EDC Program Year 6 Annual Report

Program Year 6: June 1, 2014 – May 31, 2015

Presented to:

Pennsylvania Public Utility Commission

Pennsylvania Act 129 of 2008
Energy Efficiency and Conservation Plan

Prepared for:

Duquesne Light

November 16, 2015

Prepared by:

Navigant Consulting, Inc.

NAVIGANT

EDC PROGRAM YEAR 6
ANNUAL REPORT

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ACRONYMS

C&I	Commercial and Industrial
CFL	Compact Fluorescent Lamp
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 or Curtailment Service Provider
DR	Demand Response
EDC	Electric Distribution Company
EE&C	Energy Efficiency and Conservation
EM&V	Evaluation, Measurement, and Verification
GNI	Government, Nonprofit, and Institutional
HVAC	Heating, Ventilating, and Air Conditioning
kW	Kilowatt
kWh	Kilowatt-hour
LED	Light Emitting Diode
LEEP	Low-Income Energy Efficiency Program
LIURP	Low-Income Usage Reduction Program
M&V	Measurement and Verification
MW	Megawatt
MWh	Megawatt-hour
NTG	Net-to-Gross
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
SEER	Seasonal Energy Efficiency Rating
SWE	Statewide Evaluator
TRC	Total Resource Cost
TRM	Technical Reference Manual

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 carryover references verified gross Phase I savings in excess of Act 129 Phase I targets.

Phase II
Refers to the period of time 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 Q3 is the sum of PY5, PY6, PY7 Q1, PY7 Q2, and PY7 Q3 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 Q3 will include only results that occurred during PY7 Q1, PY7 Q2, and PY7 Q3; 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 rate or verified gross savings.

Reported Gross
Refers to results of the program or portfolio, 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 (using the annual evaluation activities as the reference point for the post period).

Adjusted Ex Ante Gross
References to Adjusted Ex Ante Gross (or Adjusted 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 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 determined by the evaluation activities. Also known as ex post, or "after the fact" savings (using the 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]

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.

EDC Costs

Per the Pennsylvania 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 & development of EE&C Plans and programs, marketing, evaluation, and incentives.

Participant Costs

Participant Costs as defined by the 2013 Total Resource Cost Test Order.

Total TRC Costs

Total TRC Costs as defined by the 2013 Total Resource Cost Test Order.

Total TRC Benefits

Benefits as defined by the 2013 Total Resource Cost Test Order.

[1] All Total Resource Cost definitions are subject to the Pennsylvania PUC 2013 Total Resource Cost Test Order.

1 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.

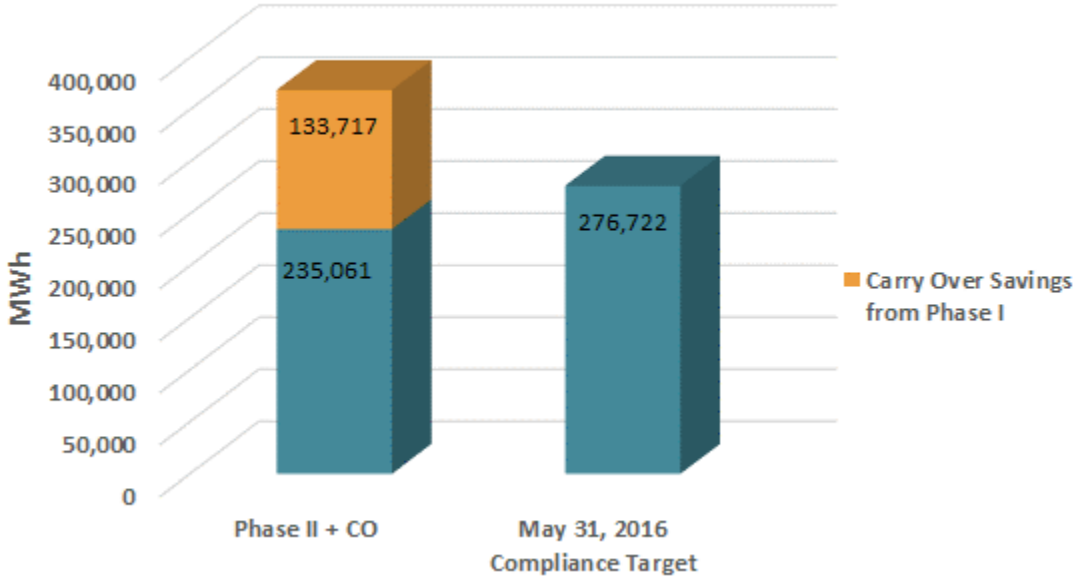
Implementation of Phase II Act 129 programs began June 1, 2013. This report documents the progress and effectiveness of the Phase II EE&C accomplishments for Duquesne Light in Program Year 6 (PY6), defined as June 1, 2014 through May 31, 2015, as well as the cumulative accomplishments of the programs since inception of Phase II. This report additionally 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 evaluated the programs, which included measurement and verification of the savings.

1.1 SUMMARY OF PROGRESS TOWARD COMPLIANCE TARGETS

Duquesne Light has achieved 133 percent of the energy savings compliance target, based on cumulative portfolio Phase II inception to date including carryover savings from Phase I ("Phase II+CO") verified gross energy savings, as shown in Figure 1-1.

