
| Program Total | 0.37 | 0.01 | 0.64 | N/A | 11% |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Process Evaluation

The evaluation team conducted multiple research activities in support of the SEI PY7 process evaluation. Navigant evaluated the SEI C&I and GNI participant groups together; thus, the results of the process evaluation are presented identically in both SEI sections of this report.

### Process Evaluation Methodology

The process evaluation research activities included the following:

* Program marketing plan review
* Tracking system review
* Interviews with three PECO program management staff and four implementation contractor staff
* Seven interviews with distributors and other market actors
* Online surveys with 51 participating C&I customers

The sampling strategy for the process evaluation activities are presented in Table 11‑8.

Table 11‑8: Smart Equipment Incentives (C&I) Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Stratum | Population Size | Assumed Proportion or CV in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | Percentage of Population Frame Contacted to Achieve Sample | Used for Evaluation Activities (Impact, Process, NTG) |
| PECO Program Managers | 3 | N/A | N/A | 3 | 3 | 100% | Process evaluation |
| Implementation Contractors | 4 | N/A | N/A | 4 | 4 | 100% | Process evaluation |
| Distributor/Trade Allies | Unknown | N/A | N/A | 7 | 7 | 100% | Process evaluation |
| Program Total | **N/A** | **N/A** | **N/A** | **14** | **14** | **100%** | **Process evaluation** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Evaluation Results

The SEI program was successful at moving its measure mix toward non-lighting measures in PY7, and it is encouraging some changes within the market. In summary, the Phase II SEI program strategy worked. However, to have a greater market impact in Phase III, PECO will need to add implementation tactics to increase market transformation. The results of the SEI process evaluation are as follows:

1. **Finding:** The SEI program participants vary widely across business sizes, types, and other defining characteristics. As the SEI incentive levels will be reduced in Phase III, PECO may need to find ways to add value to the program for its varied customers in order to maintain high levels of participation. For example, the needs of a church are different from those of a small business.
   1. **Recommendation:** Segment the eligible customer population further to explore the value of the SEI program and identify marketing or outreach approaches to reach each segment effectively.
2. **Finding:** Based on program staff interviews, the trade ally incentive program succeeded in PY7 by rewarding trade allies for completing a certain number of projects through the SEI program. This approach is a great tool to encourage trade allies to engage in the program and pursue projects. It does not, however, provide control over what types of projects or customers are engaged by trade allies. The participating trade allies are often larger companies themselves that may have the ability to pursue and leverage projects regionally or nationwide. These trade allies, while skilled at completing rebate applications, may shift their business strategy in Phase III to focus on other utility regions where incentives are richer in response to PECO’s lower incentive levels. This leaves an opportunity to engage more local contractors in the program.
   1. **Recommendation:** Change the trade ally incentives program to incent targeted project types or customer segments.
   2. **Recommendation:** Conduct additional outreach to engage new trade allies in the program (especially local contractors, who are less likely than larger companies to transfer their focus to projects in other states where incentives are richer).
3. **Finding:** SEI has a goal of bringing in a diverse measure mix, focusing on achieving a higher percentage of non-lighting projects. In Phase II, SEI succeeded at reducing the percentage of lighting projects from PY5 to PY7, increasing custom projects. In Phase III, an increased focus on prescriptive measures could aid in the effort to encourage non-lighting projects. However, the decreased incentive levels might mean a decrease in these non-lighting measures, as engineering costs will remain high.Interviews and survey responses indicate that in some cases, PY7 incentive levels barely covered the cost of the engineering requirements in the rebate application.
   1. **Recommendation:** Increase assistance to participants and trade allies with completing required documentation and TRM worksheets for custom projects.
4. **Finding:** The “limited time offer” marketing effort was very successful. It encouraged undecided participants to apply earlier and contributed to projects finishing earlier than anticipated. The offer brought in more projects in February and March, rather than later in May and June.
   1. **Recommendation:** Use the “limited time offer” as a lever in future years if participation is low.
5. **Finding:** The project database and application process has improved over Phase II, but there are additional changes that could be made to streamline applications in Phase III. For example, threshold metering sites were not always correctly or quickly identified, which caused evaluation challenges. Overall, the database contains many columns that Navigant does not need for analysis.
   1. **Recommendation:** PECO should require the CSP to build in a "flag" in its project database that identifies if a site is a threshold metering project. The CSP should then send over the project files to the evaluation team as soon as they are entered into the system rather than waiting for the quarterly data transfer.
   2. **Recommendation:** Streamline database by limiting number of fields, removing unnecessary fields, and ensuring accuracy of dates entered. Assess data requirements of all relevant parties (PECO, SWE, and Navigant) and only include required fields.

## Status of Recommendations for Program

The evaluation team used various analytical methods to complete the evaluation, including performing a gross impact evaluation; program materials review; tracking system review; a verification and due diligence review; interviews with PECO program managers and implementation contractor staff; participant surveys; and market actor interviews. Table 11‑9 lists a summary of each recommendation along with the PECO status.

Table ‑: Smart Equipment Incentives (C&I) Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected, AND Explanation of Action Taken by EDC) |
| Recommendation 1: Segment population further to explore the value of the SEI program and identify marketing or outreach approaches to reach the harder to reach segments. Develop marketing approaches for specific business types to cater to the needs of that segment. | **Implemented:** PECO has been working on a robust marketing plan with EEMF to target the industrial and commercial sector areas that are hard to reach. This will be done through direct marketing with trade allies, as well as enlisting the help of LCS. |
| Recommendation 2:   * + - * 1. Change the trade ally incentives program to incent targeted project types or customer segments.         2. Outreach to engage new trade allies in the program (especially local contractors, who are less likely to pursue projects in other states where incentives are richer). | 1. **Implemented:** In Phase III, PECO revised the program design to incent the trade ally’s on a project or customer basis, to offer a comprehensive solution as oppose to measure based approach and alter the trade ally incentives program to incent targeted project types or customer segments. 2. **Implemented:** Currently hosting many webinars inviting existing and new potential trade allies. |
| Recommendation 3: Increase assistance with completing required documentation and TRM worksheets for custom projects. | **Implemented:** PECO is offering “hand-held” assistance with translating the TRM specifications for custom projects. |
| Recommendation 4: Use the “limited time offer” as a lever in future years if participation is low. | **Implemented:** PECO is working with EEMF to establish a lever to have better controls around program participation. |
| Recommendation 5a: PECO should require the implementer to build in a "flag" in their project database that identifies if a site is threshold metering. The implementer should then make sure to send over the project files to evaluator as soon as they are entered into the system. | **Implemented:** PECO and Navigant made formal recommendation to ICF to continuously monitor for threshold metering projects. Once a project has been flagged, ICF will contact Navigant as per PECO’s instructions. |
| Recommendation 5b: Streamline database by limiting number of dates and removing unnecessary fields. Assess data requirements of all relevant parties (PECO, SWE, and Navigant) and only include required fields. | **Being Considered** |

Source: Navigant analysis

## Financial Reporting

A breakdown of the program finances (by program) is presented in Table 11‑10.

Table ‑: Summary of Smart Equipment Incentives (C&I) Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| Row # | Cost Category | Actual PYTD  Costs | Actual Phase II  Costs |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 29,735 | 58,246 |
| 2 | EDC Incentives to Participants | 8,805 | 17,325 |
| 3 | EDC Incentives to Trade Allies | 0 | 0 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 20,930 | 40,921 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10) | 4,430 | 13,634 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance**[1]** | 4,259 | 13,454 |
| 8 | Marketing**[2]** | 171 | 180 |
| 9 | EDC Evaluation Costs | 0 | 0 |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | **0** | **0** |
|  | | | |
| 12 | Total TRC Costs[3] (Sum of Rows 1, 5, and 11) | 34,165 | 71,881 |
| 13 | Total NPV Lifetime Energy Benefits | 83,453 | 162,582 |
| 14 | Total NPV Lifetime Capacity Benefits | 10,867 | 20,952 |
| 15 | Total NPV TRC Benefits[4] | 94,325 | 183,550 |
|  | | | |
| 16 | TRC Benefit-Cost Ratio[5] | 2.76 | 2.55 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart Equipment Incentives: GNI

PECO launched the Smart Equipment Incentives (SEI) program in Phase I and has continued the program into Phase II. The program offers incentives for projects with prescriptive measures (e.g., lighting and VFDs) and custom projects. A main goal of the SEI program in Phase II is to encourage the installation of efficient non-lighting equipment.

PECO filed the SEI program with the Pennsylvania PUC as two programs targeting different nonresidential customer segments: C&I and GNI. The SEI C&I program targets the C&I segment, while the SEI GNI program targets the GNI segment. This section focuses on the SEI GNI program.

PECO hired a CSP, DNV GL, to implement and market the program throughout the PECO service territory. DNV GL was responsible for employing the customer service staff to market and assist with program participation while developing and maintaining trade allies. DNV GL is also responsible for program marketing, contractor invoicing, rebate processing, reviews of ex ante savings, and provision of biweekly program participation data that feeds into PECO’s SIDS database.

PECO’s GNI customers that own or rent their space are eligible for the program. Participating customers first identify energy efficiency projects at their facility including deemed, partially deemed, or custom measures. Next, the customer must submit a pre-application to DNV GL before completing the project. Once approved, the project is implemented by the customer’s selected contractor, and either the customer or the contractor submits the rebate paperwork to DNV GL. DNV GL completed 469 GNI retrofit projects in PY7. Notably, 44% of total SEI GNI PY7 energy savings came from lighting measures, including lighting controls.

## Program Updates

The SEI program launched a new trade ally program in PY6 that financially rewards trade allies for achieving energy savings targets. Trade allies can become silver-, gold-, or platinum-level trade allies, depending upon the number and size of projects they bring into the SEI program. Trade allies receive recognition at quarterly events and financial compensation for achieving each level. This program became more robust and popular in PY7. The SEI CSP implemented a “limited time offer” in which participants were eligible for additional incentive money if they completed the project before January 31, 2016. Communication between PECO and the CSP was also more consistent and transparent in PY7 compared to past program years. PECO also used their account managers in a more strategic role than previous years as advocates for the program with their large account customers.

### Definition of Participant

For the SEI program, PECO defines a participant by one completed project. Each project may include the installation of one or more measures, and each project can be of different measure types.

## Impact Evaluation Gross Savings

The SEI program achieved verified energy and demand savings of 132,883 MWh and 25.5 MW, respectively, in Phase II. The total reported energy savings for Phase II were 133,586 MWh, reported gross demand savings were 25.3 MW, and total incentives paid to customers were $9,114. Table 12‑1 shows the Phase II savings and incentive results for the SEI program for the GNI sector.

Table ‑: Phase II Smart Equipment Incentives (GNI) Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector [1]** | **Participants** | **Reported Gross Energy Savings (MWh/yr)** | **Reported Gross Demand Reduction (MW)[2]** | **Verified Gross Energy Savings (MWh/yr)** | **Verified Gross Demand Reduction (MW/yr)[2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Residential (Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Small C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Large C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| GNI | 796 | 133,586 | 25.3 | 132,883 | 25.5 | $9,114 |
| **Phase II Total** | **796** | **133,586** | **25.3** | **132,883** | **25.5** | **$9,114** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.

**Note:** Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

Navigant used three main approaches for evaluating the sampled projects: desk reviews, phone verifications, and onsite M&V. Navigant completed a desk review for all projects, and carefully reviewed all project documentation and the SIDS for each sampled project. Navigant sampled the population of projects into four categories: municipal lighting, small, medium, and large projects. These projects were determined by the program categorization as well as their energy savings size. Small projects are those with under 250,000 kWh in energy savings and not municipal lighting; medium projects are those between 250,000 kWh and 1,500,000 kWh in energy savings and not municipal lighting; and large projects are those with more than 1,500,000 kWh in energy savings.

1. **Desk review.** All 57 projects underwent a desk review and two small strata projects only received a desk review due to difficulty contacting the customer. Navigant made use of project applications, associated calculations, and submitted invoices and specification sheets. Project documentation had to be complete to be used for measure verification. PECO provided project-specific analysis files, invoices, specification sheets, and other retrofit documents for the sampled projects so the evaluation team could conduct the desk reviews. Documentation included scanned files of hard copy application forms and supporting documentation from the applicant (e.g., ex ante impact calculations, invoices, and measure specification sheets), CSP inspection reports, photos of installed measures, and important email and memoranda.
2. **Phone verification.** Navigant supplemented the desk reviews by conducting verification phone calls for eight small and four municipal lighting projects. Navigant used the following criteria when determining which sites could be verified without visiting the site: 1) the project was a small, partially deemed project where the TRM or an IMP applied; 2) the project had relatively small savings (i.e., those in the small sample stratum); and 3) the project documentation was complete and could be used to verify that the measures were installed. The primary objectives of phone verification were to achieve verbal verification of installed measures and to collect the data identified in the SSMVP, including installed quantities and type, equipment nameplate data, operating schedules, and a careful description of site conditions.
3. **Onsite inspections.** Navigant conducted onsite verification for large and medium sample projects and for small projects that did not meet certain requirements to supplement the desk reviews. Navigant visited 43 of the 58 GNI projects in the sample to verify measure installation. The primary objectives of the visits were to achieve visual verification of installed measures and to collect the data identified in the SSMVP, including installed quantities and type, equipment nameplate data, operating schedules, and a careful description of site conditions. For 37 of the 43 visited sites, Navigant also installed data loggers to measure runtime hours and/or energy consumption, downloaded energy consumption data, or completed a billing analysis using utility meter data.

The sample design for PY7 SEI projects used stratified ratio estimation similar to the method used in PY5 and PY6. Based on a combined PY7 population of 470 GNI projects, the final verified sample size for the PY7 evaluation was 58 GNI projects, with samples allocated by participation from each quarter and by stratum. The evaluation team designed the final GNI sample to exceed the required 85/15 confidence and precision at the program level with coefficients of variation chosen to reflect the PY4, PY5, and PY6 achieved relative precision targets.[[49]](#footnote-50) Navigant also added extra sites to meet the SWE’s request to exceed 90/10 confidence and precision and to better ensure the results meet the required 85/15 confidence and precision.

The evaluation team defined strata boundaries based participation data, and included approximately the top 33% of reported kWh savings in the large stratum, the middle 33% of reported kWh savings in the medium stratum, and the lower 33% of reported kWh savings in the small stratum. This sampling strategy is shown in Table 12‑2.

Table ‑: Smart Equipment Incentives (GNI) Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| GNI - Large | 7 | 85/15 | 7 | 7 | File review and impact verification |
| GNI - Medium | 65 | 85/15 | 14 | 32 | File review and impact verification |
| GNI - Small | 371 | 85/15 | 14 | 14 | File review and impact verification |
| GNI - Muni Lighting | 27 | 85/15 | 4 | 5 | File review and impact verification |
| **Program Total** | **470** | **85/15** | **39** | **58** | **File review and impact verification** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The evaluation team pulled the sample in three stages: after Q2 using both Q1 and Q2 data, after Q3, and after Q4. During each stage, the team reviewed the sample design and made adjustments as needed to ensure that the sample would meet the target confidence and precision. This process included reviewing the projects in the pipeline and estimating the number of projects that would be completed prior to the end of PY7. The percentage of total projects sampled during each stage was based on the number of completed projects in that stage as a proportion of the expected number of projects for the entire program year. Lastly, the team included all projects in the sample design, but only sampled from projects representing the top 98% of aggregate program savings. The team determined that sampling from the smallest projects representing the bottom 2% of aggregate program savings would be of limited value to the program evaluation. The team also worked to mitigate systematic uncertainty in the PY7 evaluation. The sources, examples, and strategies to mitigate systematic uncertainty are listed below.

* **Source:** Onsite metering

**Examples:** Uncertainty in the metering device itself, equipment placement, poor calibration

**Strategies to Mitigate:** Systematic uncertainty could have been found in the placement of lighting loggers. If the lighting loggers were not correctly placed, they may have been influenced by alternative lighting sources, including non-program-incentivized lighting or natural sunlight. To mitigate against this uncertainty, Navigant reviewed all logger data to ensure that it was reasonable. Navigant also decided to not use certain logger data if the information was not reasonably comparable with normal lighting use. Navigant ensured against systematic uncertainty in equipment by utilizing experienced field staff to deploy and ensure metering equipment was installed correctly.

* **Source:** Survey design

**Examples:** Incomplete information collected onsite, leading survey questions

**Strategies to Mitigate:** Systematic uncertainty could have been found in the collection of information while onsite. To prevent against any potential information lost, Navigant followed up with the customer on any uncertain items such as HOU, baseline questions, etc.

* **Source:** Human error during site visits

**Example:** Forgetting to complete a key field on the field form

**Strategies to Mitigate:** Systematic uncertainty could have been found in the information gathered while onsite. To prevent against this, Navigant trained field staff before completing onsite visits and also reviewed field forms to ensure that all proper information was collected from the field staff.

* **Source:** Sample design

**Examples:** Non-coverage errors, non-response bias, self-selection bias

**Strategies to Mitigate:** Navigant solicited the help of PECO to contact a few of the sampled sites. Navigant reviewed the sampled sites to ensure that it was representative of the entire population.

The evaluation team verified gross impacts for demand and energy through different approaches for the three categories of measures in this program: 1) deemed, 2) partially deemed, and 3) custom measures. The measures in these categories are defined by the TRM and IMP approved by the Pennsylvania PUC through the SWE team. The impacts for deemed measures were provided in the TRM or in an approved IMP. The evaluation approach for deemed measures was to verify both the installed quantity and that the installed measure matched the TRM-required specifications.

The TRM or approved IMP provided the algorithms and default assumptions for calculating the impacts and the variables to be verified for partially deemed measures. Depending on the complexity of the partially deemed measure, the evaluation team applied either a basic or enhanced level of rigor, as described in the applicable protocols and the Audit Plan. The evaluation team conducted an application and file review and developed a SSMVP for all partially deemed projects. The team completed site visits (or phone interviews if the criteria described above were satisfied) following the activities laid out in the SSMVP and calculated verified savings using the variables determined through the site visit or phone interview in accordance with the TRM or IMP.

For projects that included custom measures (defined as measures not included in the TRM or in an IMP, or measures that were initially reported as TRM measures but determined through the evaluation to be custom), the evaluation team conducted an application review, developed a SSMVP, and conducted a site visit. The primary difference was that there were no deemed variables and all custom measures followed an enhanced rigor level of effort.

The peak kW savings estimation methodology was consistent with the SWE’s requirements for each project.[[50]](#footnote-51) These requirements align with the PJM peak demand period defined as 2:00-6:00 p.m. on non-holiday weekdays during June, July, and August. The evaluation of PY7 projects included a review of program tracking data.

### Gross Verified Savings Results

In PY7, the SEI GNI program achieve a gross realization rate of 0.99 for energy. The program’s verified energy savings was 97,110 MWh/yr. The program-level relative precision was 7% at an 85% confidence interval, which meets the 15% relative precision goal for the program year. Each stratum independently achieved realization rates of 0.99, except the municipal lighting program, which had a realization rate of 1.00. The summary of the energy evaluation results is presented in Table 12‑3.

Table ‑: PY7 Smart Equipment Incentives (GNI) Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Reported Gross Energy Savings  (MWh/yr) | Energy Realization Rate  (%) | Verified Gross Energy Savings  (MWh/yr) | Observed CV or Proportion in Sample Design | Relative Precision at 85% Confidence Interval |
| GNI - Large | 38,351 | 0.99 | 38,118 | 0.10 | 0% |
| GNI - Medium | 38,488 | 0.99 | 38,292 | 0.20 | 4% |
| GNI - Small | 18,961 | 0.99 | 18,729 | 0.84 | 34% |
| GNI - Muni Lighting | 1,968 | 1.00 | 1,971 | 0.00 | 0% |
| PROGRAM TOTAL | **97,768** | **0.99** | **97,110** | **N/A** | **7%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Overall, the SEI GNI program achieved a gross realization rate of 1.04 for demand. The program’s verified demand savings was 21.4 MW. The program-level relative precision was 6% at an 85% confidence interval, which meets the 15% relative precision goal for the program year. Each stratum independently achieved realization rates of 1.01 for large projects, 1.10 for medium projects, 0.99 for small projects, and 0.00 for municipal lighting projects. The summary of the demand evaluation results is presented in Table 12‑4.

Table ‑: PY7 Smart Equipment Incentives (GNI) Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Reported Gross Demand Savings (MW)[1] | Demand Realization Rate (%) | Verified Gross Demand Savings (MW)[1] | Observed CV or Proportion in Sample Design | Relative Precision at 85% Confidence Interval |
| GNI - Large | 9.2 | 1.01 | 9.3 | 0.19 | 0% |
| GNI - Medium | 7.4 | 1.10 | 8.2 | 0.71 | 13% |
| GNI - Small | 4.0 | 0.99 | 4.0 | 0.50 | 21% |
| GNI - Muni Lighting | 0.0 | 0.00 | 0.0 | N/A | 0% |
| Program Total | 20.6 | 1.04 | 21.4 | N/A | 6% |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Through Navigant’s gross evaluation, Navigant found zero projects with major discrepancies. However, Navigant did find various differences between the ex ante and ex post savings estimates from using updated utility-metered data and trend data and finding differences in fixture quantities and fixture HOU and CFs. Table 12‑5 indicates the total number of discrepancies across the onsite inspections.

Table ‑: PY7 Smart Equipment Incentives (GNI) Onsite Inspections Summary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measure | Inspection Firm | Number of Inspections Planned | Number of Inspections Conducted | Number of Sites with Discrepancies from Reports | Resolution of Discrepancies |
| Lighting | Navigant/Mondre | 18 | 17 | 0 | N/A |
| HVAC | Navigant/Mondre | 12 | 12 | 0 | N/A |
| Motors and Drives | Navigant/Mondre | 6 | 6 | 0 | N/A |
| Custom | Navigant/Mondre | 2 | 2 | 0 | N/A |
| Mixed | Navigant/Mondre | 5 | 5 | 0 | N/A |
| TOTAL |  | **43** | **42** | **0** | **N/A** |

Source: Navigant analysis

## Impact Evaluation Net Savings

After Navigant calculated gross program impacts, the team derived net program impacts by estimating a NTG ratio to quantify the percentage of the gross program impacts that can reliably be attributed to the program.

### Net Verified Savings Methodology

The evaluation team calculated the final PY7 program NTG value using a system that weighted customer NTG responses based on the total kWh savings contributed to the SEI program during the program year. Table 12‑6 shows the sample design for the PY7 NTG research, and illustrates the need to weight the resulting NTG values, due to oversampling the small strata and undersampling large and medium strata.

Table ‑: Smart Equipment Incentives (GNI) Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Stratum | Stratum Boundaries | Population Size | Assumed CV or Proportion in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | Percentage of Sample Frame Contacted[1] to Achieve Sample |
| GNI Large | >= 500,000 kWh Total Savings | 25 | 0.50 | 85/15 | Attempted Census | 7 | 100% |
| GNI Small | < 500,000 kWh Total Savings | 137 | 0.50 | 85/15 | Attempted Census | 28 | 100% |
| Program Total | **N/A** | **162** | **N/A** | **85/15** | **Attempted Census** | **35** | **100%** |

[1] The sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Once the evaluation team estimated free ridership, Navigant calculated the NTG ratios, as illustrated in the following equation.

Equation ‑: Total NTG Ratio

*NTG Ratio = 1 – Free Ridership Rate*

The team assessed free ridership using a customer self-report approach following the SWE’s Common Approach for Downstream Programs.[[51]](#footnote-52) This approach uses a survey designed to assess the likelihood that participants would have installed some or all of the energy efficiency measures incented by the program, even if the program had not existed. Based on the ETO methodology, the SEI free ridership analysis included the following two elements of free ridership: 1) intention to carry out the energy efficient project without program funds; and 2) influence of the program in the decision to carry out the energy efficient project.

The total free ridership score illustrated in Equation 15‑2 is the sum of the intention and the program influence scores, resulting in a score ranging from 0 to 100. This score is divided by 100 to convert it into a proportion for application to gross savings values.

Equation ‑: Total Free Ridership

#### Intention Score

The intention score was assessed through several brief questions used to determine how the upgrade or equipment replacement likely would have differed if the respondent had not received the program assistance. The initial question asked the respondent to identify, out of a limited set of options, the option that best described what most likely would have occurred without the program assistance. Note that program assistance often includes more than just the incentive—it may also include audits, technical assistance, etc. The offered response options (typically four or five, and preferably no more than six) captured the following four general outcomes:

* Would have canceled or postponed the project, upgrade, or purchase
* Would have done something that would have produced savings, but not as much as those achieved through the upgrade or equipment replacement as implemented
* Would have completed the upgrade or equipment replacement as implemented
* Don’t know

The algorithm does consider respondents who said they would have canceled or postponed the project as free riders in terms of intention (a score of 0 for the intention score). The approach did consider respondents who indicated they would have done something that would have resulted in less energy savings as partial free riders in terms of intention (free ridership ranging from 12.5 to 37.5 for the intention component in the case of nonresidential programs). The respondents that indicated they would have undertaken the project as implemented without the program received a score based on how they would have paid for the upgrade. “Don’t know” responses were assigned the midpoint score of 25 for the intention component.

#### Program Influence Score

To assess the program influence score on the participant’s decision to implement energy efficiency improvements, Navigant asked respondents how much influence—on a scale of 1 (no influence) to 5 (great influence)—various program elements had on the decision to implement the project. The elements used to influence customer decision-making included program information, program incentives, interaction with program staff (technical assistance), and interaction with program proxies, such as members of a trade ally network.

A participant’s program influence score was then set to the participant’s maximum influence rating for any program element. The rationale was that if any given program element had a great influence score on the respondent’s decision, then the program itself had that level of influence, even if other elements had less influence. The program influence score and free ridership have an inverse relationship: the greater the program influence, the lower the free ridership, and vice versa.

Figure 15‑1 summarizes both the intention score and program influence score calculations for the SEI program. The figure shows the possible response combinations to the questions described in the intention score section and the value assigned to each unique combination. In addition, it shows the program influence score and possible answers to the 5-point scale along with the “don’t know” answers.

Figure ‑: Phase II Free Ridership Algorithm



Source: Navigant analysis

Spillover occurs when there are reductions in energy consumption or demand caused by the presence of the energy efficiency program, but which the program does not directly influence. The evaluation team asked program participants a battery of questions to quantitatively assess spillover. Below are examples of the spillover questions:

* Since your participation in the program, did you install any additional energy efficiency measures at this facility that did not receive incentives through any utility or government program?
* To the best of your knowledge, do you know when you installed the additional energy efficient equipment?
* Could you describe the energy efficiency measure installed?
* Thinking of the additional measure(s) you installed on your own at this same facility, how do the energy savings compare to what you installed through the program? Were the savings lower, about the same, or higher? (Probe for percentage as compared to all incented projects.)
* Since participating in the program, have you installed any energy efficient measures in other facilities within PECO’s territory?
* Thinking of these additional measure(s) you installed on your own at other facilities, how does the quantity compare to what you installed through the program? Did you install more, less, or the same amount of measures? (Probe for percentage as compared to all incented projects.)
* Have or will these measures receive incentives through the program?
* What were the reasons that they did not receive an incentive?

The battery of questions attempted to quantify all the savings from additional non-incented equipment installed after the respondent’s participation in the program. Additionally, the evaluation team included a question about the level of influence the program had on the respondent’s decision to install the additional measures. An example of the question is below.

* On a 0 to 5 scale, with 0 meaning “Not at all influential” and 5 meaning “Extremely influential,” how influential was your experience with PECO's program in your decision to install the additional energy efficient equipment?

The team assigned the influence rating a value, which determined what proportion of the measure’s energy savings were attributed to the program:

* A rating of 4 or 5 = 1.0 (full savings attributed to the program)
* A rating of 2 or 3 = 0.5 (half of the savings attributed to the program)
* A rating of 0 or 1 = 0 (no savings attributed to the program)

Where applicable, Navigant calculated the savings for each additional measure installed per the TRM. For measures not included in the TRM, the evaluator may conduct a brief engineering analysis to assess savings or to identify an alternative source and methodology for assessing savings.

Navigant calculated spillover for measures reported as the product of the measure savings, number of units, and influence score, as illustrated in Equation 12‑3. Navigant calculated all spillover estimates using customer self-reported data and did not conduct follow-up interviews or site visits.

Equation ‑: Spillover Savings from Installed Measures

For each of the above categories, the evaluators then totaled the savings associated with each program participant, to give the overall participant spillover savings reflected in Equation 12‑4.

Equation ‑: Overall Participant Spillover

*Participant SO = ΣMeasure SO*

The team then multiplied the mean participant spillover savings for the participant sample by the total number of participants to yield an estimated total participant spillover savings for the program. Equation 12‑5 shows the algorithm used to calculate spillover for the program.

Equation ‑: Spillover Savings for the Program

Population *N*

Finally, the team divided the total savings by the total program savings to yield a participant spillover percentage, as shown in Equation 12‑6.

Equation ‑: Participant Spillover Percentage

100

### Net Verified Savings Results

The SEI GNI NTG evaluation research in PY7 resulted in lower confidence and precision than planned, due to a low survey response rate among larger participants. Several of the largest participants failed to respond to the NTG survey, despite repeated requests from the evaluation team. This issue was compounded by the fact that several surveys were completed by contractors as opposed to decision makers, which resulted in those responses being omitted from the sample. This issue has been observed in previous evaluations as well, and is further discussed in Section 11.4 above.

In PY7, the Navigant team analyzed the responses of the online survey through which spillover was identified based on participant responses. Navigant designed the spillover survey questions to identify those cases where spillover was possible and to quantify the self-reported energy and demand savings from the spillover equipment installation.

As shown in Figure 12‑2, the Navigant team determined that of the 35 participants surveyed, 15 reported installing additional energy efficient equipment. Out of those 15 participants, nine participants either could not verify that the spillover projects were developed during PY7 or did not give enough information to estimate energy savings.

While the spillover analysis revealed a high percentage of self-reported activity, only four participants provided enough information to quantify spillover; the spillover calculated was 0.01.

Figure ‑: PY7 Smart Equipment Incentives (GNI) Spillover Results Illustration

17% of sample had qualified spillover

Source: PY7 NTG participant surveys

Table 12‑7 shows the results of the PY7 NTG research.

Table ‑: PY7 Smart Equipment Incentives (GNI) Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Estimated Free Ridership | Estimated Participant Spillover | NTG Ratio | Observed CV or Proportion | Relative Precision |
|
| GNI Large | 0.64 | 0.01 | 0.37 | 0.82 | 51% |
| GNI Small | 0.29 | 0.00 | 0.72 | 0.32 | 9% |
| Program Total | **0.58** | **0.01** | **0.43** | **N/A** | **41%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Process Evaluation

The evaluation team conducted multiple research activities in support of the SEI PY7 process evaluation. Navigant evaluated the SEI GNI and C&I participant groups together; thus, the results of the process evaluation are presented identically in both SEI sections of this report.

### Process Evaluation Methodology

The process evaluation research activities included the following:

* Program marketing plan review
* Tracking system review
* Interviews with three PECO program management staff, and four implementation contractor staff
* Seven interviews with distributors and other market actors
* Online surveys with 35 participating GNI customers

The sampling strategy for the process evaluation activities are presented in Table 12‑8.

Table ‑: Smart Equipment Incentives (GNI) Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Stratum | Population Size | Assumed Proportion or CV in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | Percentage of Population Frame Contacted to Achieve Sample | Used for Evaluation Activities (Impact, Process, NTG) |
| PECO Program Managers | 3 | N/A | N/A | 3 | 3 | 100% | Process Evaluation |
| Implementation Contractors | 4 | N/A | N/A | 4 | 4 | 100% | Process Evaluation |
| Distributor/ Trade Allies | Unknown | N/A | N/A | 7 | 7 | 100% | Process Evaluation |
| Program Total | **N/A** | **N/A** | **N/A** | **14** | **14** | **100%** | **Process Evaluation** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Evaluation Results

The SEI program was successful at moving its measure mix toward non-lighting measures in PY7, and it is encouraging some changes within the market. In summary, the Phase II SEI program strategy worked, but to have a greater market impact in Phase III, PECO will need to add implementation tactics to increase market transformation. The results of the SEI process evaluation are as follows:

1. **Finding:** the SEI program participants vary widely across business sizes, types, and other defining characteristics. As the SEI incentive levels will be reduced in Phase III, PECO may need to find ways to add value to the program for its varied customers in order to maintain high levels of participation. For example, the needs of a church are different from those of a small business.
   1. **Recommendation:** Segment the eligible customer population further to explore the value of the SEI program, and identify marketing or outreach approaches to reach each segment effectively.
2. **Finding:** Based on program staff interviews, the trade ally incentive program succeeded in PY7 by rewarding trade allies for completing a certain number of projects through the SEI program. This approach is a great tool to encourage trade allies to engage in the program and pursue projects. It does not, however, provide control over what types of projects or customers are engaged by trade allies. The participating trade allies are often larger companies themselves that may have the ability to pursue and leverage projects regionally or nationwide. These trade allies, while skilled at completing rebate applications, may shift their business strategy in Phase III to focus on other utility regions where incentives are richer in response to PECO’s lower incentive levels. This leaves an opportunity to engage more local contractors in the program.
   1. **Recommendation:** Change the trade ally incentives program to incent targeted project types or customer segments.
   2. **Recommendation:** Conduct additional outreach to engage new trade allies in the program (especially local contractors, who are less likely than larger companies to transfer their focus to projects in other states where incentives are richer).
3. **Finding:** SEI has a goal of bringing in a diverse measure mix, focusing on achieving a higher percentage of non-lighting projects. In Phase II, SEI succeeded at reducing the percentage of lighting projects from PY5 to PY7, increasing custom projects. In Phase III, an increased focus on prescriptive measures could aid in the effort to encourage non-lighting projects, but the decreased incentive levels might mean a decrease in these non-lighting measures, as engineering costs will remain high.Interviews and survey responses indicate that in some cases, PY7 incentive levels barely covered the cost of the engineering requirements in the rebate application.
   1. **Recommendation:** Increase assistance to participants and trade allies with completing required documentation and TRM worksheets for custom projects.
4. **Finding:** The “limited time offer” marketing effort was very successful. It encouraged undecided participants to apply earlier and contributed to projects finishing earlier than anticipated. The offer brought in more projects in February and March, rather than later in May and June.
   1. **Recommendation:** Use the “limited time offer” as a lever in future years if participation is low.
5. **Finding:** The project database and application process has improved over Phase II, but there are additional changes that could be made to streamline applications in Phase III. For example, threshold metering sites were not always correctly or quickly identified which caused evaluation challenges. Overall, the database contains many columns that Navigant does not need for analysis.
   1. **Recommendation:** PECO should require the CSP to build in a "flag" in its project database that identifies if a site is a threshold metering project. The CSP should then send over the project files to the evaluation team as soon as they are entered into the system rather than waiting for the quarterly data transfer.
   2. **Recommendation:** Streamline database by limiting number of fields, removing unnecessary fields, and ensuring accuracy of dates entered. Assess data requirements of all relevant parties (PECO, SWE, and Navigant) and only include required fields.

## Status of Recommendations for Program

The evaluation team used various analytical methods to complete the evaluation, including performing a gross impact evaluation; program materials review; tracking system review; a verification and due diligence review; interviews with PECO program managers and implementation contractor staff; participant surveys; and market actor interviews. Table 12‑9 lists a summary of each recommendation along with the PECO status.

Table ‑: Smart Equipment Incentives (GNI) Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1: Segment population further to explore the value of the SEI program and identify marketing or outreach approaches to reach the harder to reach segments. Develop marketing approaches for specific business types to cater to the needs of that segment. | **Implemented:** PECO has been working on a robust marketing plan to target the industrial and commercial sector areas that are hard to reach. |
| Recommendation 2:  a. Change the trade ally incentives program to incent targeted project types or customer segments.  b. Outreach to engage new trade allies in the program (especially local contractors, who are less likely to pursue projects in other states where incentives are richer). | **Implemented:** In Phase III, PECO revised the program design to incent the trade ally’s on a project or customer basis, to offer a comprehensive solution as oppose to measure based approach. |
| Recommendation 3: Increase assistance with completing required documentation and TRM worksheets for custom projects. | **Implemented:** PECO is offering “hand-held” assistance with translating the TRM specifications for custom projects. |
| Recommendation 4: Use the “limited time offer” as a lever in future years if participation is low. | **Implemented:** PECO is working with EEMF to establish a lever to have better controls around program participation. |
| Recommendation 5:  a. PECO should require the implementer to build in a "flag" in its project database that identifies if a site is threshold metering. The implementer should then make sure to send over the project files to evaluator as soon as they are entered into the system.  b. Streamline database by limiting number of dates and removing unnecessary fields. Assess data requirements of all relevant parties (PECO, SWE, and Navigant) and only include required fields. | **Being Considered:** Working with tracking system vendor to capture these features in the next Phase. |

Source: Navigant analysis

## Financial Reporting

A breakdown of the program finances (by program) is presented in Table 12‑10.

Table ‑: Summary of Smart Equipment Incentives (GNI) Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| Row # | Cost Category | Actual PYTD  Costs | Actual Phase II  Costs |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 24,161 | 34,664 |
| 2 | EDC Incentives to Participants | 9,114 | 12,977 |
| 3 | EDC Incentives to Trade Allies | 0 | 0 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 15,047 | 21,687 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10) | 2,803 | 8,383 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance**[1]** | 2,633 | 8,213 |
| 8 | Marketing**[2]** | 170 | 170 |
| 9 | EDC Evaluation Costs | 0 | 0 |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | **0** | **0** |
|  | | | |
| 12 | Total TRC Costs[3] (Sum of Rows 1, 5, and 11) | 26,964 | 43,048 |
| 13 | Total NPV Lifetime Energy Benefits | 58,367 | 81,360 |
| 14 | Total NPV Lifetime Capacity Benefits | 11,191 | 13,224 |
| 15 | Total NPV TRC Benefits[4] | 69,659 | 94,697 |
|  | | | |
| 16 | TRC Benefit-Cost Ratio[5] | 2.58 | 2.20 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart Construction Incentives

The PECO Smart Construction Incentives (SCI) program is designed to instill and accelerate adoption of energy efficient design and construction practices so that new C&I facilities in PECO’s territory are more energy efficient than the current stock. The program covers both new construction and buildings undergoing major renovation, which PECO defines as construction projects that involve the complete removal, redesign, and replacement of two or more major building systems. The target markets for the SCI program include customer organization decision makers, renovation contractors, and developers. The program provides facility designers and builders with training, design assistance, and financial incentives to incorporate energy efficient systems into their building designs. The eligible customer population for the program includes all C&I and GNI new construction and major renovation projects in PECO’s service territory or accounts provided with electricity by PECO, including GNI facilities.

PECO hired a CSP, DNV GL, to implement and market the SCI program throughout the PECO service territory. In PY7, the CSP continued its previously developed outreach strategies by engaging with customers and contractors. In PY7, the SCI program completed 181 projects. Of these 181 projects, 137 were in the C&I sector and 44 were in the GNI sector.

## Program Updates

PECO did not make any major updates to the SCI program in PY7 and continued to build on its plan by implementing outreach, marketing, and trade ally relations efforts from PY5 and PY6. PECO rebuilt and recharacterized its trade ally network in the middle of PY6, ensuring that all trade allies were fully committed to the effort. PECO vetted the trade allies through in-depth surveys and verified references; trade allies were also provided with trainings to ensure complete buy-in. These strategies helped increase program participation in PY7 to attain a significantly higher percentage of the program year goal than in previous years. Program managers are confident that these strategies will continue to provide benefit the new construction sector into Phase III.

### Definition of Participant

PECO defines each participant of the SCI program by a completed project. Each project may include the installation of one or more measures, and each can be of different measure types.

## Impact Evaluation Gross Savings

The SCI program achieved PY7 verified gross energy and demand savings of 22,995 MWh and 3.7 MW, respectively. The total reported energy savings for Phase II were 45,254 MWh, reported gross demand savings were 8 MW. Table 13‑1 shows the Phase II savings and incentive results for the SCI program by customer sector.

Table ‑: Phase II Smart Construction Incentives Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh/yr)** | **Reported Gross Demand Reduction (MW) [2]** | **Verified Gross Energy Savings (MWh/yr)** | **Verified Gross Demand Reduction (MW/yr) [2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 0 | 0 | 0 | 0 | 0 | $0 |
| Residential (Low-Income) | 0 | 0 | 0 | 0 | 0 | $0 |
| Small C&I | 137 | 9,657 | 2.0 | 9,129 | 1.6 | $893 |
| Large C&I | 78 | 23,366 | 4.1 | 22,516 | 3.3 | $2,662 |
| GNI | 68 | 12,231 | 2.0 | 11,703 | 1.7 | $1,547 |
| **Phase II Total** | **283** | **45,254** | **8.0** | **43,348** | **6.6** | **$5,102** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

The gross impact evaluation consisted of a combination of desk reviews, telephone verifications, onsite verifications, and building energy models for a sample of projects.

1. **Desk review and telephone verification.** Navigant conducted desk reviews for all projects in the evaluation sample. The desk reviews made use of project applications, project-specific analysis files and associated calculation sheets, measure invoices, measure specification sheets, construction plans, and other construction documents provided by PECO. Documentation included scanned files of hard copy forms, as well as electronic files of CSP inspection reports, photos of installed measures, important emails, and memoranda. For whole-building projects, PECO also provided the executable modeling files and related model output files. The evaluation team supplemented the desk reviews with telephone verification or onsite verification. The telephone verification consisted of interviewing customers about their projects, the quantities and type of each measure installed, the operating status of the measures, equipment nameplate data, operating schedules, a careful description of site conditions, and overall verification of the information contained in the project files.
2. **Desk review and onsite M&V.** Navigant conducted onsite verification for all projects in the Large and Large Whole-Building sample strata. The team also conducted onsite verification for complex projects in the Small and Small Whole-Building strata where project documentation was insufficient for verification via desk review or telephone interview. Large projects are those with reported annual savings of at least 250,000 kWh, while smallprojects are those with reported annual savings values below 250,000 kWh. Navigant also conducted onsite verification for projects where the 2015 PA TRM required a detailed inventory, such as lighting projects with demand savings greater than 20 kW. The primary objective of the site visits was to collect the data identified in the SSMVPs, including verification of installed measure quantities and type, equipment nameplate data, operating schedules, and a careful description of site conditions. Navigant achieved the verification through visual inspection of the measures and by interviewing the customers. For projects that surpassed the expected kWh savings thresholds set in Table 1-2 of the 2015 PA TRM, the evaluation team collected site-specific information for open variables used in the calculation of energy and demand savings. Site-specific information included end-use metered data and trend data from a building management system.
3. **Whole-building energy modeling.** Navigant verified the building models for all projects in the Small Whole-Building and Large Whole-Building strata. This analysis included comparing model inputs to verified parameters and making adjustments to modeled savings as needed. In all cases, PECO provided the executable modeling files and Navigant was able to directly adjust the original models.
4. **Onsite inspections.** The evaluation team conducted onsite verification for a total of 20 projects in the PY7 evaluation sample. Of these projects, five were in the Large stratum, eight were in the Large Whole-Building stratum, six were in the Small stratum, and one was in the Small Whole-Building stratum. The onsite verification of these 20 projects aligns with the SCI evaluation plan for Phase II, which states that Navigant will conduct onsite verification for all sampled projects in the top whole-building strata (Large Whole-Building) and the top non-whole-building strata (Large). In addition, the evaluation plan states that Navigant may support verification by gathering supplemental information or performing onsite verification for other whole-building projects (Small Whole-Building stratum) and projects for which project files are unclear (Small Whole-Building and Small strata).

Navigant selected a sample of projects for the impact evaluation by following a dynamic sampling methodology executed on a batch-wise basis. This approach used a stratified random sample of projects from the population of program participants in the PY7 tracking database. The evaluation team conducted sampling activities after Q2, Q3, and Q4. The sample design targeted program-level confidence and precision of 85/15 (two-tailed) based on the kWh savings for measures incented by the SCI program and reported in PY7. The original sampling strategy used in PY7 is presented in Table 13‑2.

Table ‑: Smart Construction Incentives Original Sampling Strategy for PY7

| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| --- | --- | --- | --- | --- | --- |
| Large | 26 | 85/15 | 11 | 10 | Desk review and onsite M&V |
| Small | 142 | 85/15 | 13 | 13 | Desk review and telephone verification |
| Large Whole-Building | 11 | 85/15 | 4 | 7 | Desk review, onsite M&V, and whole-building energy model |
| Small Whole-Building | 3 | 85/15 | 2 | 2 | Desk review, telephone verification and whole-building energy model |
| **Program Total** | **182** | **85/15** | **30** | **32** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

While conducting site visits on several Q4 projects, Navigant found that five of 10 visited sites were either not fully complete or not fully occupied, despite having passed the TRM-mandated deadline for completion and occupancy to be counted towards Phase II. The savings for these projects were credited with PY7 verified savings according to TRM protocol, but the accompanying realization rates were low, as Navigant only counted savings in spaces that were both fully complete and fully occupied.

Navigant determined that the best course of action for extrapolating the realization rates related to this finding to the entire PY7 population would be to create separate strata for Q4 and dead-zone (DZ) projects, as project incompletion was not an issue in any of the visited Q1, Q2, or Q3 sites. DZ projects are those that were completed in Q4, but too late to be included in the standard final program quarterly data extract for sampling. Table 13‑3 shows the modified sampling strategy used in PY7.

Table ‑: Smart Construction Incentives Modified Sampling Strategy for PY7

| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Achieved Sample Size** | **Evaluation Activity** |
| --- | --- | --- | --- | --- |
| Large Q1-Q3 | 13 | 85/15 | 7 | Desk review and onsite M&V |
| Large Q4-DZ | 13 | 85/15 | 3 | Desk review and onsite M&V |
| Small Q1-Q3 | 80 | 85/15 | 8 | Desk review and telephone verification |
| Small Q4-DZ | 62 | 85/15 | 5 | Desk review and telephone verification |
| Large Whole-Building Q1-Q3 | 7 | 85/15 | 5 | Desk review, Onsite M&V, and whole-building energy model |
| Large Whole-Building Q4-DZ | 4 | 85/15 | 2 | Desk review, onsite M&V, and whole-building energy model |
| Small Whole-Building Q1-Q3 | 3 | 85/15 | 2 | Desk review, telephone verification, and whole-building energy model |
| **PROGRAM TOTAL** | **182** | **85/15** | **32** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Results

Overall, the SCI program achieved PY7 gross realization rates of 0.87 for energy and 0.72 for demand. Given the modified stratification approach to accommodate the multiple incomplete projects found in the Q4 sample, the achieved program-level relative precision was 29% at 85% confidence interval for energy and 22% relative precision at 85% confidence interval for demand. The program therefore did not meet the goal of 15% precision at 85% confidence for either energy or demand. This is due to the decision to re-stratify the population in order to most accurately estimate the program-level energy savings after the incomplete projects uncovered in Q4.

While the program did not achieve the required PY7 sampling statistics, Navigant believes the modified sample stratification is the most appropriate approach to estimating savings for the program given the findings for the Q4 wave, which showed a significant difference from the Q1-Q3 sample waves. While the sampling statistics were not met for PY7, they were met for the SCI program over the course of the phase. The summary of verified savings results for energy and demand is presented in Table 13‑4 and Table 13‑5, respectively.

Table ‑: PY7 Smart Construction Incentives Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Reported Gross Energy Savings  (MWh/yr) | Energy Realization Rate  (%) | Verified Gross Energy Savings  (MWh/yr) | Observed CV or Proportion in Sample Design | Relative Precision at 85% Confidence Interval |
| Large Q1-Q3 | 6,229 | 1.14 | 7,117 | 0.55 | 23% |
| Large Q4-OT | 5,970 | 0.15 | 895 | 1.03 | 118% |
| Small Q1-Q3 | 4,275 | 1.07 | 4,573 | 0.32 | 17% |
| Small Q4-OT | 3,852 | 1.22 | 4,713 | 0.36 | 28% |
| Large Whole-Building Q1-Q3 | 4,150 | 1.10 | 4,553 | 0.36 | 15% |
| Large Whole-Building Q4-OT | 1,599 | 0.42 | 676 | 0.76 | 159% |
| Small Whole-Building Q1-Q3 | 470 | 1.00 | 469 | 0.00 | 0% |
| Small Whole-Building Q4-OT | 0 | N/A | 0 | N/A | 0% |
| Program Total | **26,545** | **0.87** | **22,995** | **N/A** | **29%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table ‑: PY7 Smart Construction Incentives Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Reported Gross Demand Savings  (MW) [1] | Demand Realization Rate  (%) | Verified Gross Demand Savings  (MW)[1] | Observed CV or Proportion in Sample Design | Relative Precision at 85% Confidence Interval |
| Large Q1-Q3 | 1.2 | 0.91 | 1.1 | 0.46 | 19% |
| Large Q4-OT | 1.2 | 0.14 | 0.2 | 0.72 | 83% |
| Small Q1-Q3 | 1.0 | 0.95 | 0.9 | 0.29 | 16% |
| Small Q4-OT | 0.8 | 0.73 | 0.6 | 0.46 | 35% |
| Large Whole-Building Q1-Q3 | 0.5 | 1.17 | 0.6 | 0.45 | 19% |
| Large Whole-Building Q4-OT | 0.3 | 0.42 | 0.1 | 0.61 | 127% |
| Small Whole-Building Q1-Q3 | 0.1 | 2.10 | 0.1 | 0.46 | 78% |
| Program Total | **5.1** | **0.72** | **3.7** | **N/A** | **22%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The SCI program completed site inspections for 20 projects in PY7, in accordance with the evaluation plan. Warren Energy Engineering, an evaluation team member, conducted six of the inspections, and Navigant conducted the remaining 14 inspections. In most cases, the onsite verification team verified that equipment was installed and in operation within a fully occupied space; however, five of 10 Q4 sites failed the inspection process with regard to project completion or partial occupancy. Navigant credited the program with verified savings only in the portions of each project that were complete and occupied in accordance with the PA TRM requirements for commercial date of operation (CDO) for new construction projects. As a result, four of the five projects achieved realization rates of 40% or lower.