Figure 1-1: Cumulative Portfolio Phase II Inception to Date Verified Gross Energy Impacts



According to the Phase II Implementation Order , Duquesne Light is allowed by the PUC to "carry over" into Phase II the Phase I verified energy savings that exceeded the Phase I compliance target. Table 1-1 shows the incremental annual MWh savings from Phase I that Duquesne Light is carrying over into Phase II. Table 1-2 shows the lifetime MWh savings from Phase I that Duquesne Light 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	PYTD Verified Gross Savings (MWh)	Phase II Verified Gross Savings (Cumulative Phase II MWh/Yr)	Verified Gross Savings Carried Over from Phase 1 (Cumulative Annual MWh/Yr)	Phase II+CO Verified Gross Savings (Cumulative MWh/Yr)
Residential (non Low Income)	36,817	87,979	72,602	160,581
Residential (Low Income)	2,293	15,092	16,576	31,668
Total Residential (Non Low Income Plus Low Income)	39,110	103,071	89,178	192,249
Commercial and Industrial	53,215	117,022	36,817	153,839
GNI	14,228	14,968	7,722	22,690
Total	**106,553**	**235,061**	**133,717**	**368,778**

Table 1-2: Phase II Verified Gross Lifetime Savings and Verified Gross Lifetime Savings from PY4 Carried Into Phase II

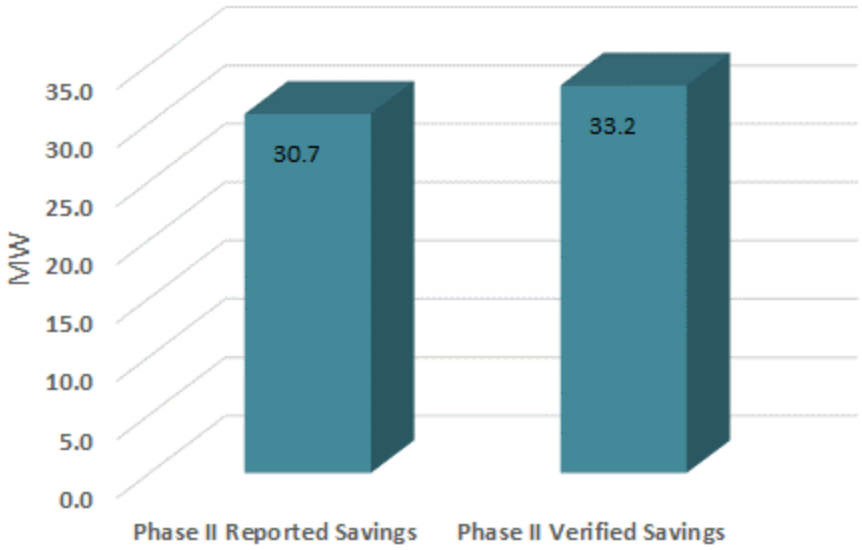
Sector	PYTD Verified Gross Savings (Lifetime MWh)	Phase II Verified Gross Savings (Lifetime MWh)	Verified Gross Savings Carried Over from Phase 1 (Lifetime MWh)	Phase II+CO Verified Gross Savings (Lifetime MWh)
Residential (non Low Income)	286,933	629,309	429,775	1,059,084
Residential (Low Income)	15,166	103,820	99,456	203,276
Total Residential (Non Low Income Plus Low Income)	302,099	733,129	529,231	1,262,360
Commercial and Industrial	694,179	1,213,625	515,530	1,729,155
GNI	201,712	212,736	114,012	326,748
Total	**1,197,991**	**2,159,491**	**1,158,772**	**3,318,262**

Table 1-3: Phase II Verified Net First-Year and Lifetime Savings

Sector	PYTD Verified Net Savings (MWh/year)	Phase II Verified Net Savings (Cumulative Phase II MWh/Yr)	PYTD Verified Net Gross Savings (Lifetime MWh)	Phase II Verified Net Savings (Lifetime MWh)
Residential (non Low Income)	25,410	76,573	198,088	449,985
Residential (Low Income)	1,741	14,541	11,517	78,008
Total Residential (Non Low Income Plus Low Income)	27,152	91,113	209,605	527,993
Commercial and Industrial	34,522	98,329	447,504	793,689
GNI	8,295	9,035	114,185	119,918
Total	**69,969**	**198,477**	**771,295**	**1,441,600**

In addition, Duquesne Light has achieved 33.2 MW of gross verified demand reduction during Phase II[2]. See Figure 1-2 below. Additional detail on achieved demand reduction by program can be found in Table 1-9 and Table 1-10 of this section.

Figure 1-2: Phase II Portfolio Reported and Verified Demand Reduction



[2] 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.

There are 14 measures available at no cost to low-income customers. These measures offered to the low-income sector comprise 15 percent of the total measures offered. As required by the Phase II goal, this exceeds the fraction of the electric consumption of the utility's low-income households divided by the total electricity consumption in the Duquesne Light territory by (8.4 percent).[3] These values are shown in Table 1-4 and Table 1-5.

Table 1-4: Low-Income Sector Compliance (Number of Measures)

	Low-Income Sector	All Sectors	% Low-Income	Goal
# of Measures Offered	14	96	14.6%	8.4%

Table 1-5: Low-Income Sector Compliance (Percentage of Savings)