In addition to the adjustments for completion percentage, the verification team used data it gathered to adjust the inputs for open variables in the calculation of verified energy and demand savings. The parameter the team updated most frequently was equipment hours of operation. Navigant adjusted open variables for most of the 20 projects that were verified onsite.

Table 13‑6 summarizes the site inspection activities and results for PY7.

Table 13‑6: PY7 Smart Construction Incentives Onsite Inspections Summary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measure | Inspection Firm | Number of Inspections Planned | Number of Inspections Conducted | Number of Sites with Discrepancies from Reports | Resolution of Discrepancies |
| Whole-Building, HVAC, Lighting, Motors and Drives, Custom, Refrigeration | Navigant Consulting | 14 | 14 | 4 | For projects not fully complete and occupied by 5/31/2016, verified savings accrued only in portions of the project that were both complete and fully occupied. |
| Whole-Building, HVAC, Lighting, Motors and Drives, Custom, Refrigeration | Warren Energy Engineering | 6 | 6 | 1 | For projects not fully complete and occupied by 5/31/2016, verified savings accrued only in portions of the project that were both complete and fully occupied. |

Source: Navigant analysis

## Impact Evaluation Net Savings

Navigant quantified, in detail, the NTG ratio during PY6 in accordance with the Phase II evaluation plan. There are no significant factors leading Navigant to believe that the NTG ratio should change for PY7. Details of the PY6 NTG methodology and calculations can be found in Section 13.3 of the PY6 Annual Report. The results from the PY6 NTG research are shown in Table 13‑7. The overall SCI NTG ratio from the PY6 evaluation was 0.52. This is the NTG value that was applied to the PY7 verified gross savings to estimate net savings for PY7.

Table ‑: PY6 Smart Construction Incentives Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Estimated Free Ridership | Estimated Participant Spillover | NTG Ratio | Planned CV or Proportion | Relative Precision |
|
| Small | 0.69 | 0.00 | 0.31 | 0.50 | 46.5% |
| Medium | 0.43 | 0.00 | 0.57 | 0.50 | 12.5% |
| Large | 0.35 | 0.00 | 0.65 | 0.50 | 17.3% |
| PROGRAM TOTAL[1] | **0.48** | **0.00** | **0.52** | **0.50** | **9.5%** |

[1] NTG ratio at the program level should be developed using stratum weight and stratum NTG ratios.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Net Verified Savings Results

Accounting for the individual NTG ratios of the different program strata as well as an overall program NTG ratio of 0.52, the SCI program achieved PY7 net savings of 13,193 MWh for energy and 2.1 MW for demand. For Phase II as a whole, the program achieved net savings of 25,072 MWh for energy and 3.7 MW for demand. A summary of net savings results can be seen in Table 13‑8.

Table ‑: PY7 and Phase II Smart Construction Incentives Summary of NTG Savings Results

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Phase II Overall | Gross Verified Energy (MWh) | Gross Verified Demand (MW) | NTG (from PY6) | Net Verified Energy (MWh) | Net Verified Demand (MW) |
| Small C&I | 9,129 | 1.6 | 0.31 | 2,830 | 0.5 |
| Large C&I | 22,516 | 3.3 | 0.65 | 14,635 | 2.1 |
| GNI | 11,703 | 1.7 | 0.65 | 7,607 | 1.1 |
| TOTAL | **43,348** | **6.6** | **0.52** | **25,072** | **3.7** |
| PY7 | **Gross Verified Energy (MWh)** | **Gross Verified Demand (MW)** | **NTG (from PY6)** | **Net Verified Energy (MWh)** | **Net Verified Demand (MW)** |
| Small C&I | 5,160 | 0.9 | 0.31 | 1,600 | 0.3 |
| Large C&I | 11,427 | 1.7 | 0.65 | 7,428 | 1.1 |
| GNI | 6,409 | 1.0 | 0.65 | 4,166 | 0.7 |
| TOTAL | **22,995** | **3.7** | **0.52** | **13,193** | **2.1** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

*Source: Navigant analysis*

## Process Evaluation

In accordance with the evaluation plan and in conjunction with the extensive process evaluation activities conducted in prior years, the evaluation team conducted multiple research activities in support of a high-level process evaluation in PY7. These research activities included an interview with PECO program management staff and two interviews with CSP staff.

### Process Evaluation Methodology

Navigant limited the PY7 process research to interviews with PECO and CSP staff. The evaluation team conducted these in-depth interviews in February 2016. Navigant designed the interview guides to enable the evaluation team to ask questions about the program’s administration and delivery during PY7, and to obtain real-time information about current program activity through open-ended questions that created a free-flowing conversation. To aid in making these interviews informative, the evaluation team also reviewed current program reporting documents and marketing plans and materials in advance. Table 13‑9 summarizes these process evaluation activities.

Table ‑: Smart Construction Incentives Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Stratum | Population Size | Assumed Proportion or CV in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | Percentage of Population Frame Contacted to Achieve Sample | Used for Evaluation Activities (Impact, Process, NTG) |
| Program Manager | 1 | N/A | N/A | 1 | 1 | 100% | Process |
| Program CSP | 2 | N/A | N/A | 2 | 2 | 100% | Process |
| Program Total | 3 | N/A | N/A | 3 | 3 | 100% | Process |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Findings and Recommendations

Based on the evaluation activities conducted in PY7, Navigant presents the following process findings and recommendations:

1. **Finding:** During the course of the site inspection process, the evaluation team found several incomplete projects, especially in Q4. Ten Q4 projects received site visits, of which the evaluation team found five projects to be less than 100% complete and/or less than 100% occupied. At these sites, either some of the equipment still needed to be installed or the building had yet to be fully occupied by the end of the PY7 deadline. Navigant credited the program with verified savings only in the portions of each project that were complete and occupied in accordance with the PA TRM requirements for CDO for new construction projects. As a result, four of the five projects achieved realization rates of 40% or lower, resulting in lower whole-program realization rates, delayed savings opportunities, and increased spending, as the incentives paid for these projects did not end up contributing to the overall savings portfolio for Phase II. The energy savings realization rates dropped from over 112% (had the buildings been fully complete and occupied) to 87% as verified in the current states of completion and occupancy.

Navigant identified several root causes of the incomplete or partially occupied projects. These include the overzealous pursuit of projects despite tight deadlines by the CSP, empathy for customers rushing to be included in Phase II of the program, internal confusion at the CSP about TRM rules for completion and occupancy, and slightly ambiguous language in the program application about certificates of occupancy. In addition, the CSP M&V team only selected a subset of the project population to receive post-installation inspections (which would have alerted the program manager of a project’s completion status) and post-installation inspection reports were frequently not reviewed in detail by program and CSP management staff beyond ensuring their existence.

* 1. **Recommendation:** To the extent possible, PECO should ensure that all reported projects are fully completed and operational before completing the incentive process. Doing so will increase the effectiveness of the incentives paid out by the program, while reducing the risk associated with missing out on the overall regulatory mandates. Navigant recommends specific steps to achieve this goal:
* Re-emphasize the specific completion and occupancy rules in the TRM each year during program kickoff meetings
* Include the TRM occupancy requirement and explicit CDO deadline on the application
* Exclude projects that are unlikely to meet the CDO deadline for either completion or occupancy
* Schedule simple walkthrough post-install inspections for more (or all) sites
* Strengthen the review process of post-install inspection documents to emphasize both completion and occupancy

1. **Finding:** The SCI program greatly improved upon its prior Phase II performance in PY7, in part due to the program’s PY6 efforts to identify and requalify committed trade allies. The actions taken in December 2014 included rebuilding the trade ally database from scratch by conducting surveys, collecting and checking trade ally references, conducting training activities, and creating a peering program to ensure the alignment of goals and achievement of trade ally incentive targets. Interviews with the CSP revealed a strong feeling that the encouraging performance in PY7 was most likely a product of an improved trade ally network. Program managers are confident that these strategies will continue to provide benefit in the new construction sector well into Phase III.
   1. **Recommendation**: Continue to leverage strong relationships with committed trade allies to achieve and maintain greater participation in the program. Participation in professional trade organizations has been among the most effective means of increasing program awareness. These methods place an emphasis on talking to potential participants one-on-one about the program, developing relationships, and asking about specific projects that might be applicable and of interest to the program and to the client. PECO has already been sourcing potential trade allies through reports from Dodge Data & Analytics and by hosting trade ally open house events. The continuation of such activities is highly encouraged.
2. **Finding**: The new construction projects that participate in the SCI program have long lead times and require consistent and committed long-term partners to guide them through the program. Looking at the improvements in participation from PY5 through PY7, the program appears to have a long ramp up in performance that appears somewhat likely to continue into Phase III.
   1. **Recommendation**: Continue to provide early and continuous outreach efforts, especially for new construction projects. Treat each project as a long-term relationship and avoid using the new construction portfolio as a lever to ramp up or ramp down program-wide energy savings.
3. **Finding:** The SCI program has consistently relied on lighting to achieve a majority of its savings and looks to continue with a similar end-use portfolio. The overall Phase II end-use breakdown includes over 75% of the portfolio coming from either lighting or custom projects. In practice, the custom project type has also tended to include a majority of lighting savings. The planned Phase III breakdown of project end uses is similar, with lighting and whole-building contributing roughly 75% of the program’s total savings again.
   1. **Recommendation:** Strive for measure end-use diversification and ensure that whole-building projects are saving energy in more ways than just lighting. It is important to think about program diversification as LED lighting becomes codified and lighting energy savings relative to code becomes more difficult to achieve. Structuring incentives toward projects with end uses other than lighting will help to smooth the transition away from lighting as a source of easy energy savings. A high diversity in the types of projects also is an indirect indicator of the success of the marketing program and the awareness created by greater market penetration.

## Status of Recommendations for Plug-in

The evaluation team’s recommendations for the SCI program are provided in Table 13‑10. These recommendations are based on the results of the PY7 evaluation and PECO’s vision for the program going forward into Phase III.

Table ‑: Smart Construction Incentives Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1: Ensure that all projects are complete before the close of the incentive process:   * Set clear occupancy expectations when qualifying projects * Re-emphasize TRM rules to the entire team * Strengthen post-install inspection protocol * Strengthen post-install documentation review | **Being Considered:** PECO will ensure that these point are refined and implemented going into Phase III. CSP and program managers will be held accountable to institute protocols. |
| Recommendation 2: Leverage strong relationships with committed trade allies to achieve greater program participation. Continue trade ally training and recruitment as a tool to sustain current program performance. | **Implemented:** Strengthening the trade ally training and recruitment to maintain existing and form new relationships. |
| Recommendation 3: Provide early and continuous outreach efforts, especially for new construction projects. Avoid using new construction as a lever for portfolio-level savings. | **Implemented:** This recommendation was implemented in late stages of the Phase II plan. However, the wait list in Phase II pushed the program behind schedule and it became difficult to capture early stage projects. |
| Recommendation 4: Strive for greater measure end-use diversification in Phase III (with special emphasis away from lighting projects). | **Implemented:** The whole building model approach was designed to create projects that are more comprehensive. |

Source: Navigant analysis

## Financial Reporting

The SCI program achieved a TRC benefit-cost ratio of 1.38 in PY7. This shows that the program continues to operate cost-effectively. A breakdown of the program finances is presented in Table 13‑11.

Table ‑: Summary of Smart Construction Incentives Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| Row # | Cost Category | Actual PYTD  Costs | Actual Phase II  Costs |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 12,122 | 21,034 |
| 2 | EDC Incentives to Participants | 2,585 | 4,602 |
| 3 | EDC Incentives to Trade Allies | 248 | 501 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 9,289 | 15,932 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10 ) | 1,194 | 3,529 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance**[1]** | 1,102 | 3,437 |
| 8 | Marketing**[2]** | 92 | 92 |
| 9 | EDC Evaluation Costs | 0 | 0 |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| 12 | Total TRC Costs[3] (Sum of Rows 1, 5, and 11) | 13,316 | 24,563 |
| 13 | Total NPV Lifetime Energy Benefits | 16,197 | 30,578 |
| 14 | Total NPV Lifetime Capacity Benefits | 2,115 | 3,757 |
| 15 | Total NPV TRC Benefits[4] | 18,312 | 34,335 |
|  | | | |
| 16 | TRC Benefit-Cost Ratio[5] | 1.38 | 1.40 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission and distribution capacity and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart Multi-Family Solutions Program

The PECO Smart Multi-Family (SMF) Solutions program’s purpose is to increase awareness of energy savings opportunities in multifamily buildings and to assist multifamily tenants and property owners/managers (referred to as landlords in the remainder of this report) to act on those opportunities. PECO designed this program to encourage and assist customers by offering two main participation channels. The DI channel offers cost-free CFL, low-flow showerhead, and low-flow faucet aerator direct installation in apartment units/condos (units) or common areas. The prescriptive channel offers incentives to multifamily landlords who install high efficiency equipment in common areas.

A major barrier to energy efficient measure adoption in multifamily buildings is the division of responsibilities between landlords and tenants. Landlords are responsible for building improvements, but they usually are not the ones paying the energy bills for tenant spaces. Therefore, they do not reap the benefits of installing more expensive energy efficient measures within those spaces. This is also known as the split incentive issue. The issue often results in energy efficiency becoming a low priority item for both landlords and tenants. The SMF Solutions program helps PECO overcome the split incentive issue by including cost-free DI measures, which helps landlords save capital to potentially spend on the program’s prescriptive channel offerings.

The evaluation team analyzed the SMF Solutions program’s residential and nonresidential sectors separately; this section includes results for both sectors. The residential sector includes a sub-population of low-income participants. The nonresidential sector includes participants from the C&I and GNI segments.

## Program Updates

PECO has not made any major changes to the SMF Solutions program offerings outlined in the Phase II evaluation plan.

### Definition of Participant

For reporting purposes, PECO defines the participant count as the number of individual utility accounts impacted by SMF Solutions program projects. In the residential sector, a single utility account corresponds to an individually metered apartment unit or condo. In the nonresidential sector, a single utility account could correspond to either a property’s common or office areas, a group of master metered units, or a group of third-party units.

## Impact Evaluation Gross Savings

In Phase II, the SMF Solutions program serviced a total of 22,338 PECO customers, and Navigant verified 16,835 MWh of gross energy savings and 1.8 MW of gross demand savings. Table 14‑1 provides the reported and verified savings totals at the close of Phase II.

Table ‑: Phase II Smart Multi-Family Solutions Program Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector [1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW) [2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW) [2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 21,479 | 7,873 | 0.9 | 7,436 | 0.8 | $0 |
| Residential (Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Small C&I | 736 | 4,989 | 0.5 | 4,853 | 0.5 | $0 |
| Large C&I | 75 | 3,736 | 0.4 | 3,526 | 0.4 | $0 |
| GNI | 48 | 1,139 | 0.1 | 1,020 | 0.1 | $0 |
| **PHASE II TOTAL** | **22,338** | **17,737** | **1.9** | **16,835** | **1.8** | **$0** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

The gross impact evaluation consisted of several steps. The evaluation team conducted file reviews and telephone surveys with participants for verbal verification of DI measure installation. The team then conducted onsite visits for a subset of telephoned participants for enhanced verification. The evaluation team also verified the ex ante savings algorithm’s adherence to the TRM for the census of program projects.

The evaluation team performed savings calculations for each record in the program tracking data based on guidance from the Pennsylvania TRM (June 2015) and compared the independently calculated savings to each record’s reported savings. This review found reported gross savings aligned with the TRM’s methodology.

Navigant conducted file reviews on the selected sample to verify that measure counts, efficiency ratings, and reported savings in the project summary files matched the program tracking data. The evaluation team then conducted telephone surveys to verify measure counts. The team visited a sub-sampled set of the reviewed projects to verify measure counts and efficiency ratings through visual inspection. For those sample points that received onsite visits, the onsite visit results replaced telephone survey results in the gross impact calculations. In total, the evaluation team included 72 sample points in the gross impact evaluation, where 15 of the 72 sample points received enhanced gross impact evaluations through onsite visits.

During each onsite visit, evaluation team personnel conducted a walkthrough of the facility in order to verify installed measure counts and pertinent details such as wattage and flow rate. Installed measures included CFLs, low-flow faucet aerators, and low-flow showerheads. Program tracking data does not include the DI measures’ make and model information. For CFLs, the tracking data only lists the bulb shape and wattage. For low-flow faucet aerators and low-flow showerheads, the tracking data only lists the fixture’s flow rate. Onsite personnel identified a bulb or fixture as a program measure if the shape and wattage (CFLs) or the marked flow rate (low-flow faucet aerator or low-flow showerhead) matched the tracking data specifications. It is important to note that if a program measure failed or was otherwise removed and replaced in-kind, the visual inspection would falsely identify the equipment as an installed program measure. This issue could inflate the evaluation realization rates found through onsite visits.

The evaluation team selected a stratified random sample from the program population for file reviews and telephone surveys. The team selected a separate sample for the residential and nonresidential sectors. The evaluation team selected sample sites from size-stratified residential (strata = unit project size) and nonresidential populations (strata = property total project size). The residential sector was further stratified by low-income status. The evaluation team designated participants as low income if they participate in a PECO-sponsored bill-pay assistance program for low-income customers. The evaluation plan called for a separate evaluation of low-income and non-low-income residential participants; however, since savings from the low-income population (13% of total residential reported gross energy savings) fell below the 20% threshold at which separate reporting is required per Section 3.4.1 of the Evaluation Framework, separate reporting was not necessary.

The evaluation team selected 48 total units for the residential sector and 24 properties for the nonresidential sector. The team also utilized this sample for the NTG research and process evaluation telephone surveys. The evaluation team sub-sampled 15 sites (nine residential[[52]](#footnote-53) and six nonresidential) from the 72 sample points for onsite visits. Table 14‑2 details the sampling strategy for the gross impact evaluation.

Table ‑: Smart Multi-Family Solutions Program Sampling Strategy for PY7

| **Stratum** | **Population Size[1]** | **Target Levels of Confidence and Precision** | **Target Sample Size[2]** | **Achieved Sample Size** | **Evaluation Activity** |
| --- | --- | --- | --- | --- | --- |
| Residential Participants | 3,726 | 85/15 | 48 (10) | 48 (9) | File reviews and telephone surveys (onsite Visits) |
| Nonresidential Participants | 122 | 85/15 | 24 (6) | 24 (6) | File reviews and telephone surveys (onsite Visits) |
| **Program Total** | **3,848** | **85/15** | **72 (16)** | **72 (15)** | **File reviews and telephone surveys (onsite Visits)** |

[1] The residential population size indicates the number of participants (i.e., apartment units or condos). The nonresidential population size indicates the number of participating properties.

[2] Parenthetical values indicate the size for onsite verification. The evaluation team made onsite visits to a sub-sample of the telephoned population.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Results

The residential sector gross impact evaluation efforts yielded a 0.94 realization rate for energy savings. The realization rate was less than one because telephone survey participants indicated that either the measure counts noted in the program tracking data were wrong, they did not receive the measure at all, or that the measure had been replaced. Additionally, the onsite visits discovered two sites where the number of CFLs reported in the tracking data did not match the number of CFLs found onsite, as the measures either failed or were removed by the customer. The residential gross impact evaluation achieved 4% relative precision at 85% confidence (below the 15% target). Table 14‑3 provides the gross impact summary for the residential sector energy savings.

Table ‑: PY7 Smart Multi-Family Solutions Residential Sector Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Reported Gross Energy Savings  (MWh/yr) | Energy Realization Rate  (%) | Verified Gross Energy Savings  (MWh/yr) | Observed CV or Proportion in Sample Design | Relative Precision at 85% Confidence Interval |
| Res Non-LI – Small | 526 | 1.00 | 526 | 0.00 | 0% |
| Res Non-LI –Medium | 481 | 0.91 | 439 | 0.24 | 12% |
| Res Non-LI – Large | 713 | 0.92 | 654 | 0.18 | 9% |
| Res LI – Small | 82 | 0.99 | 81 | 0.05 | 2% |
| Res LI – Medium | 93 | 0.82 | 77 | 0.40 | 23% |
| Res LI – Large | 92 | 0.98 | 90 | 0.05 | 3% |
| Program Total | **1,988** | **0.94** | **1,867** | **0.21** | **4%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The nonresidential sector gross impact evaluation yielded a 0.88 realization rate for energy savings. The realization rate was less than one because telephone survey participants indicated that either the measure counts were wrong, they did not receive the measure at all, or that the measure had been replaced. Additionally, the onsite efforts discovered one site where the amount of CFLs and low-flow faucet aerators found in the property’s common area was less than reported in the tracking data, as the measures either failed or were removed by the customer. Additionally, through visiting a sub-sample of dwelling units within the property, the evaluation team discovered three sites where the amount of CFLs found onsite was less than reported in the tracking data. The nonresidential gross impact evaluation achieved 4% relative precision at 85% confidence (well below the 15% target). Table 14‑4 provides the gross impact summary for the nonresidential sector energy savings.

Table ‑: PY7 Smart Multi-Family Solutions Nonresidential Sector Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Stratum | Reported Gross Energy Savings  (MWh/yr) | Energy Realization Rate  (%) | Verified Gross Energy Savings  (MWh/yr) | Observed CV or Proportion in Sample Design | Relative Precision at 85% Confidence Interval |
| Non-Res – Small | 899 | 0.85 | 767 | 0.23 | 7% |
| Non-Res – Medium/Large | 2,687 | 0.89 | 2,404 | 0.10 | 5% |
| PROGRAM TOTAL | **3,586** | **0.88** | **3,171** | **0.16** | **4%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

*Source: Navigant analysis*

The residential sector gross impact evaluation efforts yielded a 0.94 realization rate for demand savings. The realization rate was less than one because telephone survey participants indicated that either the measure counts were wrong, they did not receive the measure at all, or that the measure had been replaced. Additionally, the onsite visits discovered two sites where the number of CFLs reported in the tracking data did not match the number of CFLs found onsite. The residential gross impact evaluation achieved 4% relative precision at 85% confidence (below the 15% target). Table 14‑5 provides the gross impact summary for the residential sector demand savings.

Table ‑: PY7 Smart Multi-Family Solutions Residential Sector Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW)[1]** | **Demand Realization Rate (%)** | **Verified Gross Demand Savings (MW)[1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Res Non-LI – Small | 0.1 | 1.00 | 0.1 | 0.00 | 0% |
| Res Non-LI – Medium | 0.1 | 0.91 | 0.1 | 0.24 | 12% |
| Res Non-LI – Large | 0.1 | 0.92 | 0.1 | 0.17 | 9% |
| Res LI – Small | 0.0 | 0.99 | 0.0 | 0.05 | 2% |
| Res LI – Medium | 0.0 | 0.84 | 0.0 | 0.34 | 20% |
| Res LI – Large | 0.0 | 0.97 | 0.0 | 0.07 | 4% |
| **PROGRAM TOTAL** | **0.3** | **0.94** | **0.2** | **0.20** | **4%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The nonresidential sector gross impact evaluation yielded a 0.88 realization rate for demand savings. The realization rate was less than one because telephone survey participants indicated that either the measure counts were wrong, they did not receive the measure at all, or that the measure had been replaced. The onsite efforts discovered one site where the amount of CFLs and low-flow faucet aerators found in the property’s common area was less than reported in the tracking data. Additionally, through visiting a sub-sample of dwelling units within the property, the evaluation team discovered three sites where the amount of CFLs found onsite was less than reported in the tracking data. The nonresidential gross impact evaluation achieved 4% relative precision at 85% confidence (well below the 15% target). Table 14‑6 provides the gross impact summary for the nonresidential sector demand savings.

Table ‑: PY7 Smart Multi-Family Solutions Nonresidential Sector Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW)[1]** | **Demand Realization Rate (%)** | **Verified Gross Demand Savings (MW)[1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Non-Res – Small | 0.11 | 0.85 | 0.09 | 0.23 | 7% |
| Non-Res – Medium/Large | 0.31 | 0.88 | 0.28 | 0.10 | 5% |
| **PROGRAM TOTAL** | **0.42** | **0.88** | **0.37** | **0.16** | **4%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

In PY7, the evaluation team completed 15 onsite visits as enhanced gross verification sample points. The team visited six sites in the nonresidential sector and nine sites in the residential sector. The evaluation plan called for 10 sites in the residential sector; however, the evaluation team dropped one site from the analysis because the participant had recently moved within the same property and the evaluation team visited the new address. Within the nonresidential sites all common area measures were verified as well as a sample of units within the dwellings. In the residential sector, the team found two sites with discrepancies, where the number of CFLs reported in the tracking data did not match the number of CFLs found onsite. In the nonresidential sector, four sites were found with discrepancies: one nonresidential site where the amount of CFLs and low-flow faucet aerators found in the property’s common area was less than reported in the tracking data and three sites where the amount of CFLs found within dwelling units was less than reported in the tracking data. Table 14‑7 summarizes these findings.

Table ‑: PY7 Smart Multi-Family Solutions Onsite Inspections Summary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Measure** | **Inspection Firm** | **Number of Inspections Planned** | **Number of Inspections Conducted** | **Number of Sites with Discrepancies from Reports** | **Resolution of Discrepancies** |
| **Residential:** CFL, Low-Flow Faucet Aerator, Low-Flow Showerhead | Navigant and Mondre Energy | 10 | 9 | 2 | DI measures removed after installation; No Action |
| **Nonresidential:** CFL, Low-Flow Faucet Aerator, Low-Flow Showerhead | Navigant and Mondre Energy | 6 | 6 | 4 | DI measures removed after installation; No Action |

Source: Navigant analysis

## Impact Evaluation Net Savings

The evaluation team determined net impact by including the SWE Common NTG methodology’s free ridership and spillover question batteries into the participant telephone survey. The evaluation team utilized the SWE Common NTG methodology for analyzing the responses to those questions to determine NTG ratios for all sampled sites. In the residential sector, tenants answered questions regarding the project in their apartment unit or condo. In the nonresidential sector, landlords answered a separate set of questions regarding the property’s common areas and dwelling units.

### Net Verified Savings Methodology

NTG was defined in PY7 through two components: free ridership and spillover.

Equation ‑: Total NTG Ratio

*NTG Ratio = 1 – Free Ridership Rate + Spillover Rate*

In PY7, free ridership was determined from the telephone surveys using the SWE Common NTG methodology, which is summarized in the tables below. In this method an intention score and an influence score are determined through a series of questions regarding the participant’s intentions in the program’s absence and the influence of the program on their decision to install the equipment. Free ridership is defined as the sum of the intention and influence scores. Table 14‑8 and Table 14‑9 describe the intention score and influence score methodology, respectively.

Table ‑: Smart Multi-Family Solutions NTG Intention Score Method

|  |  |  |
| --- | --- | --- |
| **Question** | **Response** | **Intention Score** |
| 1. I would like you to think about what you would have done at this property if PECO’s Smart Multi-Family Solutions program was not available. Within the next year, would you have installed all, some, or none of the equipment that was installed through the program, had they not been provided? | None of the equipment that was installed through the program | 0 |
| Some, but not all, of the energy efficient equipment | Based on response to Q3 |
| All of the same energy efficiency equipment | Based on response to Q2 |
| Don’t know | 25 |
| 2. Would you have paid the entire cost to purchase and install this equipment? | Yes | 50 |
| No | 25 |
| The cost would be shared between tenant and property management or owner | 37.5 |
| Don’t know | 25 |
| 3. By how much would you have reduced the amount of equipment installed? Would you say… | Between 0% to 35% reduction | 37.5 |
| Between 35% to 65% reduction | 25 |
| Between 65% to 100% reduction | 12.5 |
| Don’t know | 25 |

Source: Adapted from SWE Common Approach for Measuring Free-Riders

Table ‑: Smart Multi-Family Solutions NTG Influence Score Method

|  |  |
| --- | --- |
| **Question** | |
| Next, I am going to list some elements of the Smart Multi-Family program. On a 1 to 5 scale where 1 is “not at all influential” and 5 is “extremely influential,” please rate the influence of each element on your decision to participate in the Smart Multifamily program  1 The free equipment  2 The energy cost savings associated with the efficient equipment  3 Your interaction with PECO  4 The information provided through marketing materials  5 [nonresidential sector only] The prescriptive program incentives  6 OTHER MENTION | |
| The maximum response to the above question is scored as follows: | |
| **Program Influence Rating** | Influence Score |
| 1 – Not at all influential | 50 |
| 2 | 37.5 |
| 3 | 25 |
| 4 | 12.5 |
| 5 – Extremely influential | 0 |
| DK | 25 |

Source: Adapted from SWE Common Approach for Measuring Free-Riders

The evaluation team adapted the SWE common approach for measuring spillover in PY7. Based on a combination of telephone surveys and an engineer desk review, the team calculated spillover using the methodology summarized in Table 14‑10.

Table ‑: Smart Multi-Family Solutions NTG Spillover Method

|  |  |  |
| --- | --- | --- |
| **Question** | **Response** | **Algorithm** |
| 1. As a result of your participation in the Smart Multi-Family Solutions Program, have you implemented any additional energy efficient measures for which you did not receive an incentive through any utility or government program? | YES | Go to Q2 |
| NO | SPILLOVER = 0 |
| 2. What was the first, second, third measure you implemented? | NewMeasure1, NewMeasure2, NewMeasure3 | Go to Q3 |
| 3. Please describe the QUANTITY, SIZE, and EFFICIENCY of this measure | Quantity, Size, Efficiency | Varies |
| 4. How significant was your experience in the Smart Multi-Family Solutions program in your decision to implement <NEWMEASURE\_#>, using a scale of 0 to 5, where 0 is not at all significant and 5 is extremely significant? | 4 or 5 | 1.0 |
| 2 or 3 | 0.5 |
| 0 or 1 | 0 |
| Steps | | |
| Step 1. IF [response to Q4 ≥ 2] THEN engineers will use responses to Q3 to estimate gross savings with the associated measure. OTHERWISE the estimated gross savings with the associated measure will be set to zero.  Step 2. The estimated gross savings will be multiplied by attribution percentage indicated by response to Q4.  Step 3. Spillover rate will be equal to the sum of the individual spillover savings divided by the ex post gross kWh savings associated with the survey sample. | | |
| i = individual, {1 , … , n survey sample} AND m = measure, {1,2,3} | | |

Source: Adapted from SWE Common Approach for Measuring Spillover

As described in Section 14.2, the evaluation team selected a stratified random sample from the program population for the telephone survey. A separate sample was selected for the residential and nonresidential sectors. The sample was selected from size-stratified residential (strata = unit project size) and nonresidential populations (strata = property total project size). The team selected 48 total units for the residential sector and 24 properties for the nonresidential sector. This sample was also utilized for the gross impact and process evaluation telephone surveys; however, some points needed to be dropped (eight residential and two nonresidential) in the NTG analysis since respondents refused to answer that portion of the survey battery. Table 14‑11 and Table 14‑12 detail the sampling strategy for the residential and nonresidential NTG surveys, respectively.

Table ‑: Smart Multi-Family Solutions Residential Sector Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Stratum | Stratum Boundaries | Population Size | Assumed CV or Proportion in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | Percentage of Sample Frame Contacted [1] to Achieve Sample |
| Res Non-LI – Small | Projects <583 Reported kWh Savings | 1,831 | 0.50 | 85/15 | 8 | 8 | 14% |
| Res Non-LI – Medium | Projects 583-809 Reported kWh Savings | 694 | 0.50 | 85/15 | 8 | 8 | 87% |
| Res Non-LI –Large | Projects > 809 Reported kWh Savings | 617 | 0.50 | 85/15 | 8 | 8 | 40% |
| Res LI – Small | Projects < 471 Reported kWh Savings | 353 | 0.50 | 85/15 | 8 | 13 | 100% |
| Res LI – Medium | Projects 471-855 Reported kWh Savings | 151 | 0.50 | 85/15 | 8 | 6 | 100% |
| Res LI – Large | Projects >= 855 Reported kWh Savings | 80 | 0.50 | 85/15 | 8 | 5 | 100% |
| Program Total | **N/A** | **3,726** | **0.50** | **85/15** | **48** | **48** | **43%** |

[1] Sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table ‑: Smart Multi-Family Solutions Nonresidential Sector Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Stratum Boundaries** | **Population Size** | **Assumed CV or Proportion in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame [1] Contacted to Achieve Sample**](file:///C:\Users\mpagnotta\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\B80E0951.xlsx#RANGE!_ftn1) |
| Non-Res – Small | < 27.2 Reported MWh Savings | 91 | 0.50 | 85/15 | 10 | 16 | 100% |
| Non-Res – Medium/Large | >= 27.2 Reported MWh Savings | 31 | 0.50 | 85/15 | 14 | 6 | 100% |
| **Program Total** | **N/A** | **122** | **N/A** | **85/15** | **24** | **22** | **100%** |

[1] Sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Net Verified Savings Results

The net impact evaluation yielded a 0.59 NTG ratio in the residential sector and a 0.62 NTG ratio in the nonresidential sector. Both sectors indicate low likelihoods of program free ridership and negligible levels of spillover. The residential net impact evaluation achieved 5% relative precision and the nonresidential net impact evaluation achieved 7% relative precision (both below the 15% target) at 85% confidence. Table 14‑13 and Table 14‑14 provide a summary of the residential and nonresidential sector NTG ratios, respectively.

Table ‑: PY7 Smart Multi-Family Solutions Residential Sector Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Estimated Free Ridership** | **Estimated Participant Spillover** | **NTG Ratio** | **Observed CV or Proportion** | **Relative Precision** |
|
| Res Non-LI – Small | 0.44 | 0.00 | 0.56 | 0.45 | 27% |
| Res Non-LI – Medium | 0.39 | 0.03 | 0.65 | 0.36 | 18% |
| Res Non-LI –Large | 0.46 | 0.00 | 0.54 | 0.60 | 30% |
| Res LI – Small | 0.33 | 0.02 | 0.69 | 0.35 | 17% |
| Res LI – Medium | 0.44 | 0.12 | 0.68 | 0.43 | 28% |
| Res LI – Large | 0.33 | 0.00 | 0.67 | 0.50 | 36% |
| **Program Total** | **0.43** | **0.01** | **0.59** | **0.26** | **5%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table ‑: PY7 Smart Multi-Family Solutions Nonresidential Sector Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Estimated Free Ridership** | **Estimated Participant Spillover** | **NTG Ratio** | **Observed CV or Proportion** | **Relative Precision** |
|
| Non-Res – Small | 0.31 | 0.01 | 0.71 | 0.29 | 10% |
| Non-Res –Medium/Large | 0.41 | 0.00 | 0.59 | 0.31 | 18% |
| **Program Total** | **0.38** | **0.00** | **0.62** | **0.24** | **7%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Process Evaluation

The PY7 SMF Solutions process evaluation illuminated how participants learned about the program, why they participated, and how aware they were of various other program elements outside of the free DI equipment.

### Process Evaluation Methodology

The process evaluation for the SMF Solutions program consisted primarily of participant telephone surveys with residential tenants and nonresidential landlords and in-depth interviews with the PECO and CSP program managers. The evaluation team used the telephone survey residential tenant sample and nonresidential landlord sample for the impact evaluations as well. Table 14‑15 shows target sample sizes and achieved sample sizes for each data collection method.

Table ‑: Smart Multi-Family Solutions Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Target Group | Population Size | Assumed Proportion or CV in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | Percentage of Population Frame Contacted to Achieve Sample | Used for Evaluation Activities (Impact, Process, NTG) |
| Residential Participating Dwelling Units | 3,726 | 0.50 | 85/15 | 48 | 48 | 43% | Impact, process, NTG |
| Nonresidential Participating Properties | 122 | 0.50 | 85/15 | 24 | 24 | 100% | Impact, process, NTG |
| Program Manager | 1 | N/A | N/A | 1 | 1 | 100% | Process |
| Program Implementer | 1 | N/A | N/A | 1 | 1 | 100% | Process |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Findings and Recommendations

Based on the process research described in the previous section and based on the impact evaluation results, the evaluation team developed several recommendations.

1. **Finding:** Free ridership levels in PY7 increased significantly over PY6 (from 0.17 to 0.38 in the nonresidential sector and from 0.25 to 0.43 in the residential sector). In fact, 36% of landlords and 69% of tenants stated they would have installed all of the same equipment if the program had not been available. Since the majority of energy savings are from DI CFLs (72% of gross reported energy savings in PY7), participants are generally stating that they would have installed CFLs, even without the program. These findings are consistent with market trends, where CFLs are taking up a high proportion of market share and are becoming the default lighting option in many homes and businesses.
   1. **Recommendation:** Monitor expansion of DI offerings in Phase III, focusing on LED penetration in each project to reduce free ridership. In Phase III, SMF Solutions will begin to offer DI LEDs in addition to DI CFLs. By installing this newer lighting technology within each project, free ridership may be dampened as it could be less likely that customers would have installed LEDs without the program.
2. **Finding:** The SMF Solutions program’s marketing efforts targeted landlords directly, and they in turn described having heard of the SMF Solutions program via a limited number of channels. Since tenants did not sign up for the program directly and were only provided an opt-out option, marketing efforts were not aimed toward this group. As shown in Figure 14‑1, the majority of participants (71%) were contacted directly by a PECO representative (i.e., the CSP). Secondly, 19% of landlords reported that they learned about the program by word of mouth. Lastly, just 5% of landlords learned about the program at a tradeshow, workshop, or conference and 5% from the PECO website. These findings are consistent with the marketing efforts discussed with the program manager and implementer, who indicated a large direct mail and cold call effort to reach out to potential landlord participants.

Figure ‑: How Landlords First Learned of Smart Multi-Family Solutions Program (n=24)

Source: Navigant analysis of participant landlord surveys

1. **Finding:** Participants generally noted a high degree of satisfaction with the program. Survey respondents were asked to rate their satisfaction with the SMF Solutions program overall on a scale of 1 to 5, where 1 is “Not satisfied” and 5 is “Extremely satisfied”. Both residential and nonresidential participants reported satisfaction with the program. Nonresidential landlords reported a 4.7 average satisfaction score, whereas the residential tenants reported a 4.5 average satisfaction score. Figure 14‑2 presents participant program satisfaction scores from both PY6 and PY7. In both sectors, satisfaction increased in PY7 over the previous program year.

Figure ‑: Smart Multi-Family Solutions Average Participant Satisfaction over Time

Source: Navigant analysis of participant survey (PY6 Nonresidential n=40, PY7 Nonresidential n=22, PY6 Residential n=44, PY7 Residential n=40)

1. **Finding:** Participants reported generally high satisfaction with program equipment. Nonresidential landlords reported a 4.7 average satisfaction score, and residential tenants reported a 4.3 average satisfaction score. Figure 14‑3 presents the equipment satisfaction scores from both PY6 and PY7. As with overall program satisfaction, equipment satisfaction increased in PY7 in comparison to the prior program year.

Figure ‑: Smart Multi-Family Solutions Participant Satisfaction with DI Equipment over Time

Source: Navigant analysis of participant surveys (PY6 Nonresidential n=40, PY7 Nonresidential n=24, PY6 Residential n=44, PY7 Residential n=48)

1. **Finding:** Nonresidential landlords described a number of reasons for making the decision to participate in the SMF Solutions program. As shown in Figure 14‑4, the most commonly cited reasons for program participation were to save energy (42%) and to save money (29%). Secondarily, landlords cited the fact that the DI measures were free as a motivating factor (11%).

Figure ‑: Smart Multi-Family Solutions Nonresidential Landlord Reasons for Program Participation (n=24)

Source: Navigant analysis of participant landlord surveys

* 1. **Recommendation:** Advertise the long-term energy cost savings associated with the new Phase III prescriptive offerings. Since the program saw zero prescriptive participation in Phase II, Navigant recommends focusing on the improved energy and cost savings associated with the newer incentive structures in Phase III, which aligns with the landlords’ stated interests.

1. **Finding:** The participant telephone survey included a series of questions to better understand participant awareness of the program’s prescriptive offerings, audit report, and other Smart Ideas programs. When asked, only 46% of landlords recalled receiving a list of incentivized energy efficiency equipment recommended through the program. The majority of landlords were not aware of or able to recall incentivized offerings through the program’s prescriptive channel. Additionally, only 50% of landlords recalled receiving an audit report as part of the DI project, and of those landlords, 25% reported that the program representative did not review the report with them. Finally, 42% of landlords did not recall being made aware of additional PECO Smart Ideas programs.
   1. **Recommendation:** Develop and implement a program representative checklist to encourage prescriptive and cross-program participation. A significant proportion of the participant population was not aware of the prescriptive incentives, audit report, or other Smart Ideas programs. By creating a checklist indicating the points the program representative must cover with each participant, the likelihood of participants learning about these other opportunities increases.

## Status of Recommendations for Program

Table 14‑16 lists recommendations for the SMF Solutions program along with the PECO status for each recommendation.

Table ‑: Smart Multi-Family Solutions Program Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1: Monitor expansion of DI offerings in Phase III, focusing on LED penetration in each project to reduce free ridership. | **Implemented:** Going into Phase III, coordinated with CSP to track LED measures in the PECO database. |
| Recommendation 2: Advertise the long-term energy cost savings associated with the new Phase III prescriptive offerings. | **Implemented:** Phase III prescriptive offerings will include marketing efforts which will focus on enhancing the trade ally network and promotion materials. |
| Recommendation 3: Develop and implement a program representative checklist to encourage prescriptive and cross-program participation. | **Implemented/ Being Considered:** For Phase II, we had a quick reference guide for all of the prescriptive offerings for Multifamily Solutions. This quick reference guide is currently being updated for Phase III. A brochure is currently being developed to cross promote residential Smart Ideas programs. |

Source: Navigant analysis

## Financial Reporting

In the residential sector, the SMF Solutions program underspent budget in PY7. Phase II SMF Solutions residential sector cumulative spending was $3,224,302, about 97% of the Phase II budget. The residential sector achieved a Phase II TRC of 1.63, just shy of the 1.70 TRC goal. Note that marketing expenses (all program marketing accounted for in the nonresidential sector) in PY7 made up 61% of Phase II marketing expenses. This reflects the extra effort in the final program year to attempt to recruit nonresidential properties. A breakdown of the SMF Solutions residential sector program finances is presented in Table 14‑17.

Table ‑: Summary of SMF Solutions Residential Sector Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| Row # | Cost Category | Actual PYTD  Costs | Actual Phase II  Costs |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 0 | 0 |
| 2 | EDC Incentives to Participants | 0 | 0 |
| 3 | EDC Incentives to Trade Allies | 0 | 0 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 0 | 0 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10 ) | 787 | 3,225 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance**[1]** | 669 | 3,032 |
| 8 | Marketing**[2]** | 118 | 192 |
| 9 | EDC Evaluation Costs | 0 | 0 |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 0 | 0 |
|  | | | |
| 12 | Total TRC Costs[3] (Sum of Rows 1, 5, and 11) | 787 | 3,225 |
| 13 | Total NPV Lifetime Energy Benefits | 1,156 | 4,610 |
| 14 | Total NPV Lifetime Capacity Benefits | 75 | 263 |
| 15 | Total NPV TRC Benefits[4] | 1,317 | 5,272 |
|  | | | |
| 16 | TRC Benefit-Cost Ratio[5] | 1.67 | 1.63 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

In the nonresidential sector, the SMF Solutions program underspent its budget in PY7. Phase II SMF Solutions nonresidential sector cumulative spending was $2,916,198, about 86% of the Phase II budget. The nonresidential sector achieved a Phase II TRC of just 1.40, missing the TRC goal of 1.63. Though the sector was able to achieve a high TRC in PY7 (1.74), by minimizing costs in line with the reduced energy savings, the PY6 TRC of 1.13 brought down the overall Phase II cost-effectiveness. A breakdown of the SMF Solutions nonresidential sector program finances is presented in Table 14‑18.

Table ‑: Summary of SMF Solutions Nonresidential Sector Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| Row # | Cost Category | Actual PYTD  Costs | Actual Phase II  Costs |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 0 | 0 |
| 2 | EDC Incentives to Participants | 0 | 0 |
| 3 | EDC Incentives to Trade Allies | 0 | 0 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 0 | 0 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10 ) | 794 | 2,916 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance**[1]** | 794 | 2,916 |
| 8 | Marketing**[2]** | 0 | 0 |
| 9 | EDC Evaluation Costs | 0 | 0 |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | **0** | **0** |
|  | | | |
| 12 | Total TRC Costs[3] (Sum of Rows 1, 5, and 11) | 794 | 2,916 |
| 13 | Total NPV Lifetime Energy Benefits | 1,119 | 3,352 |
| 14 | Total NPV Lifetime Capacity Benefits | 111 | 310 |
| 15 | Total NPV TRC Benefits[4] | 1,382 | 4,087 |
|  | | | |
| 16 | TRC Benefit-Cost Ratio[5] | 1.74 | 1.40 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart On-Site

PECO designed its Smart On-Site (SOS) program to build interest in CHP technologies by offering incentives to customers who install CHP to reduce facility energy use. CHP technologies generate electric and thermal energy from a single fuel source. Customers with steady baseload electricity usage coupled with steady thermal demand can realize significant efficiencies and savings by incorporating CHP (sometimes referred to as cogeneration) in their facilities. The best economics are realized for CHP systems sized to match the minimum electric and thermal loads. PECO designed the SOS program to ensure participating customers install CHP projects that maximize operational savings and minimize operational and maintenance costs.

PECO distributes the SOS program incentives based on a declining tiered incentive rate by installed capacity with a separate performance payment. Each tier has a fixed per-MW incentive paid toward the incremental capacity within each tier. Capacity-based incentives will not be paid for incremental capacity above 10 MW. The capacity tiers are as follows:

* Less than 0.5 MW
* Between 0.5 MW and 1.5 MW
* Between 1.5 MW and 10.0 MW

PECO pays the performance payment on a fixed per-kWh basis based on actual energy savings after a 1-year monitoring period. For projects occurring within the final year of the program, an accelerated performance payment will be available based upon the project’s expected first-year energy savings. PECO claims savings for all projects upon implementation and can be adjusted based on the performance monitoring results.

PECO hired a CSP, DNV GL, to implement the program throughout its service territory. DNV GL was responsible for the program application, savings analysis, and rebate processes. DNVL GL provided the participation data for the SIDS database.

## Program Updates

PECO launched this program in PY5 and has not made any major changes to the program offerings outlined in the Phase II plan. Six projects were completed and received rebates through the SOS program during PY7. These projects included participants from the GNI and large C&I sectors.

### Definition of Participant

PECO defines participation in the SOS program as one project at one facility.

## Impact Evaluation Gross Savings

For the entirety of Phase II, the SOS program served eight participants and Navigant verified energy and demand savings of 90,049 MWh and 11.6 MW. Table 15‑1 presents both the reported and verified Phase II savings results for the SOS program. The program targets the large C&I and GNI sectors and does not have any participants from other sectors.

Table ‑: Phase II Smart On-Site Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector[1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW) [2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW) [2]** | **Incentives Paid ($1,000)** |
| Residential (Non-Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Residential (Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Small C&I | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Large C&I | 3 | 10,051 | 1.3 | 8,745 | 1.1 | $478 |
| GNI | 5 | 83,937 | 11.0 | 81,303 | 10.4 | $6,062 |
| **PHASE II TOTAL** | **8** | **93,988** | **12.3** | **90,049** | **11.6** | **6,540** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

Navigant’s evaluation of the SOS program consisted of onsite verification, telephone interviews with program participants and the project developers they worked with, interviews with other CHP project developers who either have active CHP projects or may have such projects in the future, and interviews with the PECO and CSP program managers.