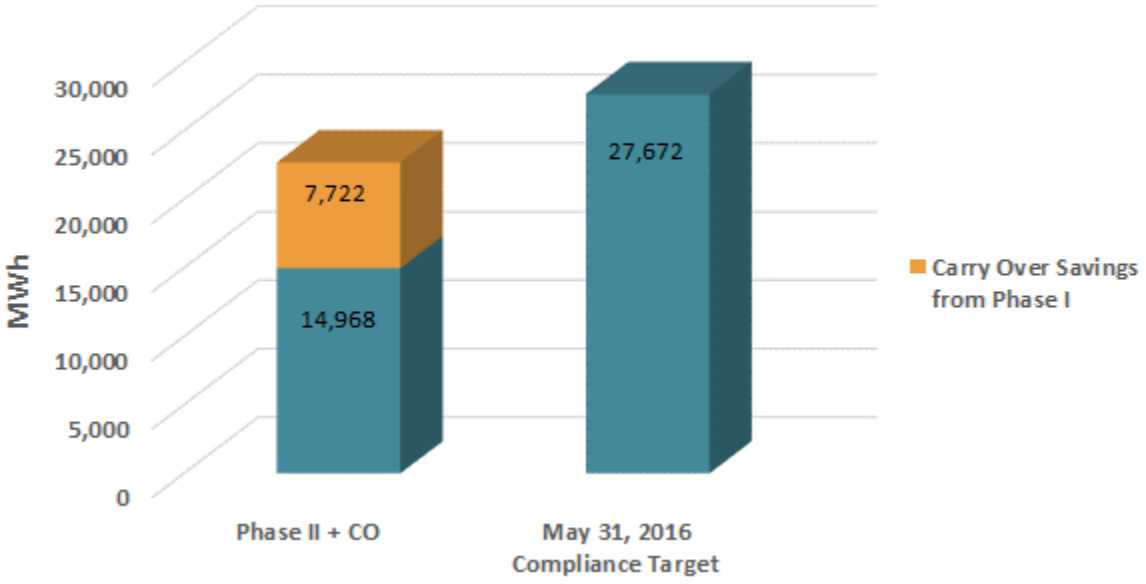
	Phase II Gross Verified
Low Income Verified Gross Savings from Low Income Programs (Incremental Annual MWh/Yr)	3,067
Low Income Verified Gross Savings from Other Residential Programs (Incremental Annual MWh/Yr)	12,292
All Low Income Verified Gross Savings	15,358
Progress Towards Low Income Goal	6.4%
Goal (MWh/Yr)	4.5%

The Phase II verified gross energy savings achieved through programs specifically designed for income-eligible customers are 3,067 MWh/yr and 12,292 MWh/year through other programs; this is 6.4 percent against the 4.5% Phase II total portfolio verified gross energy savings target for the low-income sector.

Duquesne Light achieved 82 percent of the May 31, 2016 energy reduction compliance target for the government, nonprofit, and institutional sector based on cumulative program/portfolio savings from Phase II+CO verified gross energy savings achieved from the inception of Phase II through Program Year 6 and including carry-over savings from Phase I as shown in Figure 1-3.

[3] 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).

Figure 1-3: Government, Nonprofit, and Institutional Sector Phase II Verified Gross Energy Impacts



A summary of the number of participants, Phase II verified gross energy savings (MWh/Yr), Phase II demand reduction (MW), and incentives paid ($1,000) are shown in Table 1-6.

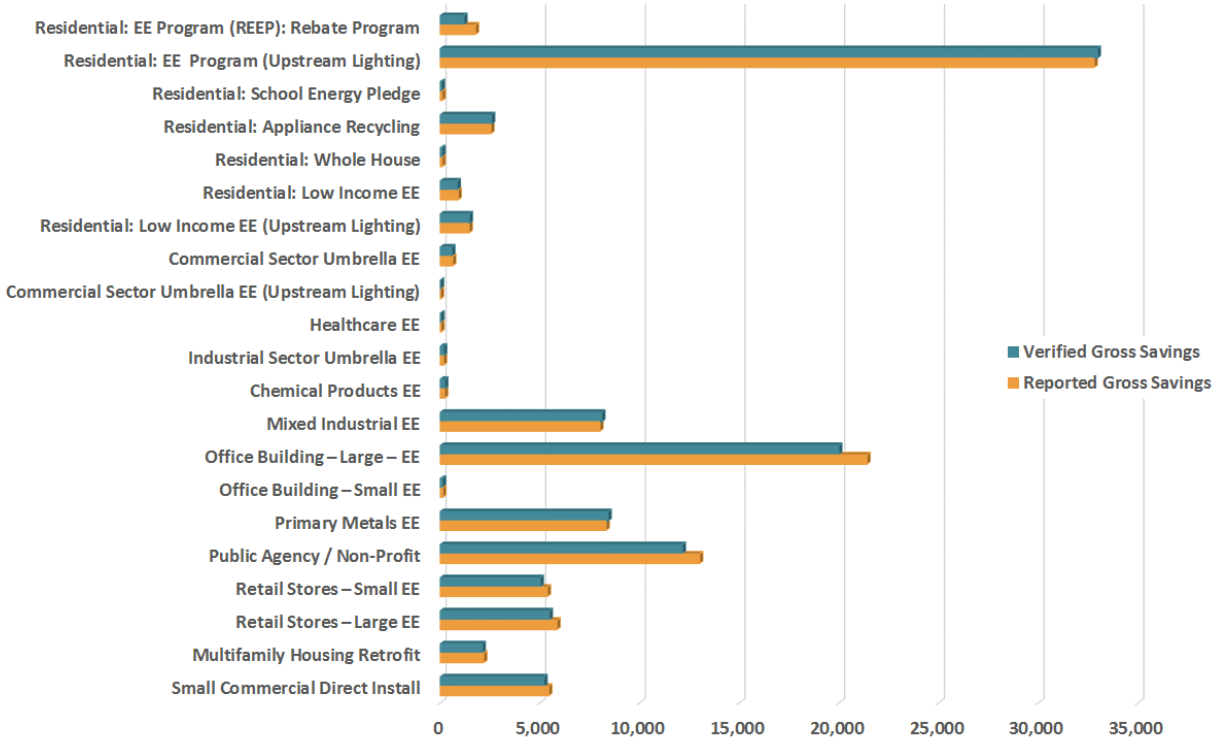
Table 1-6: Summary of Phase II Performance by Sector

Sector	Participants	Phase II Verified Gross Energy Savings (MWh/yr)	Phase II Verified Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	39,195	87,979	6.845	$3,925
Low-Income	7,592	15,092	1.058	$537
Small Commercial and Industrial	563	52,721	12.363	$1,341
Large Commercial and Industrial	228	64,301	9.867	$4,773
Government, Nonprofit, and Institutional	143	14,968	3.053	$2,288
Phase II Total	**47,721**	**235,061**	**33.185**	**$12,864**

1.2 SUMMARY OF ENERGY IMPACTS

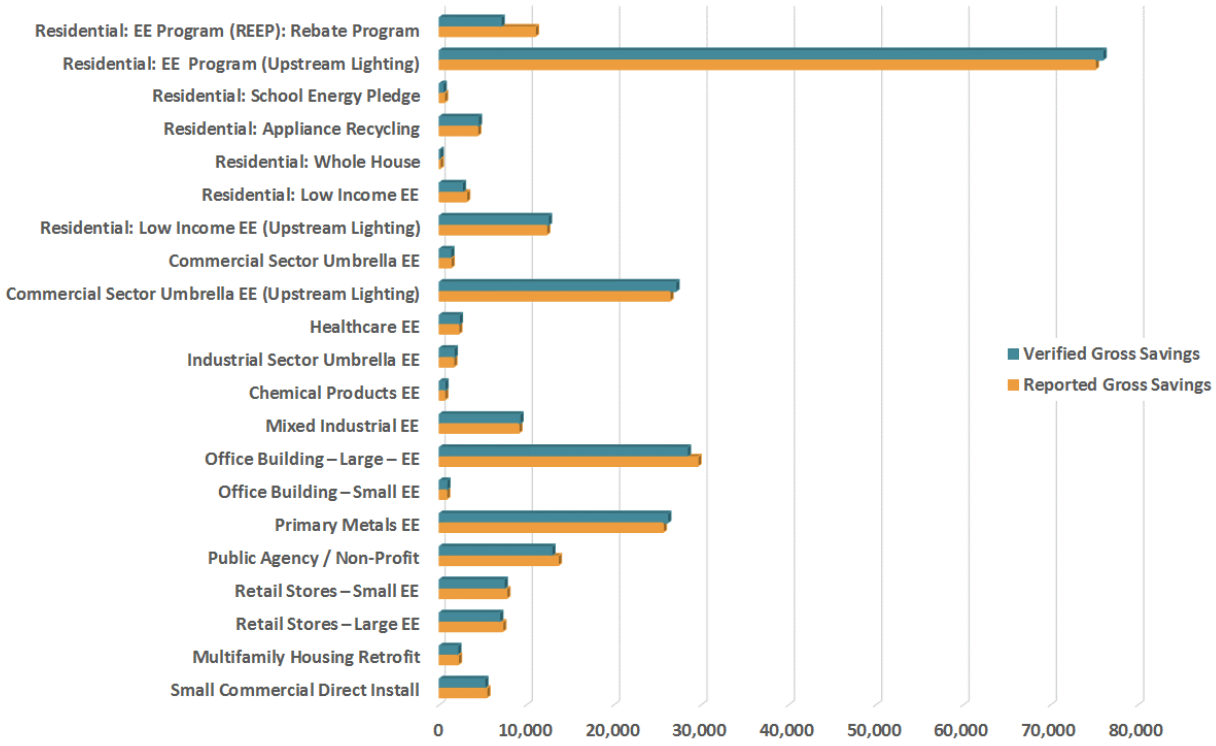
A summary of the reported and verified energy savings by program for Program Year 6 is presented in Figure 1-4.

Figure 1-4: PYTD Reported and Verified Gross Energy Savings by Program (MWh/yr)



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

Figure 1-5: Phase II Reported and Verified Gross Energy Savings by Program (MWh/yr)



Summaries of energy impacts by program through Program Year 6 are presented in Table 1-7 and Table 1-8.

Table 1-7: Reported Participation and Gross Energy Savings by Program

Program	Participants		Reported Gross Impact (MWh/Yr)	
	PYTD	Phase II	PYTD	Phase II
Residential: EE Program (REEP): Rebate Program	6,521	32,540	1,757	10,983
Residential: EE Program (Upstream Lighting)	N/A	N/A	32,793	75,100
Residential: School Energy Pledge	289	1,573	83	582
Residential: Appliance Recycling	2,788	4,960	2,531	4,380
Residential: Whole House	122	122	85	85
Residential: Low Income EE	1,957	7,592	888	3,111
Residential: Low Income EE (Upstream Lighting)	N/A	N/A	1,442	12,285
Commercial Sector Umbrella EE	16	36	613	1,327
Commercial Sector Umbrella EE (Upstream Lighting)	N/A	N/A	0	26,400
Healthcare EE	2	10	26	2,218
Industrial Sector Umbrella EE	1	3	157	1,641
Chemical Products EE	5	14	209	607
Mixed Industrial EE	41	52	8,002	9,093
Office Building – Large – EE	58	109	21,392	29,594
Office Building – Small EE	10	35	115	827
Primary Metals EE	18	25	8,314	25,626
Public Agency / Non-Profit	68	104	12,998	13,610
Retail Stores – Small EE	212	349	5,362	7,712
Retail Stores – Large EE	53	70	5,847	7,247
Multifamily Housing Retrofit	39	39	2,171	2,171
Small Commercial Direct Install	88	88	5,429	5,429
TOTAL PORTFOLIO	**12,288**	**47,721**	**110,216**	**240,030**