All participants in the SOS program are required to log the parameters necessary to calculate electricity generation net of parasitic loads (such as pumps necessary to operate the heat recovery systems) and thermal energy recovery. The evaluation team uses this data to develop the estimates of system capacity and annual generation on which PECO’s capacity and performance incentives are based. Navigant’s PY7 impact evaluation consisted of onsite verification of the installation and operation of the CHP equipment, validation of the customer-installed instrumentation logging the necessary performance parameters, and analysis of the logged data.

The evaluation team calculated gross impacts in accordance with the approved custom measure protocol (CMP) for CHP systems. The team also developed SSMVPs in accordance with the CMP that reflected the fact that PECO requires SOS participants to continuously log all relevant parameters necessary to calculate the CHP system’s net electrical generation and the facility’s net change in fuel consumption. As Table 15‑2 indicates, Navigant conducted a census of participants, completing six sites.

Table ‑: Smart On-Site Sampling Strategy for PY7

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| All | 6 | 85/15 | 6 | 6 | File review and onsite verification |
| **PROGRAM TOTAL** | **6** | **0** | **6** | **6** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Results

The program achieved a gross realization rate of 0.87 for energy in PY7. Table 15‑3 presents the gross reported and verified energy savings for PY7. The low realization rate is attributable to two projects performing poorly against their forecasted savings. One project had issues with oversizing and the other with lingering commissioning issues during the M&V interval.

Table ‑: PY7 Smart On-Site Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Energy Savings (MWh/yr)** | **Energy Realization Rate (%)** | **Verified Gross Energy Savings (MWh/yr)** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| All | 34,043 | 0.87 | 29,621 | 0.23 | 0% |
| **PROGRAM TOTAL** | **34,043** | **0.87** | **29,621** | **N/A** | **0%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The program achieved a gross realization rate of 0.86 for demand. Table 15‑4 presents the gross reported and verified demand savings for PY7. The realization rate for energy and demand are similar because CHP systems are designed to operate base loaded.

Table ‑: PY7 Smart On-Site Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW)[1]** | **Demand Realization Rate (%)** | **Verified Gross Demand Savings (MW)[1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| All | 4.5 | 0.86 | 3.9 | 0.26 | 0% |
| **PROGRAM TOTAL** | **4.5** | **0.86** | **3.9** | **N/A** | **0%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

The onsite M&V activities for PY7 are summarized in Table 15‑5. Navigant found all of the rebated equipment installed and did not note any discrepancies.

Table ‑: PY7 Smart On-Site: Onsite Inspections Summary

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Measure | Inspection Firm | Number of Inspections Planned | Number of Inspections Conducted | Number of Sites with Discrepancies from Reports | Resolution of Discrepancies |
| CHP | Navigant | 6 | 6 | 0 | N/A |

Source: Navigant analysis

## Impact Evaluation Net Savings

Navigant conducted a net savings analysis for all participating projects using the SWE-approved NTG battery of questions and methodology for interpreting responses. The analysis indicates significant evidence of free ridership in the large C&I sector (0.4) and no free ridership in the GNI sector. There is no evidence of spillover savings in either sector.

### Net Verified Savings Methodology

The SOS program uses the same NTG approach as the SEI program. The evaluation team calculated the NTG ratio for each participating sector using Equation 15‑1.

Equation ‑: Total NTG Ratio

*NTG Ratio = 1 – Free Ridership Rate + Spillover Rate*

#### Free Ridership Methodology

The evaluation team assessed free ridership using a customer self-report approach following the SWE’s Common Approach for Downstream Programs. This approach uses a survey designed to assess the likelihood that participants would have installed some or all of the energy efficiency measures incented by the program even if the program had not existed. Based on the ETO methodology, the free ridership analysis included the following two elements of free ridership: 1) intention to carry out the energy efficient project without program funds, and 2) the influence of the program in the decision to carry out the energy efficient project.

The total free ridership score illustrated in Equation 15‑2 is the sum of the intention and the program influence scores, resulting in a score ranging from 0 to 100. This score is divided by 100 to convert it into a proportion for application to gross savings values.

Equation ‑: Total Free Ridership

**Intention Score**

The team assessed the intention score through several brief questions used to determine how the project likely would have differed if the respondent had not received the program assistance. The initial question asked the respondent to identify, out of a limited set of options, the option that best described what most likely would have occurred without the program assistance. The offered response options (typically four or five, and preferably no more than six) captured the following four general outcomes:

* Would have canceled or postponed the project
* Would have done something that would have produced savings but not as much as those achieved through the project as implemented
* Would have completed the project as implemented
* Don’t know

The algorithm does consider respondents who said they would have canceled or postponed the project as free riders in terms of intention (a score of 0 for the intention score). The approach also considers respondents who indicated they would have done something that would have resulted in less energy savings as partial free riders in terms of intention (free ridership ranging from 12.5 to 37.5 for the intention component in the case of nonresidential programs). The respondents that indicated they would have undertaken the project as implemented without the program received a score based on how they would have paid for the upgrade. “Don’t know” responses were assigned the midpoint score of 25 for the intention component.

**Program Influence Score**

To assess the program influence score on the participant’s decision to implement energy efficiency improvements, Navigant asked respondents how much influence—on a scale of 1 (no influence) to 5 (great influence)—various program elements had on the decision to implement the project. The elements used to influence customer decision-making included program information, program incentives, and interaction with program staff (technical assistance).

A participant’s program influence score was then set to the participant’s maximum influence rating for any program element. The rationale was that if any given program element had a great influence score on the respondent’s decision, then the program itself had that level of influence—even if other elements had less influence. The program influence score and free ridership have an inverse relationship: the greater the program influence, the lower the free ridership, and vice versa.

Figure 15‑1 summarizes both the intention score and program influence score calculations for the SOS program. The figure shows the possible response combinations to the questions described in the intention score section and the value assigned to each unique combination. In addition, it shows the program influence score and possible answers to the 5-point scale along with the “don’t know” answers.

Figure ‑: Phase II Free Ridership Algorithm



Source: Navigant analysis

Spillover occurs when there are reductions in energy consumption or demand caused by the presence of the energy efficiency program but that the program does not directly influence. The evaluation team asked program participants a battery of questions to quantitatively assess spillover. Below are examples of the spillover questions:

* Since your participation in the program, did you install any additional energy efficiency measures at this facility that did not receive incentives through any utility or government program?
* To the best of your knowledge, do you know when you installed the additional energy efficient equipment?
* Could you describe the energy efficiency measure installed?
* Thinking of the additional measure(s) you installed on your own at this same facility, how do the energy savings compare to what you installed through the program? Were the savings lower, about the same, or higher? (Probe for percentage as compared to all incented projects.)
* Since participating in the program, have you installed any energy efficient measures in other facilities within PECO’s territory?
* Thinking of these additional measure(s) you installed on your own at other facilities, how does the quantity compare to what you installed through the program? Did you install more, less, or the same amount of measures? (Probe for percentage as compared to all incented projects.)
* Have or will these measures receive incentives through the program?
* What were the reasons that they did not receive an incentive?

The battery of questions attempted to quantify all the savings from additional non-incented equipment installed after the respondent’s participation in the program. Additionally, the evaluation team included a question about the level of influence the program had on the respondent’s decision to install the additional measures. An example of the question is below.

* On a 0 to 5 scale, with 0 meaning “Not at all influential” and 5 meaning “Extremely influential,” how influential was your experience with PECO's program in your decision to install the additional energy efficient equipment?

The evaluation team assigned the influence rating a value, which determined what proportion of the measure’s energy savings the team attributed to the program:

* A rating of 4 or 5 = 1.0 (full savings attributed to the program)
* A rating of 2 or 3 = 0.5 (half of the savings attributed to the program)
* A rating of 0 or 1 = 0 (no savings attributed to the program)

Where applicable, Navigant calculated the savings for each additional measure installed per the TRM. For measures not included in the TRM, the evaluator may conduct a brief engineering analysis to assess savings or to identify an alternative source and methodology for assessing savings.

Navigant calculated spillover for measures reported as the product of the measure savings, number of units, and influence score, as illustrated in Equation 15‑3. Navigant calculated all spillover estimates using customer self-reported data and did not conduct follow-up interviews or site visits.

Equation ‑: Spillover Savings from Installed Measures

For each of the above categories, Navigant then totaled the savings associated with each program participant to give the overall participant spillover savings reflected in Equation 15‑4.

Equation ‑: Overall Participant Spillover

*Participant SO = ΣMeasure SO*

The evaluation team then multiplied the mean participant spillover savings for the participant sample by the total number of participants to yield an estimated total participant spillover savings for the program. Equation 15‑5 shows the algorithm used to calculate spillover for the program.

Equation ‑: Spillover Savings for the Program

Population *N*

Finally, the evaluation team divided the total savings by the total program savings to yield a participant spillover percentage, as shown in Equation 15‑6.

Equation ‑: Participant Spillover Percentage

100

Navigant based its NTG analysis on a census of participants, as indicated in Table 15‑6.

Table ‑: Smart On-Site Sampling Strategy for PY7 NTG Research

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Stratum Boundaries** | **Population Size** | **Assumed CV or Proportion in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame [1] Contacted to Achieve Sample**](file:///C:\Users\rkehrl\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\BE3ACCD4.xlsx#RANGE!_ftn1) |
| C&I Projects | N/A | 3 | 0.50 | 85/15 | 3 | 3 | 100% |
| GNI Projects | N/A | 3 | 0.50 | 85/15 | 3 | 3 | 100% |
| **PROGRAM TOTAL** | **N/A** | **6** | **N/A** | **85/15** | **6** | **6** | **100%** |

[1] Sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Net Verified Savings Results

Table 15‑7 summarizes the NTG results. The low NTG ratio for the large C&I sector, 0.63, was driven by a single participant with two projects in PY7. Both projects were at apartment complexes owned by a publicly traded real estate investment trust that owns and operates 196 apartment communities nationwide. The company has a grant research and energy efficiency team dedicated to tracking utility incentive programs.

Table ‑: PY7 Smart On-Site Summary of Evaluation Results for NTG Research

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Estimated Free Ridership** | **Estimated Participant Spillover** | **NTG Ratio** | **Observed CV or Proportion** | **Relative Precision** |
|
| C&I Projects | 0.38 | 0.00 | 0.63 | 0.00 | 0% |
| GNI Projects | 0.00 | 0.00 | 1.00 | 0.00 | 0% |
| **PROGRAM TOTAL** | **0.11** | **0.00** | **0.89** | **0.00** | **0%** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Process Evaluation

Navigant’s process evaluation of the PY7 SOS program consisted of in-depth interviews with program staff, participants, and project developers.

### Process Evaluation Methodology

Navigant conducted a census of participating customers and developers as well as PECO and CSP program staff, as seen in Table 15‑8.

Table ‑: Smart On-Site Process Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Stratum** | **Stratum Boundaries** | **Population Size** | **Assumed Proportion or CV in Sample Design** | **Assumed Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | [**Percentage of Sample Frame  [1] Contacted to Achieve Sample**](file:///C:\Users\rkehrl\AppData\Local\Microsoft\Windows\Temporary%20Internet%20Files\Content.MSO\BE3ACCD4.xlsx#RANGE!_ftn1) | **Used for Evaluation Activities (Impact, Process, NTG)** |
| All | N/A | 6 | N/A | N/A | 6 | 6 | 100% | Process Evaluation |
| **PROGRAM TOTAL** | **N/A** | **6** | **N/A** | **N/A** | **6** | **6** | **100%** | **Process Evaluation** |

[1] Sample frame is a list of contacts that have a chance to be selected into the sample. Percentage contacted means of all the sample frame the percentage that were contacted to get the completed surveys.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Findings and Recommendations

The process evaluation in PY7 yielded several findings and potential program improvements. Below are specific recommendations and the associated process evaluation findings on which the evaluation team based its recommendations. Navigant conducted in-depth interviews individuals at the participating organizations who were involved with the system design and decision-making. The following findings and recommendations (where appropriate) are based on the responses of these individuals. Navigant cautions that such a small sample cannot adequately represent the entire population of eligible SOS participants.

1. **Finding:** Program staffing is adequate. Both the PECO and CSP program managers expressed the opinion that the program does not need additional staff.
2. **Finding:** Existing program promotional efforts were adequate for Phase II. PECO promoted the SOS program primarily by making presentations at trade association events and through direct contact with customers. During Phase II, the SOS program had projects that amounted to up to 96% of its targeted savings goal enrolled in the program. Any major changes to program size may require increased promotional effort.
   1. **Recommendation:** PECO should leverage completed SOS projects to promote the technology**.** CHP system owners expressed pride for their projects and may welcome the opportunity to publicize their success. If PECO wishes to foster the market for CHP in its service territory, it could invite CHP owners to speak about their experiences with the technology and PECO’s program at relevant industry events. Some CHP owners might be willing to host such events at their facility and provide tours of the system.
   2. **Recommendation:** Provide design support to customers. If PECO wishes to foster the market for CHP in its service territory, providing financial support for system design could help in the following ways:
      * **Reducing barriers by reducing costs.** Providing financial support for the early stages of project development could make it easier for customers to move beyond the barrier posed by the costs incurred to determine whether CHP is even a viable option.
      * **Lending credibility to the technology and to project developers.** Early market intervention by PECO could overcome a credibility gap among customers who are unfamiliar with the technology.
      * **Assisting customers in identifying qualified project developers.** If PECO were to adopt this recommendation, Navigant strongly recommends that it protect its design assistance investment by developing a list of qualified project developers that satisfy a set of rigorous screening criteria.
3. **Finding:** The SOS program creates significant uncertainty and risk for PECO due to the complexity of the projects and the magnitude of the project’s energy savings. For example, the average project size is 7,000 MWh (excluding the 45,000 MWh waste water treatment project). In addition, 17% of the Phase II MWh savings goal was completed in the last two days of the phase, and projects making up 7% of the Phase II MWh goal did not get completed during the Phase. Projects that did not finish during the Phase took between 15 and 28 months from the time of application to completion, making it difficult for PECO to anticipate and react to any need to adjust its plan to meet the portfolio savings goals.
   1. **Recommendation:** Set final Phase III project enrollment deadlines of January 1, 2019 for projects over 1 MW and January 1, 2020 for projects less than 1 MW to mitigate completion risks that lead to portfolio-level uncertainty.
4. **Finding:** PECO is devoting adequate attention to the impacts of the SOS program on sector- and portfolio-level savings. The PECO program manager indicated that projected SOS savings levels are reviewed with the program managers from other programs and portfolio-level managers on a biweekly basis. This indicates that PECO is aware of and attempting to mitigate the uncertainty and inherent risk that SOS projects pose.
5. **Finding:** Developers unanimously oppose restrictions on participation based on system size and Phase deadline. Developers agree that that any change to the current participation requirements would be perceived as increased market uncertainty. One developer suggested that the move toward containerized systems for systems as large as 1.5 MW is shortening the development cycle. That developer also noted that smaller systems are not typically designed by specialized firms and are prone to more issues. However, containerized systems did not complete faster than two traditional projects completed in PY5.
   1. **Recommendation:** PECO should host an open house for participants and developers to meet PECO and CSP staff to discuss any substantive changes to the program in Phase III. Based on developer sentiment, it is essential that the market clearly understands any major changes to the program to minimize confusion and uncertainty.
6. **Finding:** Obtaining an operating permit from the Pennsylvania Department of Environmental Protection (DEP) can delay projects considerably. When asked about the primary factors that contribute to delays in completing CHP systems, all developers pointed to the DEP as the source of considerable delay and uncertainty. Their estimates of the delay ranged from 4 months to a full year.
   1. **Recommendation**: Create a liaison with the DEP. By creating a relationship with the relevant parties at the DEP and making them aware of the SOS program, PECO may be able increase the priority of SOS project reviews—or at least reduce the uncertainty about the timing of a project’s completion that is due to the permitting process.
7. **Finding:** Interconnection agreements remain an issue, creating delays in the project and shortening valuable commissioning time. Three out of four developers said that they had issues with the interconnection agreement.
8. **Finding:** Participants had mixed experiences with PECO. On a 5-point scale where 1 indicates “Very dissatisfied” and 5 indicates “Very satisfied,” the participants were asked to describe their satisfaction with program incentives and their overall ratings for the program and for PECO. Several participants noted issues with customer service including responsiveness and consistency of messages across staff. Some of the dissatisfaction was due to confusion over program requirements.
   1. **Recommendation:** Develop a program manual for developers and participants. The program manual should provide a standardized feasibility template, a process chart describing key milestones, and more details regarding enrollment, interconnection, and incentive payout.

## Status of Recommendations for Program

The evaluation team’s recommendations for the SOS program are provided in Table 15‑9. These recommendations are based on the results of the PY7 evaluation and PECO’s vision for the program going forward into Phase III.

Table ‑: Smart On-Site Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1:   * + - * 1. PECO should leverage completed SOS projects to promote the technology. CHP system owners expressed pride for their projects and may welcome the opportunity to publicize their success. If PECO wishes to foster the market for CHP in its service territory, it could invite CHP owners to speak about their experiences with the technology and PECO’s program at relevant industry events. Some CHP owners might be willing to host such events at their facility and provide tours of the system.         2. Provide design support to customers. | 1. **Being Considered:** PECO is using marketing awareness campaigns as well as direct marketing outreach segmentation tactics to drive participation in this program. 2. **Implemented:** PECO did incorporate the design support incentive as part of the Phase III program offering. |
| Recommendation 2: Set final Phase III project enrollment deadlines of January 1, 2019 for projects over 1 MW and January 1, 2020 for projects less than 1 MW to mitigate completion risks that lead to portfolio-level uncertainty. | **Being Considered:** PECO is actively reshaping the enrollment strategies for Phase III by placing specific eligibility criteria and guidelines for project participation and enrollment to mitigate compliance risk. Project eligibility information will be communicated upfront as part of the application process. |
| Recommendation 3: PECO should host an open house for participants and developers to meet PECO and CSP staff to discuss any substantive changes to the program in Phase III. | **Being Considered** |
| Recommendation 4: Create a liaison with the DEP. | **Rejected** |
| Recommendation 5: Develop a program manual for developers and participants. The program manual should provide a standardized feasibility template, a process chart describing key milestones, and more details regarding enrollment, interconnection, and incentive payout. | **Implemented** |

Source: Navigant analysis

## Financial Reporting

In PY5 and PY7 the program was below its TRC goal, which brought the Phase II TRC to 0.73. This is below the Phase II TRC goal of 3.9, which was laid out in the March 2014 revision of the Phase II Energy Efficiency and Conservation Plan. A breakdown of the program finances (by program) is presented in Table 15‑10.

Table ‑: Summary of Smart On-Site Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| Row # | Cost Category | Actual PYTD  Costs | Actual Phase II  Costs |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 24,189 | 73,508 |
| 2 | EDC Incentives to Participants | 1,547 | 6,540 |
| 3 | EDC Incentives to Trade Allies | 0 | 0 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 22,643 | 66,968 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10 ) | 482 | 1,247 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance**[1]** | 482 | 1,247 |
| 8 | Marketing**[2]** | 0 | 0 |
| 9 | EDC Evaluation Costs | 0 | 0 |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | 5,900 | 18,944 |
|  | | | |
| 12 | Total TRC Costs[3] (Sum of Rows 1, 5, and 11) | 30,571 | 93,699 |
| 13 | Total NPV Lifetime Energy Benefits | 20,548 | 58,529 |
| 14 | Total NPV Lifetime Capacity Benefits | 2,313 | 6,855 |
| 15 | Total NPV TRC Benefits[4] | 22,861 | 65,384 |
|  | | | |
| 16 | TRC Benefit-Cost Ratio[5] | 0.75 | 0.70 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

# Smart Business Solutions

The PECO Smart Business Solutions (SBS) program is designed to help small business owners in overcoming the barriers to achieving energy efficiency such as time constraints, capital constraints, lack of efficiency awareness, and lack of labor resources. The program addresses these barriers by proactively identifying and evaluating potential savings from energy savings opportunities, providing incentives that are generally higher than similar measures installed through prescriptive and custom programs, and by providing turnkey installation services. SBS is a DI program that provides deeply discounted installations of lighting, electric water heating, and refrigeration efficiency measures.

PECO hired a CSP, SmartWatt, to implement and market the program throughout PECO’s service territory. SmartWatt was responsible for hiring and training the sales auditors performing the onsite energy assessments and audits, employing the customer service staff responding to program inquiries, and maintaining a list of program-approved contractors. SmartWatt also managed the program’s marketing, contractor invoicing, and provided biweekly program participation data that feeds into PECO’s SIDS program tracking database.

## Program Updates

In its third year of operation—PY7—the SBS program focused primarily on lighting measures but also installed a variety of refrigeration technologies such as electrically commutated fan motors, anti-sweat heat controls, and night covers, a newly added measure. Lighting dominated the savings for PY7, accounting for over 97% of the gross program savings. Of the savings from lighting, 67% came from linear fluorescent upgrades—replacing T12 lamps and fixtures with T8s and T5s.

PECO scaled back program activity considerably in PY7 due to cost overruns in PY6.[[53]](#footnote-54) The gross program savings in PY7 only amounted to approximately 4,971 MWh, as compared to 13,413 MWh in PY6. Program spending also dropped from $2.6 million in PY6 down to just under $1 million in PY7.

### Definition of Participant

PECO defines participation in the SBS program as one project at one facility. A project can contain multiple installations of one type of technology (e.g., multiple lighting fixtures) but does not include various technologies installed in that facility (e.g., lighting and refrigeration would each be different projects).

## Impact Evaluation Gross Savings

Table 16‑1 presents the gross reported energy and demand savings for the SBS program distributed across the impacted customer sectors. As the table demonstrates, approximately 97% of reported program activity in Phase II has been in the C&I sector, with the remainder in the GNI sector. The total verified savings for Phase II were 29,004 MWh and verified gross demand savings were 7.6 MW.

Table ‑: Phase II Smart Business Solutions Reported Results by Customer Sector

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Customer Sector [1]** | **Participants** | **Reported Gross Energy Savings (MWh)** | **Reported Gross Demand Reduction (MW) [2]** | **Verified Gross Energy Savings (MWh)** | **Verified Gross Demand Reduction (MW)** | **Incentives Paid[3] ($1,000)** |
| Residential (Non-Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Residential (Low-Income) | 0 | 0 | 0.0 | 0 | 0.0 | $0 |
| Small C&I | 1,143 | 30,437 | 5.9 | 27,672 | 7.2 | $0 |
| Large C&I | 4 | 315 | 0.1 | 290 | 0.1 | $0 |
| GNI | 25 | 1,091 | 0.2 | 1,042 | 0.3 | $0 |
| **PHASE II TOTAL** | **1,172** | **31,844** | **6.2** | **29,004** | **7.6** | **$0** |

[1] All customer sector totals are exclusive of each other and may be added together to get the Phase II totals.  
[2] All reported and verified demand savings in this report include line losses as required.

[3] DI programs handle incentives differently than those offered directly to the customer.  
Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Gross Verified Savings Methodology

Navigant conducted two impact evaluation activities in PY7: 1) an engineering review of all measure-specific records in the tracking database, and 2) a review of project files coupled with telephone verification interviews for a sample of PY7 participants.

1. **Engineering review.** The evaluation team conducted a comprehensive engineering review of all measure-specific records in the tracking database to verify proper application of TRM algorithms in reported savings values.
2. **Project file review.** Navigant designed a stratified random sample from the population of program participants in the PY7 tracking database at the project level. Navigant presented its sampling plan to the SWE in a memo dated April 29, 2016. To stratify the project file sample and conduct a random sample draw, Navigant first determined strata break points—originally large, medium, and small—and assigned each project to one of the strata. The evaluation team then assigned a random number to each project. This allowed the team to sort the projects by stratum and then by random number for inclusion in the sample. The SBS program caters primarily to small business customers and the large strata defined in the sample design only contained six projects. Navigant targeted all of these projects in the sample but only completed a file review of one large site. Navigant and PECO worked together to engage more of the large customers to participate in the telephone verification process by sending emails and calling multiple times at various times of the day. None of these efforts proved fruitful, leaving only one complete for the entire strata. This single complete is not representative of the entire strata of large customers, so Navigant combined the large and medium strata to provide more statistically significant verification results. Since the sample included all six projects in the large strata, the rigor of the sample design was not impacted by the combination of large and medium strata.

The stratified sample results included 16 project files representing the population of participants at a planned 85/15 confidence and precision. After multiple calls at various times in the day and emails from Navigant and PECO soliciting participation in the study, the evaluation team was only able to conduct telephone verification reviews of 12 of the 16 participants. Table 16‑2 shows the breakdown of the project file review sample.