Table 1-8: Verified Gross Energy Savings by Program

Program	PYTD Reported Gross Energy Savings (MWh/Year)	PYTD Energy Realization Rate	PYTD Verified Gross Energy Savings (MWh/Year)	PYTD Achieved Precision[1]	Phase II Verified Gross Energy Savings (MWh/Year)	Phase II Achieved Precision[2]
Residential: EE Program (REEP): Rebate Program	1,757	67%	1,176	11.9%	7,065	2.4%
Residential: EE Program (Upstream Lighting)	32,793	100%	32,951	0.0%	75,967	0.6%
Residential: School Energy Pledge	83	56%	47	13.9%	411	6.3%
Residential: Appliance Recycling	2,531	101%	2,562	1.8%	4,454	2.2%
Residential: Whole House	85	96%	82	4.9%	82	4.9%
Residential: Low Income EE	888	95%	844	3.0%	2,619	1.3%
Residential: Low Income EE (Upstream Lighting)	1,442	100%	1,449	0.0%	12,473	0.8%
Commercial Sector Umbrella EE	613	93%	572	8.5%	1,305	4.4%
Commercial Sector Umbrella EE (Upstream Lighting)	0	N/A	0	0.0%	27,079	1.8%
Healthcare EE	26	93%	25	8.5%	2,273	1.8%
Industrial Sector Umbrella EE	157	101%	159	12.9%	1,678	2.1%
Chemical Products EE	209	101%	212	12.9%	619	5.2%
Mixed Industrial EE	8,002	101%	8,093	12.9%	9,209	12.9%
Office Building – Large – EE	21,392	93%	19,976	8.5%	28,389	6.9%
Office Building – Small EE	115	93%	107	8.5%	838	2.0%
Primary Metals EE	8,314	101%	8,409	12.9%	26,124	4.9%
Public Agency / Non-Profit	12,998	93%	12,133	29.4%	12,873	31.6%
Retail Stores – Small EE	5,362	93%	5,007	8.5%	7,418	6.6%
Retail Stores – Large EE	5,847	93%	5,460	8.5%	6,896	7.7%
Multifamily Housing Retrofit	2,171	96%	2,095	2.9%	2,095	2.9%
Small Commercial Direct Install	5,429	96%	5,195	2.4%	5,195	2.4%

Program	PYTD Reported Gross Energy Savings (MWh/Year)	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]
TOTAL PORTFOLIO	**110,216**	**97%**	**106,553**	**4.4%**	**235,061**	**2.3%**
Phase 1 Carryover	**N/A**	**N/A**	**N/A**	**N/A**	**133,717**	**N/A**
Total Ph II+CO	**N/A**	**N/A**	**N/A**	**N/A**	**368,778**	**N/A**

[1] At the 85% confidence level

[2] At the 90% confidence level

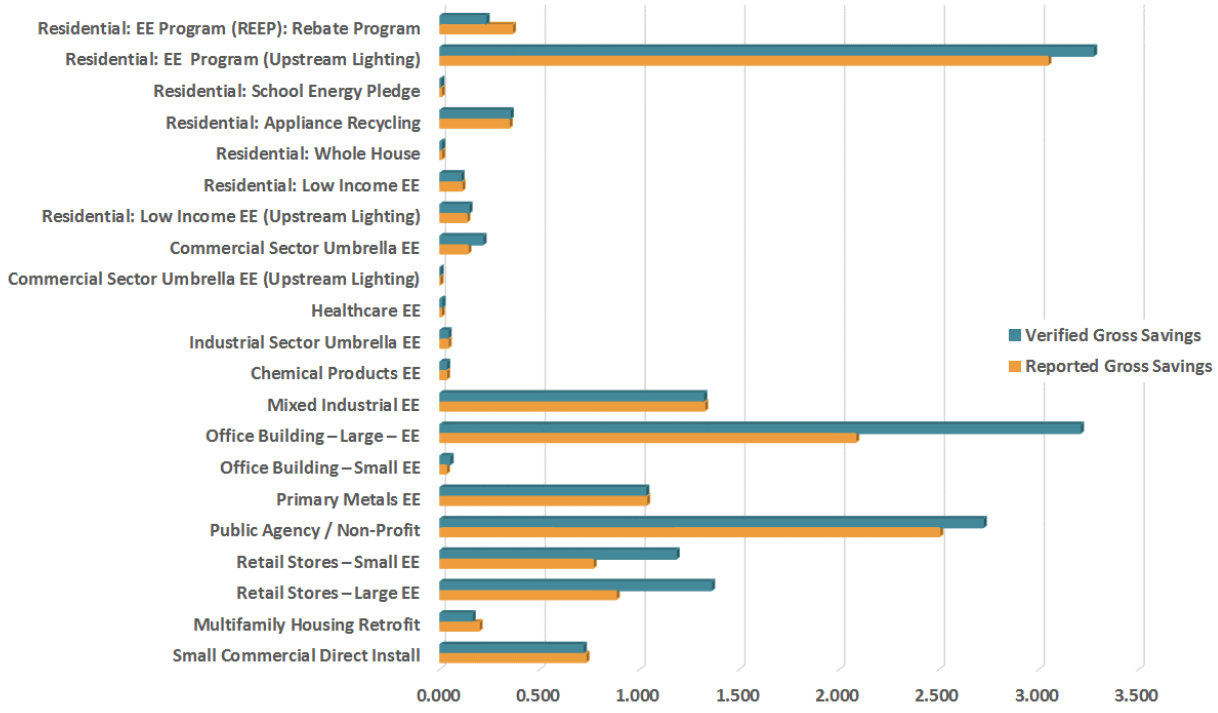
1.3 SUMMARY OF FUEL SWITCHING IMPACTS

No fuel switching measures are offered through Duquesne Light EE&C programs.

1.4 SUMMARY OF DEMAND IMPACTS

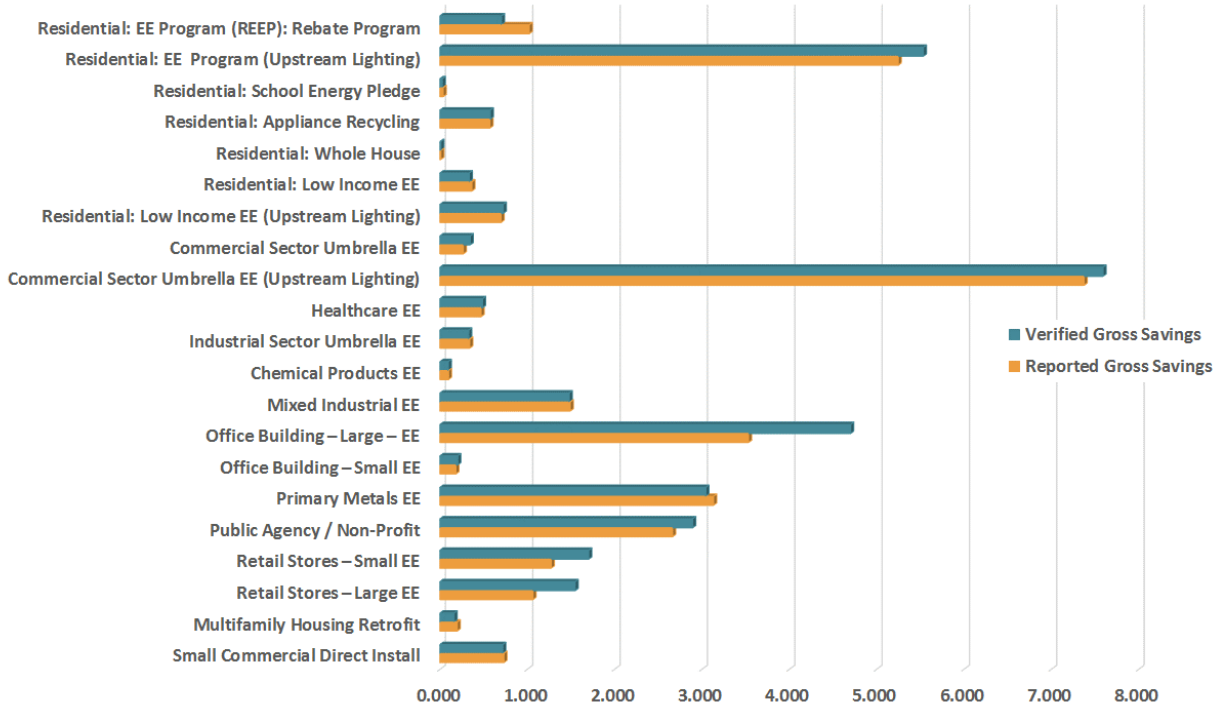
A summary of the reported and verified demand reduction by program for Program Year 6 is presented in Figure 1-6. The impacts below reflect the line loss factors shown in Table 1-13.

Figure 1-6: PYTD Reported and Verified Gross Demand Reduction by Program



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

Figure 1-7: Phase II Reported and Verified Gross Demand Reduction by Program



A summary of demand reduction impacts by program through Program Year 6 is presented in Table 1-9 and Table 1-10.

Table 1-9: Reported Participation and Gross Demand Reduction by Program

Program	Participants		Reported Gross Impact (MW)	
	PYTD	Phase II	PYTD	Phase II
Residential: EE Program (REEP): Rebate Program	6,521	32,540	0.363	1.021
Residential: EE Program (Upstream Lighting)	N/A	N/A	3.045	5.245
Residential: School Energy Pledge	289	1,573	0.007	0.035
Residential: Appliance Recycling	2,788	4,960	0.347	0.570
Residential: Whole House	122	122	0.008	0.008
Residential: Low Income EE	1,957	7,592	0.110	0.364
Residential: Low Income EE (Upstream Lighting)	N/A	N/A	0.134	0.698
Commercial Sector Umbrella EE	16	36	0.140	0.266
Commercial Sector Umbrella EE (Upstream Lighting)	N/A	N/A	0.000	7.373
Healthcare EE	2	10	0.006	0.469
Industrial Sector Umbrella EE	1	3	0.040	0.339
Chemical Products EE	5	14	0.033	0.096
Mixed Industrial EE	41	52	1.326	1.491
Office Building – Large – EE	58	109	2.083	3.532
Office Building – Small EE	10	35	0.032	0.181
Primary Metals EE	18	25	1.035	3.131
Public Agency / Non-Profit	68	104	2.503	2.661
Retail Stores – Small EE	212	349	0.768	1.272
Retail Stores – Large EE	53	70	0.883	1.063
Multifamily Housing Retrofit	39	39	0.196	0.196
Small Commercial Direct Install	88	88	0.731	0.731
TOTAL PORTFOLIO	**12,288**	**47,721**	**13.789**	**30.742**