Table ‑: PY7 Smart Business Solutions Sampling Strategy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Population Size** | **Target Levels of Confidence and Precision** | **Target Sample Size** | **Achieved Sample Size** | **Evaluation Activity** |
| Large | 42 | 85/15 | 11 | 7 | Telephone verification and file reviews |
| Small | 147 | 85/15 | 5 | 6 | Telephone verification and file reviews |
| **PROGRAM TOTAL** | **189** | **0** | **16** | **13** | **N/A** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Both evaluation activities provided information on the types and quantities of baseline and retrofit equipment and its operation both prior to and following each project. Navigant used the information collected through these activities to develop revised estimates of savings for each project and to develop program-level realization rates for energy and demand.

No onsite inspections were conducted for this program, which is consistent with the evaluation plan.

### Gross Verified Savings Results

Navigant calculated an energy realization rate of 0.97, resulting in verified gross energy savings of 4,971 MWh. The realization rate of 0.97 is an improvement over the PY6 result of 0.86, as the CSP’s HOU estimates during this program year more closely aligned with those reported by the sampled participants. Participants verified the types and quantities of measures recorded in the tracking database for all projects, so the verification rate was 100%. Table 16‑3 presents Navigant’s analysis results for PY7.

Table ‑: PY7 Smart Business Solutions Summary of Evaluation Results for Energy

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Energy Savings (MWh/yr)** | **Energy Realization Rate (%)** | **Verified Gross Energy Savings (MWh/yr)** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Large | 2,706 | 1.02 | 2,747 | 0.23 | 13% |
| Small | 2,408 | 0.92 | 2,224 | 0.29 | 20% |
| **PROGRAM TOTAL** | 5,114 | 0.97 | 4,971 | N/A | 11% |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

Table 16‑4 presents evaluation results for demand reduction. The realization rate for the program as a whole in PY7 was 0.97. The evaluation team found only minor discrepancies with the peak HOU used in the CSP’s calculations as compared to those reported by the sampled participants—mainly for projects installing HVAC equipment.

Table ‑: PY7 Smart Business Solutions Summary of Evaluation Results for Demand

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Stratum** | **Reported Gross Demand Savings  (MW) [1]** | **Demand Realization Rate (%)** | **Verified Gross Demand Savings (MW) [1]** | **Observed CV or Proportion in Sample Design** | **Relative Precision at 85% Confidence Interval** |
|
|
| Large | 0.6 | 1.07 | 0.6 | 0.16 | 9% |
| Small | 0.5 | 0.87 | 0.5 | 0.19 | 13% |
| **PROGRAM TOTAL** | **1.1** | **0.97** | **1.1** | **N/A** | **8%** |

[1] All reported and verified demand savings in this report include line losses as required.

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

## Impact Evaluation Net Savings

Navigant applied the results of the net impact evaluation conducted in PY5 to the program activity in PY6 and PY7. This methodology is in line with the approved Phase II evaluation plan for the SBS program. Refer to the net impact evaluation activities sections of the PY5 report for more information.

## Process Evaluation

Navigant’s primary process evaluation activities in PY7 consisted of in-depth interviews with the PECO and CSP program managers, as well as a review of program data.

### Process Evaluation Methodology

Navigant conducted independent interviews with the PECO and SmartWatt program managers to gather input and perspective on the operation of the program in PY7 and to discuss changes that would improve the program. Table 16‑5 provides the sampling strategy for these interviews.

Table ‑: Smart Business Solutions Sampling Strategy for PY7

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Target Group | Population Size | Assumed Proportion or CV in Sample Design | Assumed Levels of Confidence and Precision | Target Sample Size | Achieved Sample Size | Percentage of Population Frame Contacted to Achieve Sample | Used for Evaluation Activities (Impact, Process, NTG) |
| Program Managers | 2 | N/A | N/A | 2 | 2 | 100 | Process Evaluation |
| PROGRAM TOTAL | **2** | **N/A** | **N/A** | **2** | **2** | **100** | **Process Evaluation** |

Note: Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding.

Source: Navigant analysis

### Process Evaluation Results and Recommendations

This section discusses the results of the process evaluation efforts and offers a number of recommended improvements for the SBS program in future years.

**Program overall.** The PECO program manager was pleased with the overall activity and accomplishments of the SBS program in PY7, and the SmartWatt program manager thought the program ran smoothly throughout the year. Program data shows the program fell short of the Phase II targets by about 15% and overspent the budget by about $1 million. The PECO program manager described issues with the program in PY5 and PY6 that led to missing the Phase II targets. The program corrected these issues in PY7 and met the goals set forth in the final year of Phase II.

**Program control and predictability.** The program was able to ramp up and down easily and quickly to meet the goals in PY7. The PECO program manager was able to vary the length of time between the onsite audit and the delivery of the efficiency project proposal to increase or decrease the number of projects—and, therefore, control the amount of savings—coming in each month. PECO should consider using the SBS project as a lever for fine-tuning savings accomplishments at the overall portfolio level to meet targets. However, since the SBS program is an expensive option for capturing savings, PECO should be aware of the portfolio budget when increasing or decreasing SBS program activity.

**Program comprehensiveness.** Both the PECO and SmartWatt program managers called the program successful in PY7, as it was able to reach out to a wide variety of small businesses throughout PECO’s service territory. The SmartWatt manager also described the SBS program as catering to a customer base that has had little energy efficiency attention in the past due to capital constraints, time, and other such barriers. The SBS DI solution has been able to overcome those barriers and offer small business customers a means of increasing efficiency and lowering electric bills.

**Program enhancements for Phase III.** The program managers spoke extensively about the changes and enhancements made to the SBS program for the coming Phase III. The PECO program manager identified the following:

* **An expanded measure offering through the program.** SBS will continue to be a DI program for small commercial customers, but it will provide a larger list of measure options to capture more potential savings at a single site.
* **A reduced focus on measure payback.** PECO plans to move away from focusing on a 1-year measure payback for each project during Phase III. Instead, the program now appropriately incentivizes each measure, offering to make them cost-effective for the small business and small industrial sectors.

The SmartWatt program manager added the following to the list of SBS enhancements going into Phase III:

* **Reduced savings for T12 lamps and fixtures.** The SmartWatt program manager noted that the TRM for Phase III will use T8s as the baseline for T12 lamps and fixtures. This will reduce the energy savings estimates used for calculating incentives and could affect program participation. SmartWatt auditors would still calculate energy savings at the customer site using the original lamps and fixtures as the baseline. SmartWatt still sees a significant saturation of T12 fixtures in the small business and small industrial sector and does not want this change in the TRM to create a lost opportunity for energy improvements.
* **LED replacements.** SmartWatt noted that Phase III will begin to push LEDs as a replacement for T12 and T8 lamps and fixtures but was concerned about the cost-effectiveness of this new measure offering.
* **Marketing.** PECO plans to bring in a third-party marketing firm to help communicate the enhancements to the program and market the new measure offerings to customers.

Navigant offers the following findings and recommendations based on its process evaluation interviews and data review:

1. **Finding:** Based on Navigant’s discussions with sampled participants, there are still inaccuracies in the HOU utilized by the CSP in its ex ante savings estimates. Participant-reported hours were below those used in the ex ante estimates in a small number of the sampled sites. SmartWatt also incorrectly applied an 8,760 HOU value for night covers where the TRM requires an HOU of 2,190.
   1. **Recommendation:** The CSP sales auditor has reduced these HOU inaccuracies since PY6 but should continue to refine the process for gathering accurate lighting schedules at the time of the initial facility audit; this includes documenting that information clearly in the project file. The CSP should also review the TRM HOU values for new measures—such as night covers—and other measures added to the program in Phase III.
2. **Finding:** The SBS program is a highly controllable and predictable program, able to ramp up and down quickly and easily on a monthly basis to meet savings goals and targets.
   1. **Recommendation:** Going forward into Phase III, PECO should use the solution—renamed Whole-Building—as a lever for fine-tuning portfolio-level goals and targets, depending on budget.
3. **Finding:** PY7 savings still revolved around linear fluorescent upgrades of T12s to T8 and T5s, accounting for 76% of program savings. The TRM in Phase III will shift the baseline for linear fluorescent upgrades from T12s to T8s, drastically reducing the amount of savings PECO can claim for T12 upgrades.
4. **Recommendation:** PECO should have the CSP more proactively propose the installation of tubular LED (TLED) lamps and fixtures as the primary replacement for T12s. The cost of TLEDs is still high, but if PECO wants to continue to achieve strong savings and maintain the controllability of the SBS program, it must promote the TLED technologies.
5. **Finding:** There seems to be a missed opportunity for PECO to offer customers a more comprehensive approach to energy savings. Onsite visits offer the sales auditor an opportunity to review and propose more efficiency options than those incentivized through SBS, including other prescriptive technologies and behavior change.
6. **Recommendation:** PECO should take full advantage of the face time with customers during a Whole-Building audit in Phase III by connecting them with all other aspects of the small C&I program such as behavioral and equipment systems solutions. The CSP should collect primary data while onsite to provide accurate energy savings estimates for these other prescriptive technologies and begin the rebate paperwork for the customer.

## Status of Recommendations for Program

Table 16‑6 summarizes Navigant’s recommendations and their current status.

Table ‑: Smart Business Solutions Status Report on Process and Impact Recommendations

|  |  |
| --- | --- |
| Recommendations | EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC) |
| Recommendation 1: The CSP sales auditor should further refine the process for gathering and documenting accurate lighting schedules for use in the savings estimates presented to customers and in the calculation of ex ante savings. The CSP should also review the TRM HOU values for new measures—such as night covers—and other measures added to the program in Phase III. | **Being Considered:** A separate tab will be added to the Schedule C for the sales auditor to document discrepancies between the posted HOU and the true HOU. |
| Recommendation 2: Going forward into Phase III, PECO should use the program—renamed Whole-Building—as a lever for fine-tuning portfolio-level goals and targets, depending on budget. | **Implemented:** In the new plan for Phase III, the program is renamed to reflect the treatments and offerings it presents. |
| Recommendation 3: PECO should have the CSP more proactively propose the installation of TLED lamps and fixtures as the primary replacement for T12s. | **Implemented:** T12s have been proactively replaced with other more efficient measures. |
| Recommendation 4: PECO should take full advantage of the face time with customers during a Whole-Building audit in Phase III by connecting them with other aspects of the small C&I program such as behavioral and equipment systems solutions. The CSP should collect primary data while onsite to provide accurate energy savings estimates for these other prescriptive technologies and begin the rebate paperwork for the customer. | **Implemented**: Currently in process. |

Source: Navigant analysis

## Financial Reporting

Navigant’s cost-effectiveness analysis, presented in Table 4‑12, indicates that the SBS program was again cost-effective in PY7, with a benefit-cost ratio of 1.92. The overall program activity in PY7 dropped as it attempted to resolve the overspending issues from PY5 and PY6. This led to significant decreases in all cost categories for the current program year.

Table ‑: Smart Business Solutions Summary of Program Finances

|  |  |  |  |
| --- | --- | --- | --- |
| Row # | Cost Category | Actual PYTD  Costs | Actual Phase II  Costs |
| **($1,000)** | **($1,000)** |
| 1 | Incremental Measure Costs (Sum of Rows 2 through 4) | 779 | 7,170 |
| 2 | EDC Incentives to Participants | 0 | 0 |
| 3 | EDC Incentives to Trade Allies | 0 | 0 |
| 4 | Participant Costs (Net of Incentives/Rebates Paid by Utilities) | 779 | 7,170 |
|  | | | |
| 5 | Program Overhead Costs (Sum of Rows 6 through 10 ) | 1,000 | 5,536 |
| 6 | Design and Development | 0 | 0 |
| 7 | Administration, Management, and Technical Assistance**[1]** | 999 | 5,530 |
| 8 | Marketing**[2]** | 1 | 6 |
| 9 | EDC Evaluation Costs | **0** | **0** |
| 10 | SWE Audit Costs | 0 | 0 |
|  | | | |
| 11 | Increases in Costs of Natural Gas (or Other Fuels) for Fuel-Switching Programs | **0** | **0** |
|  | | | |
| 12 | Total TRC Costs[3] (Sum of Rows 1, 5, and 11) | 1,779 | 12,706 |
| 13 | Total NPV Lifetime Energy Benefits | 2,902 | 19,606 |
| 14 | Total NPV Lifetime Capacity Benefits | 507 | 3,714 |
| 15 | Total NPV TRC Benefits[4] | 3,410 | 23,417 |
|  | | | |
| 16 | TRC Benefit-Cost Ratio[5] | 1.92 | 1.84 |
| Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the “Report Definitions” section of this report for more details.  [1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.  [2] Includes the marketing CSP and marketing costs by program CSPs.  [3] Total TRC Costs includes Total EDC Costs and Participant Costs. [4] Total TRC Benefits equals the sum of Total Lifetime Energy Benefits and Total Lifetime Capacity Benefits based upon verified gross kWh and kW savings. Benefits include avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase I are not to be included as a part of Total TRC Benefits for Phase II. [5] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.  Values in tables may not reconcile exactly with the sum of more detailed level results or previously reported results due to rounding. | | | |

Source: Navigant analysis

##### EM&V Information

###### Participant Definitions

Table ‑: PY7 Participant Definition by Program

|  |  |  |  |
| --- | --- | --- | --- |
| Program | Participant Definition | Can there be more than one measure per participant? | Impact Sample Defined By: |
| Smart Home Rebates | One purchased measure | Yes | Measure |
| Smart House Call | One home | Yes | Home |
| Smart Appliance Recycling | One appliance | Yes | Measure |
| Smart Usage Profile | One home | No | Home |
| Smart Energy Saver | One kit | Yes | Kit |
| Smart Builder Rebates | One home | No | Home |
| Low Income Energy Efficiency Program | One home | Yes | Home |
| Smart AC Saver | One home | Yes | N/A |
| Smart Equipment Incentives | Unique project number | Yes | Project |
| Smart Construction Incentives | Unique project number | Yes | Project |
| Smart Multi-Family Solutions | Unique account ID (meter) | Yes | Meter |
| Smart On-Site | Unique project number | No | Project |
| Smart Business Solutions | Unique project number | Yes | Project |

Source: Navigant analysis

###### PY7 Evaluation Activities

Table ‑: PY7 Actual Evaluation Activities

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Programs | Sectors | Records Review | Participant Surveys | Nonparticipant Surveys | Site Visits | Metering[1] |
| Smart Home Rebates | Residential | 3,614,977 | 744 | N/A | N/A | N/A |
| Smart House Call | Residential | 130 | 130 | N/A | N/A | N/A |
| Smart Appliance Recycling | Residential | 9,693 | 200 | N/A | N/A | N/A |
| Smart Usage Profile | Residential | 159,076 | N/A | N/A | N/A | N/A |
| Smart Energy Saver | Residential | 73,365 | N/A | N/A | N/A | N/A |
| Smart Builder Rebates | Residential | 10 | 7 | N/A | N/A | N/A |
| Low Income Energy Efficiency Program | Low Income Residential | 514,660 | 90 | N/A | 19 | N/A |
| Smart AC Saver | Residential and C&I | 94 (Res) 91 (C&I) | 70 (Res) 70 (C&I) | N/A | N/A | N/A |
| Smart Equipment Incentives | C&I and GNI | 74 (C&I) 39 (GNI) | N/A | 52 (C&I) 35 (GNI) | 48 (C&I) 42 (GNI) | 23 (C&I)  32 (GNI) |
| Smart Construction Incentives | C&I | 32 | N/A | N/A | 20 | 12 |
| Smart Multi-Family Solutions | Residential, Commercial, and GNI | 72 | 72 | N/A | 15 | N/A |
| Smart On-Site | Commercial, GNI | 6 | 3 (C&I) 3 (GNI) | N/A | 6 | 6 |
| Smart Business Solutions | Commercial | 13 | N/A | N/A | N/A | N/A |

[1] Does not include statistical billing analysis.

Source: Navigant analysis

##### TRC Incremental Costs

Table ‑: Measure Incremental Costs Not Taken from SWE Database or Filed Plan

| **Program** | **Measure** | **Incremental Cost** | **Incremental Cost Source** |
| --- | --- | --- | --- |
| Smart AC Saver (Commercial) | Air Conditioning Control Switch | 0.00 / Switch | Inferred from Program Design |
| Smart AC Saver (Residential) | Air Conditioning Control Switch | 0.00 / Switch | Inferred from Program Design |
| Smart Business Solutions | ENERGY STAR Screw-in CFL Bulbs (General Service, Non-Dimmable) – Lumens = 1490 to 2600, 23W | 100.83 / Lamp | Program Tracking Database |
| Smart Business Solutions | ENERGY STAR Screw-in CFL Bulbs (General Service, Non-Dimmable) – Lumens = 750-1049, 13W | 36.39 / Lamp | Program Tracking Database |
| Smart Business Solutions | ENERGY STAR Screw-in CFL Bulbs (Specialty: Globe) – Lumens = 310-749, 9W | 30.41 / Lamp | Program Tracking Database |
| Smart Business Solutions | Exit Signs – Interior LED Exit Signs, 2W | 128.10 / Fixture | Program Tracking Database |
| Smart Business Solutions | LED Refrigeration Case Lighting – 5-Door LED Refrigerated Case – 60" LED Sticks, 69.6W | 275.99 / Refrigerated Case | Program Tracking Database |
| Smart Business Solutions | LED: A19, General Service Incandescent Lamp Replacement – Lumens = 310-749, 19W | 462.26 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: A19, General Service Incandescent Lamp Replacement -–Lumens = 310-749, 6.5W | 260.70 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: A19, General Service Incandescent Lamp Replacement – Lumens = 310-749, 7W | 134.36 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: A19, General Service Incandescent Lamp Replacement – Lumens = 750-1049, 11W | 117.41 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: BR30 – Lumens = 561-837, 13W | 173.11 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: BR40 – Lumens = 561-837, 12W | 104.07 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: BR40 – Lumens = 561-837, 14W | 217.30 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: LED Replacing HID – New LED Area/Pole Mount Fixture Replacing HID 100-175W, 50W | 878.02 / Fixture | Program Tracking Database |
| Smart Business Solutions | LED: LED Replacing HID – New LED Area/Pole Mount Fixture Replacing HID 400W, 137W | 518.09 / Fixture | Program Tracking Database |
| Smart Business Solutions | LED: LED Replacing HID – New LED Flood Replacing HID 175-320W, 41W | 477.71 / Fixture | Program Tracking Database |
| Smart Business Solutions | LED: LED Replacing HID – New LED Flood Replacing HID 400W, 79W | 833.52 / Fixture | Program Tracking Database |
| Smart Business Solutions | LED: LED Replacing HID – New LED Wallpack Replacing HID 176-250W, 26W | 958.72 / Fixture | Program Tracking Database |
| Smart Business Solutions | LED: MR16 – Lumens = 310-749, 6.5W | 143.87 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: MR16 – Lumens = 310-749, 6W | 462.77 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: PAR20 – Lumens = 310-749, 8W | 242.68 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: PAR30 – Lumens = 561-837, 12W | 202.08 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: PAR38 – Lumens = 750-1049, 13W | 314.26 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: A19 – Lumens = 310-749, 9.5W | 117.31 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: BR30 – Lumens = 310-749, 9.5W | 244.18 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: BR30 – Lumens = 310-749, 9W | 152.06 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: BR30 – Lumens = 561-837, 10.5W | 297.54 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: CLBR – Lumens = 180 to 309, 4W | 478.09 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: CLBR – Lumens = 310-749, 4.5W | 486.4 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: CLBR – Lumens = 310-749, 9W | 130.81 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: MR16 – Lumens = 310-749, 4.5W | 25.84 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: MR16 – Lumens = 310-749, 8.5W | 158.27 / Lamp | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast– High-Bay Fluorescent T-5, T5 3F54HO | 4,705.88 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – High-Bay Fluorescent T-5, T5 4F54HO | 1,657.66 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – High-Bay Fluorescent T-5, T5 6F54HO | 772.87 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – High-Bay Fluorescent T-8, HPT8 4F32 ISH | 615.52 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – High-Bay Fluorescent T-8, HPT8 6F32 ISH | 447.53 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2' Relamp and Reballast, HPT8 1F17 ISL | 7.55 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2' Relamp and Reballast, HPT8 2F17 ISL | 96.66 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x2 Troffer Retrofit, HPT8 2F17 ISL | 135.13 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x2 Troffer Retrofit, HPT8 3F17 ISL | 127.24 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x4 Troffer Retrofit, HPT8 2F28 ISL | 233.64 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x4 Troffer Retrofit, HPT8 2F32 ISH | 939.95 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x4 Troffer Retrofit, HPT8 2F32 ISL | 292.24 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x4 Troffer Retrofit, HPT8 2F32 ISN | 409.78 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 3' Relamp and Reballast, HPT8 1F25 ISL | 43.37 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 3' Relamp and Reballast, HPT8 2F25 ISL | 47.93 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Industrial Retrofit, HPT8 1F28 ISL | 38.45 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Industrial Retrofit, HPT8 1F32 ISL | 69.84 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Industrial Retrofit, HPT8 1F32 ISN | 256.24 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Industrial Retrofit, HPT8 2F28 ISL | 87.27 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Industrial Retrofit, HPT8 2F32 ISL | 42.64 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast - HPT8 1F28 ISL | 142.03 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast - HPT8 1F32 ISL | 177.08 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast - HPT8 2F28 ISL | 142.84 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast - HPT8 2F32 ISL | 97.71 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast - HPT8 2F32 ISN | 499.22 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast - HPT8 3F28 ISL | 461.7 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast - HPT8 3F32 ISL | 3.66 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast - HPT8 4F28 ISL | 255.01 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast - HPT8 4F32 ISL | 172.19 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 6' Industrial Retrofit, HPT8 2F25 ISL | 95.5 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 6' Industrial Retrofit, HPT8 4F25 ISL | 216.28 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 2F28 ISL | 307.45 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 2F32 ISH | 635.64 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 2F32 ISN | 281.65 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 4F28 ISL | 565.03 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 4F32 ISH | 255.37 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 4F32 ISL | 232.38 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 4F32 ISN | 589.58 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 2X4 Recessed Troffer, HPT8 2F28 ISL | 15.74 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 2X4 Recessed Troffer, HPT8 2F32 ISN | 337.25 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 4' Industrial Fixture, HPT8 1F28 ISL | 53.29 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 4' Industrial Fixture, HPT8 1F32 ISL | 50.91 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 4' Industrial Fixture, HPT8 2F28 ISL | 1.35 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 4' Industrial Fixture, HPT8 2F32 ISL | 118.09 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 4' Vaportight Fixture, HPT8 2F32 ISH | 633.79 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 4' Vaportight Fixture, HPT8 2F32 ISL | 109.61 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 4' Wrap Fixture, HPT8 2F28 ISL | 57.72 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast– New HPT8 4' Wrap Fixture, HPT8 2F32 ISL | 10.7 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast– New HPT8 8' Industrial Fixture, HPT8 2F28 ISL | 319.64 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 8' Industrial Fixture, HPT8 2F32 ISH | 142.34 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 8' Industrial Fixture, HPT8 4F28 ISL | 139.92 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast– New HPT8 8' Industrial Fixture, HPT8 4F32 ISH | 251.3 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 8' Industrial Fixture, HPT8 4F32 ISL | 185.97 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 8' Industrial Fixture, HPT8 4F32 ISN | 964.99 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 8' Vaportight Fixture, HPT8 4F28 ISL | 322.33 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 8' Vaportight Fixture, HPT8 4F32 ISH | 665.43 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 8' Wrap Fixture, HPT8 4F28 ISL | 150.89 / Fixture | Program Tracking Database |
| Smart Business Solutions | Removed – Removed Fluorescent Case Lighting, 0W | 2,626.62 / Refrigerated Case | Program Tracking Database |
| Smart Business Solutions | Removed – Removed Lighting Fixture, 0W | 556.75 / Fixture | Program Tracking Database |
| Smart Business Solutions | Controls: Anti-Sweat Heater Controls – Anti-Sweat Heater Controls, Off 85% Annually, 20% of Peak | 1148.71 / Per Door | Program Tracking Database |
| Smart Business Solutions | Evaporator Fan EC Motor for Walk-In Cases – Refrigerator, PSC to ECM, Cooler: 1/20 HP | 99.94 / Motor | Program Tracking Database |
| Smart Business Solutions | Evaporator Fan EC Motor for Walk-In Cases – Refrigerator, Shaded Pole to ECM, Cooler: 1/15 HP | 2,446.39 / Motor | Program Tracking Database |
| Smart Business Solutions | Evaporator Fan EC Motor for Walk-In Cases – Refrigerator, Shaded Pole to ECM, Cooler: 1/20 HP | 2,446.39 / Motor | Program Tracking Database |
| Smart Business Solutions | Evaporator Fan EC Motor for Walk-In Cases – Refrigerator, Shaded Pole to ECM, Freezer: 1/15 HP | 1,838.02 / Motor | Program Tracking Database |
| Smart Business Solutions | Evaporator Fan EC Motor for Walk-In Cases – Refrigerator, Shaded Pole to ECM, Freezer: 1/20 HP | 1,838.02 / Motor | Program Tracking Database |
| Smart Business Solutions | Night Cover – Night Cover, Night Cover | 348.37 / LF of case | Program Tracking Database |
| Smart Business Solutions | CFL: ENERGY STAR Screw-in CFL Bulbs (General Service, Non-Dimmable) - Lumens = 310-749, 7W | 30.1 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: A19, General Service Incandescent Lamp Replacement– Lumens = 310-749, 19W | 462.26 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: A19, General Service Incandescent Lamp Replacement – Lumens = 750-1049, 11W | 117.41 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: BR30 – Lumens = 561-837, 13W | 173.11 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: MR16 – Lumens = 310-749, 10W | 141.99 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: PAR20 – Lumens = 310-749, 8W | 242.68 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: PAR30 – Lumens = 561-837, 12W | 202.08 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: PAR38 – Lumens = 750-1049, 13W | 314.26 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: A19 – Lumens = 310-749, 9.5W | 117.31 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: BR30 – Lumens = 310-749, 9.5W | 244.18 / Lamp | Program Tracking Database |
| Smart Business Solutions | LED: CLBR – Lumens = 180 to 309, 4W | 478.09 / Lamp | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – High-Bay Fluorescent T-8, HPT8 4F32 ISH | 615.52 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2' Relamp and Reballast, HPT8 1F17 ISL | 7.55 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2' Relamp and Reballast, HPT8 2F17 ISL | 96.66 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x2 Troffer Retrofit, HPT8 2F17 ISL | 135.13 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x2 Troffer Retrofit, HPT8 3F17 ISL | 127.24 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x4 Troffer Retrofit, HPT8 2F28 ISL | 233.64 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x4 Troffer Retrofit, HPT8 2F32 ISL | 292.24 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 2x4 Troffer Retrofit, HPT8 2F32 ISN | 409.78 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 3' Relamp and Reballast, HPT8 2F25 ISL | 47.93 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Industrial Retrofit, HPT8 1F32 ISN | 256.24 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast, HPT8 1F28 ISL | 142.03 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast, HPT8 2F28 ISL | 142.84 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast, HPT8 2F32 ISL | 97.71 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast, HPT8 3F28 ISL | 461.7 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 4' Relamp and Reballast, HPT8 4F28 ISL | 255.01 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 4F28 ISL | 565.03 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 4F32 ISL | 232.38 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – HPT8 8' Industrial Retrofit, HPT8 4F32 ISN | 589.58 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 4' Industrial Fixture, HPT8 2F28 ISL | 1.35 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 8' Industrial Fixture, HPT8 4F28 ISL | 139.92 / Fixture | Program Tracking Database |
| Smart Business Solutions | Linear Fluorescent: T8/T5 Fluorescent Fixture w/ Electronic Ballast – New HPT8 8' Wrap Fixture, HPT8 4F28 ISL | 150.89 / Fixture | Program Tracking Database |
| Smart Business Solutions | Evaporator Fan EC Motor for Walk-In Cases – Refrigerator, Shaded Pole to ECM, Cooler: 1/15 HP | 2,446.39 / Motor | Program Tracking Database |
| Smart Equipment Incentives (C&I) | A/C: Air Source – < 65,000 Btu/h, 15 SEER or Greater | 180.43 / Per Ton | Program Tracking Database |
| Smart Equipment Incentives (C&I) | A/C: Air Source – < 65,000 Btu/h (5.5 tons), 15 SEER or Greater | 172.00 / Per Ton | Program Tracking Database |
| Smart Equipment Incentives (C&I) | A/C: Air Source – >= 135,000 Btu/h and < 240,000 Btu/h, 12.1 EER or Greater | 89.13 / Per Ton | Program Tracking Database |
| Smart Equipment Incentives (C&I) | A/C: Air Source – >= 65,000 Btu/h and < 135,000 Btu/h, 12.3 EER or Greater | 27.35 / Per Ton | Program Tracking Database |
| Smart Equipment Incentives (C&I) | A/C: Air Source – >= 760,000 Btu/h (> 63.33 tons), 10.3 IEER/10.3 IPLV or Greater | 151.35 / Per Ton | Program Tracking Database |
| Smart Equipment Incentives (C&I) | Controls: EMS | 0.51 / Per Ton | Program Tracking Database |
| Smart Equipment Incentives (C&I) | Controls: Hotel Guest Room Occupancy Sensor – Electric Heat/AC, Electric Heat/AC | 260.00 / Per Ton | Program Tracking Database |
| Smart Equipment Incentives (C&I) | VSD on Air Compressors– Screw Air Compressor < 50 HP, < 50 HP | 430.00 / Per Fan | Program Tracking Database |
| Smart Equipment Incentives (C&I) | Controls: Evaporator Coil Defrost Control – Evaporator Coil Defrost Control, Controls | 500.00 / Per Unit | Program Tracking Database |
| Smart Equipment Incentives (C&I) | Controls: Floating-Head Pressure Controls – Floating-Head Pressure Controls, Compressors >= 1.5 HP | 867.25 / Per Unit | Program Tracking Database |
| Smart Equipment Incentives (C&I) | Evaporator Fan EC Motor for Reach-in Cases – Freezer | 185.00 / Per Unit | Program Tracking Database |
| Smart Equipment Incentives (C&I) | Evaporator Fan EC Motor for Reach-in Cases – Refrigerator | 185.00 / Per Unit | Program Tracking Database |
| Smart Equipment Incentives (C&I) | Evaporator Fan EC Motor for Walk-In Cases – Freezer | 250.00 / Per Unit | Program Tracking Database |
| Smart Equipment Incentives (C&I) | Evaporator Fan EC Motor for Walk-In Cases – Refrigerator | 250.00 / Per Unit | Program Tracking Database |
| Smart Equipment Incentives (GNI) | Controls: Hotel Guest Room Occupancy Sensor – Electric Heat/AC | 260.00 / Per Ton | Program Tracking Database |
| Smart On-Site (C&I) | Combined Heat and Power– <= 0.5 MW | 1.93 / per kWh saved | PECO EE&C Phase II Plan (Converted Based on Unit Capacity) |
| Smart On-Site (C&I) | Combined Heat and Power – > 0.5 MW, <= 1.5 MW | 0.79 / per kWh saved | PECO EE&C Phase II Plan (Converted Based on Unit Capacity) |
| Smart On-Site (GNI) | Combined Heat and Power – <= 0.5 MW | 1.95 / per kWh saved | PECO EE&C Phase II Plan (Converted Based on Unit Capacity) |
| Smart On-Site (GNI) | Combined Heat and Power – > 0.5 MW, <= 1.5 MW | 0.71 / per kWh saved | PECO EE&C Phase II Plan (Converted Based on Unit Capacity) |
| Smart On-Site (GNI) | Combined Heat and Power – > 1.5 MW, <= 10 MW | 0.35 / per kWh saved | PECO EE&C Phase II Plan (Converted Based on Unit Capacity) |