Table 1-10: Verified Gross Demand Reduction by Program

Program	PYTD Reported Gross 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]
Residential: EE Program (REEP): Rebate Program	0.363	64%	0.230	15.4%	0.703	6.1%
Residential: EE Program (Upstream Lighting)	3.045	107%	3.273	0.0%	5.533	0.4%
Residential: School Energy Pledge	0.007	58%	0.004	14.4%	0.025	6.3%
Residential: Appliance Recycling	0.347	101%	0.351	1.8%	0.575	2.1%
Residential: Whole House	0.008	97%	0.008	4.8%	0.008	4.8%
Residential: Low Income EE	0.110	95%	0.105	2.8%	0.334	1.6%
Residential: Low Income EE (Upstream Lighting)	0.134	107%	0.144	0.0%	0.723	0.8%
Commercial Sector Umbrella EE	0.140	154%	0.215	21.9%	0.345	15.6%
Commercial Sector Umbrella EE (Upstream Lighting)	0.000	N/A	0.000	0.0%	7.591	2.5%
Healthcare EE	0.006	154%	0.010	21.9%	0.486	2.5%
Industrial Sector Umbrella EE	0.040	100%	0.040	12.2%	0.326	2.4%
Chemical Products EE	0.033	100%	0.032	12.2%	0.093	5.0%
Mixed Industrial EE	1.326	100%	1.320	12.2%	1.479	12.4%
Office Building – Large – EE	2.083	154%	3.208	21.9%	4.700	17.1%
Office Building – Small EE	0.032	154%	0.050	21.9%	0.203	6.4%
Primary Metals EE	1.035	100%	1.031	12.2%	3.042	4.9%
Public Agency / Non-Profit	2.503	109%	2.721	5.8%	2.892	6.3%
Retail Stores – Small EE	0.768	154%	1.182	21.9%	1.702	17.4%
Retail Stores – Large EE	0.883	154%	1.360	21.9%	1.546	22.0%
Multifamily Housing Retrofit	0.196	82%	0.160	4.1%	0.160	4.1%
Small Commercial Direct Install	0.731	98%	0.717	5.0%	0.717	5.0%

Program	PYTD Reported Gross 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]
TOTAL PORTFOLIO	**13.789**	**117%**	**16.163**	**8.1%**	**33.185**	**4.6%**
Phase 1 Carryover	**N/A**	**N/A**	**N/A**	**N/A**	**0**	**N/A**
Total Ph II+CO	**N/A**	**N/A**	**N/A**	**N/A**	**33.185**	**N/A**
[1] At the 85% confidence level [2] At the 90% confidence level						

1.5 SUMMARY OF PROGRAM YEAR 6 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 for Table 1-11. Table 1-11 presents a summary of NTG ratios by program.

Table 1-11: Program Year 6 NTG Ratios by Program.

Program Name	Free Ridership (%)	Spillover (%)	NTG Ratio PY6	PY6 Verified Net Energy Savings (MWh/Yr)	PY6 Verified Net Demand Savings (MW/Yr)	NTG Categories Included[4]
Residential: EE Program (REEP): Rebate Program	50%	20%	71%	840	0.165	FR, Part. SO
Residential: EE Program (Upstream Lighting)	54%	24%	69%	22,810	2.266	FR, Part. SO
Residential: School Energy Pledge	42%	34%	92%	43	0.004	FR, Part. SO
Residential: Appliance Recycling	51%	15%	64%	1,648	0.226	FR, Part. SO
Residential: Whole House	28%	13%	84%	69	0.007	FR, Part. SO
Residential: Low Income EE	21%	9%	88%	738	0.092	FR, Part. SO
Residential: Low Income EE (Upstream Lighting)	54%	24%	69%	1,003	0.100	FR, Part. SO
Commercial Sector Umbrella EE	49%	1%	52%	298	0.112	FR, Part. SO
Commercial Sector Umbrella EE (Upstream Lighting)	N/A	N/A	N/A	N/A	N/A	FR, Part. SO
Healthcare EE	49%	1%	52%	13	0.005	FR, Part. SO
Industrial Sector Umbrella EE	24%	2%	78%	124	0.031	FR, Part. SO
Chemical Products EE	24%	2%	78%	165	0.025	FR, Part. SO
Mixed Industrial EE	24%	2%	78%	6,312	1.030	FR, Part. SO
Office Building – Large – EE	49%	1%	52%	10,391	1.669	FR, Part. SO
Office Building – Small EE	49%	1%	52%	56	0.026	FR, Part. SO
Primary Metals EE	24%	2%	78%	6,559	0.804	FR, Part. SO
Public Agency / Non-Profit	49%	1%	52%	6,312	1.416	FR, Part. SO
Retail Stores – Small EE	49%	1%	52%	2,605	0.615	FR, Part. SO
Retail Stores – Large EE	49%	1%	52%	2,840	0.707	FR, Part. SO
Multifamily Housing Retrofit	5%	0%	95%	1,984	0.152	FR, Part. SO
Small Commercial Direct Install	7%	7%	99%	5,159	0.712	FR, Part. SO
Portoflio Level	**44%**	**9%**	**66%**	**69,969**	**10.163**	**N/A**

[4] For example, free-ridership, nonparticipant spillover, and participant spillover.

1.6 SUMMARY OF PORTFOLIO FINANCES AND COST-EFFECTIVENESS

A breakdown of the portfolio finances is presented in Table 1-12.

Table 1-12: 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 to 4)	**$26,758**	**$36,977**
2	EDC Incentives to Participants	$7,788	$12,864
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$18,970	$24,113
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$13,615**	**$23,852**
6	Design & Development	$0	$239
7	Administration, Management, and Technical Assistance[1]	$11,606	$19,581
8	Marketing[2]	$140	$972
9	EDC Evaluation Costs	$944	$1,385
10	SWE Audit Costs	$925	$1,675
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)	$40,373	$60,827
13	Total NPV Lifetime Energy Benefits	$59,367	$102,718
14	Total NPV Lifetime Capacity Benefits	$5,917	$9,443
15	Total NPV TRC Benefits[4]	$69,452	$119,116
16	TRC Benefit-Cost Ratio[5]	1.72	1.96

NOTES

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.