##### Low-Income Participation in Non-Low-Income Programs

All Low-Income Energy Efficiency Program (LEEP) participants are assumed to be low-income participants. In order to determine the rate of participation of low-income customers outside of LEEP, Navigant fielded a standard battery of demographics questions for all other residential programs. These batteries include questions regarding the following:

* Number of people (including the respondent) who lived in the respondent’s household full time for at least six month of the year
* Total household income for 2013

For those respondents who would not provide total household income, the survey included questions regarding ranges of income. The survey language was as follows:

QD5A. How many people, including yourself, live in your home full time at least six months of the year?

**\_\_\_\_\_\_ [RECORD NUMBER OF OCCUPANTS]**

1. DON’T KNOW
2. REFUSED

QD5B. What is your total 2015 income before taxes for all members of your household? Was it (***READ LIST) STOP ME WHEN I GET TO THE RIGHT RANGE***

1. Less than $30,000
2. $30,000 but under $50,000
3. $50,000 but under $75,000
4. $75,000 but under $100,000
5. $100,000 but under $150,000
6. $150,000 but under $200,000
7. Above $200,000

99. Refused

**If the entirety of income range reported in QD5b is greater than the [INCOME\_THRESHOLD\_150] corresponding to the occupancy level reported in QD5A, Skip to QD7.**

**If the entirety of income range reported in QD5b is less than or equal to the [INCOME\_THRESHOLD\_150] corresponding to the occupancy level reported in QD5A, flag as “low income <150” and skip to QD7.**

**If some, but not all, of the income range reported in QD5b is equal to or less than the [INCOME\_THRESHOLD\_150] corresponding to the occupancy level reported in QD5A, then ask QD6A**

QD6A.  Just for clarification purposes, was your total 2014 household income before taxes below **[INCOME\_THRESHOLD\_150]**?

1. Yes **[FLAG AS “low income < 150” AND SKIP TO QD7]**
2. No
3. Don’t know **[SKIP TO QD7]**
4. Refused **[SKIP TO QD7]**

**Income Threshold Table**

|  |  |
| --- | --- |
| **QD5 (# People in HH)** | **INCOME\_THRESHOLD\_150** |
| **1** | **$ 18,000** |
| **2** | **$ 24,000** |
| **3 or DK/REF** | **$ 30,000** |
| **4** | **$ 37,000** |
| **5** | **$ 43,000** |
| **6** | **$ 49,000** |
| **7** | **$ 55,000** |
| **8** | **$ 62,000** |
| **9** | **$ 68,000** |
| **10** | **$ 74,000** |
| **11** | **$ 80,000** |
| **12 or more** | **$ 87,000** |

QD7. What is the highest education level you have completed? [**READ LIST]**

1. Some high school
2. High school graduate
3. Some college/vocational school
4. College degree
5. Graduate or professional degree
6. OTHER (SPECIFY) \_\_\_\_\_\_\_\_\_\_\_\_\_\_
7. REFUSED

QD8. Gender **[DO NOT ASK RESPONDANT, USE YOUR JUDGEMENT]**

1. MALE
2. FEMALE

QD9. What energy source do you use to heat your water? **[PROMPT IF NECESSARY]**

1. Natural Gas
2. Electricity
3. Oil
4. Propane
5. OTHER (SPECIFY) \_\_\_\_\_\_\_\_\_\_\_\_\_
6. DON’T KNOW
7. REFUSED

##### SHR Residential Lighting Upstream Program Cross-Sector Sales

Navigant developed the PY7 cross-sector installation rate from the SHR in-store intercept surveys. As shown in Table D‑1, the intercept surveys were conducted in a representative sampling of participating retail stores by sales channel.

Table ‑: Store Sampling for PY5 Intercepts Based on Proportion of Program Bulb Sales

|  |  |  |  |
| --- | --- | --- | --- |
| Retailer Name | Proportion of Total Program Bulb Sales\* | Proportional Sample Number of Stores, by Program Sales | Number of Stores Visited by Evaluation Team |
| Ace Hardware | 2% | 0.3 | 0 |
| BJs Wholesale Club | 1% | 0.1 | 0 |
| Batteries Plus | 0% | 0 | 0 |
| Billows Electric Supply | 0% | 0 | 0 |
| City Electric Supply | 0% | 0 | 0 |
| Colonial Electric | 0% | 0 | 0 |
| Costco | 15% | 0.7 | 0 |
| Denney Electric | 1% | 0 | 1 |
| Do it Best | 0% | 0 | 0 |
| Dollar Tree | 1% | 0.5 | 0 |
| Family Dollar | 2% | 1.3 | 0 |
| Giant Food Stores | 0% | 0.1 | 0 |
| Goodwill | 2% | 0.2 | 1 |
| HTR | 1% | 0.3 | 0 |
| Habitat ReStore | 1% | 0 | 0 |
| Kody Lighting | 0% | 0 | 0 |
| Lighting by Design | 0% | 0 | 0 |
| Lowe’s | 5% | 0.9 | 2 |
| Rittenhouse Lighting Supply | 0% | 0 | 0 |
| Sam’s Club | 3% | 0.1 | 1 |
| Target | 2% | 0.4 | 2 |
| TechniArt.com | 1% | 0 | 0 |
| The Home Depot | 53% | 13.2 | 10 |
| True Value | 0% | 0 | 0 |
| Walgreens | 0% | 0.2 | 0 |
| Walmart | 9% | 2.3 | 1 |
| Wegmans | 0% | 0 | 0 |

\*Proportions are reported with one significant digit. Values of 0% reflect fractional percentages that are non-zero.

Source: Navigant analysis

In the PY7 analysis, 198 program bulb purchasers answered questions pertaining to cross-sector installation of bulbs. Of the 808 bulbs in the baskets of those 198 respondents, 38 were slated for nonresidential sockets, which yielded a cross-sector sales rate of 7.3%. The evaluation team applied the bulb-specific rates of 11.0% for CFLs, 1.3% for omni-directional LEDs, and 7.3% for directional LEDs. Table D‑2 shows cross-sector installations by bulb type and by commercial building type from the PY7 intercept survey data.

**Table D‑2: PY7 Cross-Sector Bulb Installations by Business** Type

|  |  |  |  |
| --- | --- | --- | --- |
| Business Type | CFLs | Omni-Directional LEDs | Directional LEDs |
| Apartment Building: High-Rise and Low-Rise | 12 | 0 | 6 |
| Office | 0 | 0 | 4 |
| Public Services (Nonfood) | 0 | 4 | 5.5 |
| Restaurant | 0 | 1.5 | 0 |
| Retail | 0 | 0 | 1 |
| Storage Conditioned/Unconditioned | 4 | 0 | 0 |
| TOTAL | **16** | **5.5** | **16.5** |

Source: Navigant analysis

##### Glossary of Terms

This Glossary of Terms was provided by the SWE.[[54]](#footnote-55)

**-A-**

**Administration Management and Technical Assistance Costs:** Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management, and legal and technical assistance.

**Avoided Cost**: In the context of energy efficiency, the costs that are avoided by the implementation of an energy efficiency measure, program, or practice. Such costs are used in benefit-cost analyses of energy efficiency measures and programs as defined by the Pennsylvania PUC in the 2013 TRC Test Order.

**-B-**

**Baseline**: Conditions that would have occurred without implementation of the subject measure or project. Baseline conditions are sometimes referred to as business-as-usual conditions and are used to calculate program-related efficiency or emissions savings. Baselines can be defined as either project-specific baselines or performance-standard baselines (e.g., building codes). For the purposes of Act 129, baselines are defined in the Pennsylvania TRM, in approved custom protocols, and in TRM interim approved protocols.

**Baseline Data**: The information representing the systems being upgraded before the energy efficiency activity takes place.

**Benefit-Cost Ratio**: The mathematical relationship between the benefits and costs associated with the implementation of energy efficiency measures, programs, or practices. The benefits and costs are typically expressed in dollars. This is the ratio of the discounted total benefits of the program to the discounted total costs over the expected useful life of the energy efficiency measure. The explicit formula for use in Pennsylvania is set forth in the TRC Order. Also see *Benefit-Cost Test*.

**Benefit-Cost Test**: Also called the *Cost-Effectiveness Test,* defined as the methodology used to compare the benefits of an investment to the costs. For programs evaluated under Act 129, the TRC Test is the required benefit-cost test as established in the TRC Order.

**Bias**: The extent to which a measurement, sampling, or analytic method systematically underestimates or overestimates a value. Some examples of types of bias include engineering model bias; meter bias; sensor bias; an inadequate or inappropriate estimate of what would have happened absent a program or measure installation; a sample that is unrepresentative of a population; and selection of other variables in an analysis that are too correlated with the savings variable (or each other) in explaining the dependent variable (such as consumption).

**-C-**

**Coefficient of Variation (CV)**: The mean (average) of a sample divided by its standard error.

**Coincident Demand**: The demand of a device, circuit, or building that occurs at the same time as the system peak demand. For purposes of Act 129 reporting, the coincident demand is during the peak period as defined in the TRM (June through August, excluding weekends and holidays between 2 p.m. and 6 p.m.).

**Coincidence Factor**: The ratio, expressed as a numerical value or as a percentage of connected load, of the coincident demand of an electrical appliance or facility type to the system peak.

**Completed Project:** A project in which the energy conservation measure has been installed and is commercially operable, and for which an incentive has been provided.

**Confidence**: An indication of the probability that an estimate is within a specified range of the true value of the quantity in question. Confidence is the likelihood that the evaluation has captured the true value of a variable within a certain estimated range. Also see *Precision*.

**Correlation**: For a set of observations, such as for participants in an energy efficiency program, the extent to which values for one variable are associated with values of another variable for the same participant. For example, facility size and energy consumption usually have a high positive correlation.

**Cost-Benefit and Cost-Effectiveness Analysis**: See *Benefit-Cost Test*.

**Cost-Effectiveness**: An indicator of the relative performance or economic attractiveness of an investment or practice. In the energy efficiency field, the present value of the estimated benefits produced by an energy efficiency program is compared to the estimated total costs to determine if the proposed investment or measure is desirable from a variety of perspectives (e.g., whether the estimated benefits exceed the estimated costs consistent with definitions in the TRC Order. See *Benefit-Cost Test*.

**Cost-Effectiveness Test**: See *Benefit-Cost Test*.

**Cumulative Energy Savings**: The summation of energy savings associated with multiple projects or programs over a specified period of time.

**Custom Program**: An energy efficiency program intended to provide efficiency solutions to unique situations not amenable to common or prescriptive solutions addressed by the Pennsylvania TRM. Each custom project is examined for its individual characteristics, savings opportunities, efficiency solutions, and often, customer incentives. Under Act 129, these programs fall outside of the jurisdiction of the Pennsylvania TRM, and thus the M&V protocols for each should be approved by the SWE.

**-D-**

**Deemed Savings**: An estimate of energy or demand savings for a single unit of an installed energy efficiency measure that: (1) has been developed from data sources and analytical methods that are widely considered acceptable for the measure and purpose, and (2) is applicable to the situation being evaluated. Individual parameters or calculation methods can also be deemed. Deemed savings for measures implemented under Act 129 are stipulated in the Pennsylvania TRM, which undergoes an annual review and update process, as well as in the Interim TRM Measures, which are subject to interim approval by the SWE.

**Defensibility**: The ability of evaluation results to stand up to scientific scrutiny. Defensibility is based on assessments by experts of the evaluation’s validity, reliability, and accuracy. Under Act 129, it is the role of the SWE to determine the defensibility of the verified savings estimates reported by each of the EDCs.

**Delta Watts**: The difference in the connected load (wattage) between existing or baseline equipment and the energy efficient replacement equipment, expressed in Watts or kilowatts.

**Demand**: The rate of energy flow. Demand usually refers to the amount of electric energy used by a customer or piece of equipment over a defined time interval (e.g., 15 minutes), expressed in kilowatts (equals kWh/h). Demand can also refer to natural gas usage over a defined time interval, usually as Btu/hr., kBtu/hr., therms/day, or ccf/day.

**Demand Reduction**: See *Demand Savings*.

**Demand Response**:The reduction of customer energy usage at times of peak usage in order to help system reliability, to reflect market conditions and pricing, or to support infrastructure optimization or deferral of additional infrastructure. DR programs may include contractually obligated or voluntary curtailment, direct load control, and pricing strategies.

**Demand Savings**: The reduction in electric demand from the demand associated with a baseline system to the demand associated with the higher-efficiency equipment or installation. Demand savings associated with energy efficiency measures implemented under Act 129 are calculated according to the approved calculation methods stipulated in the TRM or subsequently approved through alternative methods (e.g., interim measures, custom protocols).

**Demand-Side Management**: Strategies used to manage energy demand including energy efficiency, load management, fuel substitution, and load shedding.

**-E-**

**Energy Efficiency and Conservation (EE&C) Plan:** Plan as filed by the EDC and approved by the PUC.

**EE&C Plan Estimate for Program Year:** An estimate of the energy savings or demand reduction for the current program year as filed in the EDC EE&C plans.

**Effective Useful Life**: An estimate of the median number of years that efficiency measures installed under a program are still in place and operable. For measures implemented under Act 129, it is required that the effective useful life or 15 years, whichever is less, be used to determine measure assessments.

**Electric Distribution Company (EDC)**: In reference to Act 129, there are seven EDCs with at least 100,000 customers that are required to adopt a plan to reduce energy and demand consumption within their service territory in accordance with 66 Pa. C.S. § 2608. The seven EDCs are: Duquesne Light, Metropolitan Edison Company, Pennsylvania Electric Company, Pennsylvania Power Company, PECO Energy Company, PPL Electric Utilities, and West Penn Power.

**End Use**: An appliance, activity, system, or equipment that uses energy.

**Energy Conservation**: Using less of a service in order to save energy. The term often is used unintentionally instead of *energy efficiency*.

**Energy Efficiency**: The use of less energy to provide the same or an improved level of service to the energy consumer; or the use of less energy to perform the same function.

**Energy Efficiency Measure:** An installed piece of equipment or a system, modification of equipment systems, or modified operations in customer facilities that reduce the total amount of electrical or gas energy and the capacity that otherwise would have been needed to deliver an equivalent or improved level of comfort or energy service.

**Energy Savings**: A reduction in electricity use (kWh) or in fossil fuel use in thermal unit(s).

**Evaluation**: The conduct of any of a wide range of assessment studies and other activities aimed at documenting an enhanced understanding of a program or portfolio, including determining the effects of a program, understanding or documenting program performance, program-related markets and market operations, program-induced changes in energy efficiency markets, levels of potential demand or energy savings, and/or program cost-effectiveness. Market assessments, monitoring and evaluation, and M&V are aspects of evaluation.

**Ex Ante Savings Estimate**: Forecasted savings used for program and portfolio planning purposes.

**Ex Post Savings Estimate**: Savings estimate reported by an evaluator after the energy impact evaluation has been completed.

**-F-**

**Free Driver**: A program nonparticipant who adopted a particular efficiency measure or practice as a result of the evaluated program. Also see *Spillover*.

**Free Rider**: A program participant who would have implemented the program measure or practice in the absence of the program. Free riders can be: (1) total, in which the participant’s activity would have completely replicated the program measure; (2) partial, in which the participant’s activity would have partially replicated the program measure; or (3) deferred, in which the participant’s activity would have completely replicated the program measure, but after the program’s timeframe.

**Free Ridership Rate**: The percentage of savings attributable to free riders.

**-G-**

**Gross Impact**: See *Gross Savings*.

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

**Gross kW**: Expected demand reduction based on a comparison of standard or replaced equipment with equipment installed through an energy efficiency program.

**Gross kWh**: Expected kWh reduction based on a comparison of standard or replaced equipment with equipment installed through an energy efficiency program.

**-H, I-**

**Impact Evaluation**: An evaluation of the program-specific, directly induced quantitative changes (kWh, kW, and therms) attributable to an energy efficiency program.

**Incremental Cost**: The difference between the cost of an existing or baseline equipment or service and the cost of an alternative energy efficient equipment or service.

**Incremental Energy Savings**: The difference between the amount of energy savings associated with a project or a program in one period and the amount of energy savings associated with that project or program in a prior period.

**-J, K-**

**Kilowatt (kW)**: A measure of the rate of power used during a pre-set time period (e.g., minutes, hours, days, months) equal to 1,000 Watts.

**Kilowatt-Hour (kWh)**: A common unit of electric energy; one kilowatt-hour is numerically equal to 1,000 Watts used for one hour.

**-L-**

**Lifetime kW**: The expected demand savings over the lifetime of an installed measure, equal to the annual peak kW reduction associated with a measure multiplied by the expected lifetime of that measure. It is expressed in units of kW-years.

**Lifetime MWh**: The expected electrical energy savings over the lifetime of an installed measure, calculated by multiplying the annual MWh reduction associated with a measure by the expected lifetime of that measure.

**Lifetime Supply Costs**: The net present value of avoided supply costs associated with savings, net of changes in energy use that would have happened in the absence of the program over the life of the energy efficiency measure, factoring in persistence of savings. See *Avoided Cost*.

**Load Factor**: A percentage indicating the ratio of electricity or natural gas used during a given timeframe to the amount that would have been used if the usage had stayed at the highest demand the whole time. The term is also used to indicate the percentage of capacity of an energy facility, such as a power plant or gas pipeline, that is utilized for a given period of time.

**Load Management**: Steps taken to reduce power demand at peak load times or to shift some of it to off-peak times. Load management may coincide with peak hours, peak days, or peak seasons. Load management may be pursued by persuading consumers to modify behavior or by using equipment that regulates some electric consumption. This may lead to complete elimination of electric use during the period of interest (load shedding) and/or to an increase in electric demand in the off-peak hours as a result of shifting electric usage to that period (load shifting).

**-M-**

**Market Assessment**: An analysis that provides an assessment of how and how well a specific market or market segment is functioning with respect to the definition of well-functioning markets or with respect to other specific policy objectives. Generally includes a characterization or description of the specific market or market segments, including a description of the types and number of buyers and sellers in the market, the key factors that influence the market, the type and number of transactions that occur on an annual basis, and the extent to which market participants consider energy efficiency as an important part of these transactions. This analysis may also include an assessment of whether a market has been sufficiently transformed to justify a reduction or elimination of specific program interventions. Market assessments can be blended with strategic planning analysis to produce recommended program designs or budgets. One particular kind of market assessment effort is a baseline study, or the characterization of a market before the commencement of a specific intervention in the market, for the purpose of guiding the intervention and/or assessing its effectiveness later.

**Measurement and Verification (M&V)**: A subset of program impact evaluations that are associated with the documentation of energy savings at individual sites or projects using one or more methods that can involve measurements, engineering calculations, statistical analyses, and/or computer simulation modeling.

**Measurement Error**: In the evaluation context, a reflection of the extent to which the observations conducted in the study deviate from the true value of the variable being observed. The error can be random (equal around the mean) or systematic (indicating bias).

**Megawatt (MW)**: A unit for measuring electricity equal to 1,000 kilowatts or one million watts.

**Megawatt-Hour (MWh)**: A unit of electric energy numerically equal to 1,000,000 Watts used for one hour.

**Metered Data**: Data collected over time through a meter for a specific end use, energy-using system (e.g., lighting, HVAC), or location (e.g., floors of a building, a whole premise). Metered data may be collected over a variety of time intervals. Usually refers to electricity or gas data.

**Metering**: The collection of energy consumption data over time through the use of meters. These meters may collect information about an end use, a circuit, a piece of equipment, or a whole building (or facility). *Short-term metering* generally refers to data collection for no more than a few weeks. *End-use metering* refers specifically to separate data collection for one or more end uses in a facility, such as lighting, air conditioning, or refrigeration. *Spot metering* is an instantaneous measurement (rather than over time) to determine equipment size or power draw.

**Monitoring**: The collection of relevant measurement data over time at a facility, including but not limited to energy consumption or emissions data (e.g., energy and water consumption, temperature, humidity, volume of emissions, and hours of operation) for the purpose of conducting a savings analysis or to evaluate equipment or system performance.

**-N-**

**Net Impact**: See *Net Savings*.

**Net Present Value**: The discounted value of the net benefits or costs over a specified period of time (e.g., the expected useful life of the energy efficiency measure).

**Net Savings**: The total change in load that is attributable to an energy efficiency program. This change in load may include, implicitly or explicitly, the effects of spillover, free riders, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption or demand. Net savings are calculated by multiplying verified savings by a NTG ratio.

**Net-to-Gross (NTG)**: A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts.

**Nonparticipant**: Any consumer who was eligible but did not participate in the subject efficiency program in a given program year.

**-O-**

**Off-Peak Energy kWh Savings**: The kWh reduction that occurs during a specified period of off-peak hours for energy savings (see the PA TRM Table 1-1).

**On-Peak Energy kWh Savings**: The kWh reduction that occurs during a specified period of on-peak hours for energy savings (see the PA TRM Table 1-1).

**-P-**

**Participant**: A utility customer partaking in an energy efficiency program, defined as one transaction or one rebate payment in a program. For example, a customer receiving one payment for two measures within one program counts as one participant. A customer receiving two payments in two programs counts as two participants. A customer partaking in one program at two different times receiving two separate payments counts as two participants.

**Participant Costs**: Costs incurred by a customer participating in an energy efficiency program.

**Peak Demand**: The maximum level of metered demand during a specified period, such as a billing month or a peak demand period.

**Peak Load**: The highest electrical demand within a particular period of time. Daily electric peaks on weekdays typically occur in the late afternoon and early evening. Annual peaks typically occur on hot summer days.

**Percentage of Estimate Committed**: The program year to date total committed savings as a percentage of the savings targets established in each EDC EE&C Plan, calculated by dividing the PYTD total committed by the EE&C Plan program year estimate.

**Portfolio**: Can be defined as: (1) a collection of programs addressing the same market (e.g., a portfolio of residential programs), technology (e.g., motor efficiency programs), or mechanisms (e.g., loan programs); or (2) the set of all programs conducted by one or more organizations, such as a utility or program administrator, and which could include programs that cover multiple markets, technologies, etc.

**Precision**: An indication of the closeness of agreement among repeated measurements of the same physical quantity. It is also used to represent the degree to which an estimated result in social science (e.g., energy savings) would be replicated with repeated studies.

**Preliminary Program Year to Date (PYTD) Net Impact**: Net impacts reported in quarterly reports. These net impacts are preliminary in that they are based on preliminary realization rates.

**Preliminary Program Year to Date (PYTD) Verified Impact**: Verified impacts reported in quarterly reports. These verified impacts are preliminary in that they are based on preliminary realization rates.

**Preliminary Realization Rate**: Realization rates reported in quarterly reports based on the results of M&V activities conducted on the sample to date. These results are preliminary because the sample to date is likely not to have met the required levels of confidence and precision.

**Prescriptive Program**: An energy efficiency program focused on measures that are one-for-one replacements of the existing equipment and for which anticipated similar savings results across participants.

**Process Evaluation**: A systematic assessment of an energy efficiency program for the purposes of documenting program operations at the time of the examination and identifying and recommending improvements to increase the program’s efficiency or effectiveness for acquiring energy resources, while maintaining high levels of participant satisfaction.

**Program Administrator**: Those entities that oversee the implementation of energy efficiency programs. This generally includes regulated utilities, other organizations chosen to implement such programs, and state energy offices.

**Program Year Energy Savings Target**: Energy target established for the given program year as approved in each EDC EE&C Plan.

**Program Year Sample Participant Target**: Estimated sample size for evaluation activities in the given program year.

**Program Incentive**: An incentive, generally monetary, that is offered to a customer through an energy efficiency program to encourage their participation. The incentive is intended to overcome one or more barriers that keep the customer from taking the energy efficiency action on their own.

**Program Participant**: A consumer that received a service offered through an efficiency program in a given program year. The term “service” can refer to one or more of a wide variety of services, including financial rebates, technical assistance, product installations, training, energy efficiency information, or other services, items, or conditions.

**Program Year to Date (PYTD)**: Beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30).

**Program Year to Date (PYTD) Net Impact**: The total change in load that is attributable to an energy efficiency program from June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30).

**Program Year to Date (PYTD) Participants**: The number of utility customers participating in an energy efficiency program beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30).

**Program Year to Date (PYTD) Reported Gross Impact**: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated, beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30). This value is unverified by an independent third-party evaluator.

**Program Year to Date (PYTD) Sample Participants**: Total participant sample beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30).

**Program Year to Date (PYTD) Total Committed**: The estimated gross impacts, including reported impacts and in-progress impacts, beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30), calculated by adding PYTD reported gross impacts for projects in progress.

**Project**: An activity or course of action involving one or multiple energy efficiency measures at a single facility or site.

**Projects in Progress**: Energy efficiency and DR projects currently being processed and tracked by the EDC, but that are not yet complete at the time of the report. See *Completed Project*.

**-Q, R-**

**Realization Rate**: The term is used in several contexts in the development of reported program savings. The primary applications include the ratio of project tracking system savings data (e.g., initial estimates of project savings) to savings that: 1) are adjusted for data errors, and 2) incorporate the evaluated or verified results of the tracked savings.

**Rebate Program**: An energy efficiency program in which the program administrator offers a financial incentive for the installation of energy efficient equipment.

**Rebound Effect**: Also called “snap back,” defined as a change in energy-using behavior that yields an increased level of service that is accompanied by an increase in energy use and occurs as a result of taking an energy efficiency action. The result of this effect is that the savings associated with the direct energy efficiency action are reduced by the resulting behavioral change.

**Regression Analysis**: Analysis of the relationship between a *dependent variable* (response variable) to specified *independent variables* (explanatory variables). The mathematical model of their relationship is the *regression equation*.

**Regression Model**: A mathematical model based on statistical analysis where the dependent variable is quantified based on its relationship to the independent variables that are believed to determine its value. In so doing, the relationship between the variables is estimated statistically from the data used.

**Reliability:** The quality of a measurement process that would produce similar results on: (1) repeated observations of the same condition or event, or (2) multiple observations of the same condition or event by different observers.

**Renewable Energy**: Energy derived from resources that are naturally replenishing. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

**Reported Gross Impact:** The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated. This value is unverified by an independent third-party evaluator. Also referred to as ex post impact.

**Reporting Period**: The time following implementation of an energy efficiency activity during which results are to be determined.

**Representative Sample**: A sample that has approximately the same distribution of characteristics as the population from which it was drawn.

**Rigor**: The level of effort expended to minimize uncertainty due to factors such as sampling error and bias. The higher the level of rigor, the more confidence there is that the results of the evaluation are accurate and precise.

**-S-**

**Sample**: In program evaluation, a portion of the population selected to represent the whole. Differing evaluation approaches rely on simple or stratified samples (based on some characteristic of the population).

**Sample Design**: The approach used to select the sample units.

**Sampling Error**: The error in estimating a parameter caused by the fact that all of the disturbances in the sample are not zero.

**Savings Factor (SVG):** The percentage of time the lights are off due to lighting controls relative to the baseline controls system (typically a manual switch).Also referred to as the *lighting controls savings factor*.

**Simple Random Sample**: A method for drawing a sample from a population such that all samples of a given size have an equal probability of being drawn.

**Snap Back**: See *Rebound Effect*.

**Simulation Model**: An assembly of algorithms that calculate energy use based on engineering equations and user-defined parameters.

**Spillover**: Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program. There can be participant and/or nonparticipant spillover. *Participant spillover* is the additional energy savings that occur when a program participant independently installs energy efficiency measures or applies energy-saving practices after having participated in the efficiency program as a result of the program’s influence. *Nonparticipant spillover* refers to energy savings that occur when a program nonparticipant installs energy efficiency measures or applies energy-saving practices as a result of a program’s influence.

**Spillover Rate**: An estimate of energy savings attributable to spillover effects expressed as a percentage of savings installed by participants through an energy efficiency program.

**Standard Error**: A measure of the variability in a data sample indicating how far a typical data point is from the mean of a sample. In a large sample, approximately two-thirds of observations lie within one standard error of the mean, and 95% of observations lie within two standard errors.

**Statistically Adjusted Engineering Models**: A category of statistical analysis models that incorporate the engineering estimate of savings as a dependent variable. The regression coefficient in these models is the percentage of the engineering estimate of savings observed in changes in energy usage. For example, if the coefficient of the statistically adjusted engineering term is 0.8, the customers are, on average, realizing 80% of the savings from their engineering estimates.

**Stipulated Values**: See *Deemed Savings*.

**Stratified Random Sampling**: The population is divided into subpopulations called *strata* that are non-overlapping and together comprise the entire population. A simple random sample of each stratum is taken to create a sample based on stratified random sampling.

**Stratified Ratio Estimation**: A sampling method that combines a stratified sample design with a ratio estimator to reduce the CV by using the correlation of a known measure for the unit (e.g., expected energy savings) to stratify the population and allocate a sample from the strata for optimal sampling.

**-T-**

**Takeback Effect**: See *Rebound Effect*.

**Total Resource Cost (TRC) Test**: A cost-effectiveness test that measures the net direct economic impact to the utility service territory, state, or region. The TRC Order details the method and assumptions to be used when calculating the TRC Test for EE&C portfolios implemented under Act 129. The results of the TRC Test are to be expressed as both a net present value and a benefit-cost ratio.

**Total Resource Cost (TRC) Test Benefits**: Benefits calculated in the TRC Test that include the avoided supply costs, such as the reduction in transmission, distribution, generation, and capacity costs, valued at a marginal cost for the periods when there is a consumption reduction. The PA TRC benefits will consider avoided supply costs, such as the reduction in forecasted zonal wholesale electric generation prices, ancillary services, losses, generation capacity, transmission capacity, and distribution capacity. The avoided supply costs will be calculated using net program savings, defined as the savings net of changes in energy use that would have happened in the absence of the program. The persistence of savings over time will also be considered in the net savings.

**Total Resource Cost (TRC) Test Costs:** The costs calculated in the TRC Test will include the costs of the various programs paid for by an EDC (or by a default service provider) and the participating customers, and costs that reflect any net change in supply costs for the periods in which consumption is increased in the event of load shifting. Note that the TRC Test should use the incremental costs of services and equipment. Thus, for example, this would include costs for equipment, installation, operation and maintenance, removal (less salvage value), and administrative tasks, regardless of who pays for them.

**-U-**

**Uncertainty**: The range or interval of doubt surrounding a measured or calculated value within which the true value is expected to fall with some degree of confidence.

**Upstream Program**: A program that provides information and/or financial assistance to entities in the delivery chain of high efficiency products at the retail, wholesale, or manufacturing level. Such a program is intended to yield lower retail prices for the products.

**-V-**

**Verification**: An independent assessment of the reliability (considering completeness and accuracy) of claimed energy savings or an emissions source inventory.

**Verified Gross Impact**: Calculated by applying the realization rate to reported gross impacts. Also referred to as ex ante impact.

**-W-**

**Watt**: A unit of measure of electric power at a point in time as capacity or demand. One Watt of power maintained over time is equal to one Joule per second. The Watt is named after Scottish inventor James Watt, and is shortened to W and used with other abbreviations, as in kWh (kilowatt-hours).

**Watt-Hour**: One Watt of power expended for one hour, or one-thousandth of a kilowatt-hour.

**Whole-Building Calibrated Simulation Approach**: A savings measurement approach (defined in the International Performance Measurement and Verification Protocol Option D and in the American Society of Heating, Refrigerating and Air-Conditioning Engineers Guideline 14) that involves the use of an approved computer simulation program to develop a physical model of the building in order to determine energy and demand savings. The simulation program is used to model the energy used by the facility before and after the retrofit. The pre- or post-retrofit models are developed by calibration with measured energy use, demand data, and weather data.

**Whole-Building Metered Approach**: A savings measurement approach (defined in the International Performance Measurement and Verification Protocol Option C and in the American Society of Heating, Refrigerating and Air-Conditioning Engineers Guideline 14) that determines energy and demand savings through the use of whole-facility energy (end use) data, which may be measured by utility meters or data loggers. This approach may involve the use of monthly utility billing data or data gathered more frequently from a main meter.

1. All Total Resource Cost definitions are subject to the Pennsylvania PUC 2013 Total Resource Cost (TRC) Test Order. [↑](#footnote-ref-2)
2. Pennsylvania Public Utilities Commission, *Act 129 Phase I Compliance Determination Order*, March 20, 2014, p.6. [↑](#footnote-ref-3)
3. Statewide Evaluator, Guidance Memo GM-021, *Reporting Unverified Energy and Peak Demand Savings for Phase I Projects in the Act 129 Phase I Final Report*. September 13, 2013. [↑](#footnote-ref-4)
4. PECO Energy Company, *Quarterly Report to the Pennsylvania Public Utility Commission; For the Period of December 2013 through February 2014 Program Year 5, Quarter 3*. April 15, 2014. [↑](#footnote-ref-5)
5. Unlike Phase I, there is no compliance target for demand reduction in Phase II. The Commission, however, requires that demand reduction savings in Phase II be reported including line losses, as was done in Phase I. [↑](#footnote-ref-6)
6. Pennsylvania Public Utilities Commission, *Implementation Order; Energy Efficiency and Conservation Program*. Docket No. M-2012-2289411 and M-2008-2069887. Public meeting held August 2, 2012. [↑](#footnote-ref-7)
7. Act 129 includes a provision requiring electric distribution companies to offer a number of energy efficiency measures to low-income households that are “proportionate to those households’ share of the total energy usage in the service territory.” 66 Pa.C.S. §2806.1(b)(i)(G). [↑](#footnote-ref-8)
8. PECO Energy Company. *Quarterly Report to the Pennsylvania Public Utility Commission; For the Period of March 2016 through May 2016 Program Year 7, Quarter 4*. July 15, 2016. [↑](#footnote-ref-9)
9. PECO Energy Company. *PECO Program Year 6 Annual Report*. November 13, 2015. [↑](#footnote-ref-10)
10. The Act 129 Fuel Switching Working Group Staff Report. April 30, 2010. Page2. [↑](#footnote-ref-11)
11. Pennsylvania Public Utility Commission, “Technical Reference Manual,” June 2014. [↑](#footnote-ref-12)
12. Relatively few specialty CFLs were purchased through the program in PY7, so the evaluation team did not attempt to obtain statistically significant results for this stratum. Therefore, specialty CFLs and standard CFLs were combined into a single stratum for PY7. For more information regarding sample design, please refer to the memo titled, “PECO SHR Residential Lighting Survey Retail Store Sampling Approach,” March 2, 2016. [↑](#footnote-ref-13)
13. Phil Degens and Sarah Castor, Energy Trust of Oregon, *Energy Trust Free Ridership Methodology*, August 2013. [↑](#footnote-ref-14)
14. The average sales across all installers interviewed for technologies that met the requirements for high efficiency is 45%. [↑](#footnote-ref-15)
15. HVAC installer interview counts: for PY7, n=11; for PY6, n=12. [↑](#footnote-ref-16)
16. The evaluation team conducted participant phone interviews in April and May 2016 with 130 program participants, including 52 assessment participants, 47 audit participants who had not installed major measures at the time of the survey, and 31 audit participants who had installed major measures at the time of the survey. [↑](#footnote-ref-17)
17. Three of the customers who removed LEDs did not specify how many they removed so the evaluation team assumed half the number of bulbs installed were removed. [↑](#footnote-ref-18)
18. In any case where the prior bulb wattage is registered as zero in the tracking data, then the change in wattage—calculated as prior wattage minus installed wattage—returns a negative value. [↑](#footnote-ref-19)
19. Phil Degens and Sarah Castor, “Energy Trust Free Ridership Methodology,” Energy Trust of Oregon. August 7, 2013. [↑](#footnote-ref-20)
20. The evaluation team carried the free ridership score calculated in PY5 forward to PY6. [↑](#footnote-ref-21)
21. The SAR tracking data makes no distinction between low-income participants and other residential participants. [↑](#footnote-ref-22)
22. These are the default UEC values provided in Tables 2 and 3 of Section 2.4.3 of the 2015 TRM and then multiplied by the default part-use factors  
     in Table 1. [↑](#footnote-ref-23)
23. For many types of energy efficiency programs a realization rate is estimated first and then applied to a whole program to calculate verified savings. For appliance recycling the evaluation team verifies most of the programs units and then calculates a realization rate. The realization rate is only used estimate verified savings for the nonresidential units (2%). [↑](#footnote-ref-24)
24. Apex Analytics and Research Into Action, Memorandum to Pennsylvania Program Evaluation Group, “Common Approach for Measuring Net Savings for Appliance Retirement Programs,” March 14, 2014. [↑](#footnote-ref-25)
25. National Renewable Energy Laboratory, *Unified Methods Protocol, “*Chapter 7: Refrigerator Recycling Evaluation Protocol,” April 2013. [↑](#footnote-ref-26)
26. The Pennsylvania Public Utility Commission, “Act 129 EE&C Phase II Implementation Order,” August 3, 2012. [↑](#footnote-ref-27)
27. PECO defines high usage as greater than or equal to 14,000 kWh per household per year. [↑](#footnote-ref-28)
28. For the SUP program, PECO defines low-income customers as those who receive discounted rates via the PECO Community Assistance Program (CAP). For CAP eligibility requirements, see the PECO website at: www.peco.com/CustomerService/AssistancePrograms/CAP/Pages/default.aspx. [↑](#footnote-ref-29)
29. The web portal is available to all PECO customers regardless of their enrollment in the SUP program. PECO does not have specific goals relating to customer engagement with the web portal. [↑](#footnote-ref-30)
30. State and Local Energy Efficiency Action Network, *Evaluation, Measurement and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*, May 2012. [↑](#footnote-ref-31)
31. This equation corresponds to Formula 1.1 in Appendix C of *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*, published by the State and Local Energy Efficiency Action Network in May 2012. [↑](#footnote-ref-32)
32. The Statewide Evaluation Team, “Evaluation Framework: For Pennsylvania Act 129 Phase II Energy Efficiency and Conservation Programs,” June 30, 2013. [↑](#footnote-ref-33)
33. The State and Local Energy Efficiency (SEE) Action protocol refers to this estimate of average savings as the intent to treat estimate. [↑](#footnote-ref-34)
34. The program assumes that students that attend schools within PECO territory are PECO customers. [↑](#footnote-ref-35)
35. Curriculum aligns with Pennsylvania’s Core Standards, as outlined at http://www.pdesas.org/Standard/PACore. [↑](#footnote-ref-36)
36. Navigant’s evaluation included analysis of a student installation survey as well as parent/guardian and teacher survey data from both full (SES) and slimmed down (PEEP) kit recipient households. [↑](#footnote-ref-37)
37. Based on the PY6 implementer interview with RAP. [↑](#footnote-ref-38)
38. Navigant used the deemed in-service rate from the PA TRM to calculate savings for the CFL measures. All other measures used the student survey results to determine savings. [↑](#footnote-ref-39)
39. The inputs for the reported savings calculations are based on the results of previous year evaluations. [↑](#footnote-ref-40)
40. For more information on ENERGY STAR certification, see https://www.energystar.gov/newhomes. [↑](#footnote-ref-41)
41. The evaluation team calculated savings using methods and inputs from the TRM version corresponding to the permit date of the home. [↑](#footnote-ref-42)
42. Jane Peters and Ryan Bliss, Research Into Action, *Common Approach for Measuring Free Riders for Downstream Programs*, October 4, 2013. [↑](#footnote-ref-43)
43. Target market definitions may be adjusted to align with program participation and results. [↑](#footnote-ref-44)
44. In previous program years, Navigant conducted onsite verification visits as part of the verification and due diligence process. Because PECO obtained a switch operability study from Comverge in October 2013, which is suitable for load research studies submitted to PJM for 5 years, the team did not conduct any onsite verification visits in PY7. [↑](#footnote-ref-45)
45. In previous program years, Navigant conducted onsite verification visits as part of the verification and due diligence process. Because PECO obtained a switch operability study from Comverge in October 2013, which is suitable for load research studies submitted to PJM for 5 years, the team did not conduct any onsite verification visits in PY7. [↑](#footnote-ref-46)
46. Navigant designed the SEI C&I sample with an assumed CV of 0.4 for large, 0.5 for medium, 0.7 for small, and 0.3 for municipal lighting projects based on industry experience and actual CVs from PECO’s SEI C&I PY6 and PY5 evaluations. [↑](#footnote-ref-47)
47. [↑](#footnote-ref-48)
48. Jane Peters and Ryan Bliss, Research Into Action Team, *Common Approach for Measuring Free Riders for Downstream Programs*, October 4, 2013. [↑](#footnote-ref-49)
49. Navigant designed the SEI GNI sample with an assumed CV of 0.4 for large, 0.5 for medium, 0.7 for small, and 0.3 for municipal lighting projects based on industry experience and actual CVs from PECO’s SEI GNI PY6 and PY5 evaluations. [↑](#footnote-ref-50)
50. [↑](#footnote-ref-51)
51. Jane Peters and Ryan Bliss, Research Into Action Team, *Common Approach for Measuring Free Riders for Downstream Programs*, October 4, 2013. [↑](#footnote-ref-52)
52. A tenth onsite visit was completed in the residential sector; however, the participant had recently moved within the same property and the field team visited the new address, so the site had to be dropped from onsite analysis. [↑](#footnote-ref-53)
53. Issues with the CSP contract led to significant cost overruns in PY5 and PY6 as discussed in the PY5 and PY6 compliance reports. [↑](#footnote-ref-54)
54. PAH Associations, prepared by Paul Horowitz. Facilitated by the Northeast Energy Efficiency Partnerships. Glossary of Terms Version 1.0. A project of the Regional Evaluation, Measurement and Verification Forum. March 2009. [↑](#footnote-ref-55)