1.7 SUMMARY OF COST-EFFECTIVENESS BY PROGRAM

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. Table 1-13 shows the TRC ratios by program and other key factors used in the TRC ratio calculation for Phase II programs.

Table 1-13: PYTD TRC Ratios by Program[5]

Program	TRC NPV Benefits ($1000)	TRC NPV Costs ($1000)	TRC Benefit-Cost Ratio	Discount Rate	Energy Line Loss Factor	Demand Line Loss Factor
Residential: EE Program (REEP): Rebate Program	$20,069	$9,279	2.16	6.90%	1.074	1.074
Residential: School Energy Pledge	$21	$176	0.12	6.90%	1.074	1.074
Residential: Appliance Recycling	$1,151	$559	2.06	6.90%	1.074	1.074
Residential: Whole House	$29	$376	0.08	6.90%	1.074	1.074
Residential: Low Income EE	$1,135	$864	1.31	6.90%	1.074	1.074
Commercial Sector Umbrella EE	$511	$699	0.73	6.90%	1.074	1.074
Healthcare EE	$21	$715	0.03	6.90%	1.074	1.074
Industrial Sector Umbrella EE	$117	$127	0.92	6.90%	1.074	1.074
Chemical Products EE	$160	$394	0.41	6.90%	1.074	1.074
Mixed Industrial EE	$6,342	$1,621	3.91	6.90%	1.074	1.074
Office Building – EE	$13,387	$8,071	1.66	6.90%	1.074	1.074
Primary Metals EE	$5,376	$2,902	1.85	6.90%	1.074	1.074
Public Agency / Non-Profit	$9,692	$5,311	1.83	6.90%	1.074	1.074
Retail Stores	$7,280	$4,163	1.75	6.90%	1.074	1.074
Multifamily Housing Retrofit	$1,156	$1,309	0.88	6.90%	1.074	1.074
Small Commercial Direct Install	$3,004	$2,766	1.09	6.90%	1.074	1.074
TOTAL	**$69,452**	**$40,373**	**1.72**	**6.90%**	**1.074**	**1.074**

* Note that TRC costs includes an additional $1,039K for HER that is not included in the table above due to having only maintenance costs and no participant activity or savings.

1.8 COMPARISON OF PROGRAM YEAR 6 PERFORMANCE TO APPROVED EE&C PLAN

Table 1-14 below shows Program Year 6 expenditures compared to the budget estimates set forth in the EE&C plan.

Table 1-14: Comparison of PY6 Program Expenditures to PY6 EE&C Plan

Program	PY6 Budget from EE&C Plan	PY6 Actual Expenditures	% Difference from PY6 EE&C Plan [(Planned – Actual)/Planned]
Residential: EE Program (REEP): Rebate Program	$5,837	$4,588	21.4%
Residential: EE Program (REEP): Upstream Lighting			
Residential: School Energy Pledge	$428	$128	70.1%

[5] For reporting purposes, PYTD TRC Ratios by Program are reported based on the gross verified energy and demand savings.

Program	PY6 Budget from EE&C Plan	PY6 Actual Expenditures	% Difference from PY6 EE&C Plan [(Planned – Actual)/Planned]
Residential: Appliance Recycling	$135	$514	-280.1%*
Residential: Whole House	$250	$350	-40.0%
Residential: Low Income EE	$1,381	$510	63.1%
Residential: Low Income EE Upstream Lighting			
Commercial Sector Umbrella EE	$1,460	$609	58.3%
Healthcare EE	$567	$609	-7.5%
Industrial Sector Umbrella EE	$330	$64	80.6%
Chemical Products EE	$816	$291	64.3%
Mixed Industrial EE	$730	$843	-15.6%
Office Building – Large – EE	$1,000	$1,964	-96.4%
Office Building – Small EE			
Primary Metals EE	$2,246	$1,798	20.0%
Public Agency / Non-Profit	$1,289	$2,957	-129.4%
Retail Stores – Small EE	$460	$976	-112.4%
Retail Stores – Large EE			
Multifamily Housing Retrofit	$585	$350	40.2%
Small Commercial Direct Install	$1,139	$1,678	-47.3%
TOTAL	**$18,652**	**$18,229**	**2.3%**

*Duquesne Light reports that its EE&C Plan understated certain RARP implementation costs by including them under the Residential Energy Efficiency Program, and that costs will be adjusted in the PY7 final report. Program costs incurred to-date are in accordance with Commission approved program implementation contracts with the implementing CSP.

Table 1-15 shows Program Year 6 program savings compared to the energy and demand savings estimates filed in the EE&C plan.

Table 1-15: Comparison of PY6 Actual Program Savings to EE&C Plan for PY6

Program	PY6 MWh Savings Projected in EE&C Plan	Actual Reported PY6 MWh Savings	% Difference [(Planned – PY6 Actual)/PY Planned]	PY6 MW Savings Projected in EE&C Plan	Actual Reported PY6 MW Savings	% Difference [(PY6 Planned – PY6 Actual)PY6 /Planned]
Residential: EE Program (REEP): Rebate Program	28,021	1,757	-23%	1.541	0.363	-121%
Residential: EE Program (Upstream Lighting)		32,793			3.045	
Residential: School Energy Pledge	1,186	83	93%	0.038	0.007	82%
Residential: Appliance Recycling	1,326	2,531	-91%	0.164	0.347	-111%
Residential: Whole House	277	85	69%	0.020	0.008	58%
Residential: Low Income EE	4,151	888	44%	0.208	0.110	-17%
Residential: Low Income EE (Upstream Lighting)		1,442			0.134	
Commercial Sector Umbrella EE	4,327	613	86%	0.725	0.140	81%
Commercial Sector Umbrella EE (Upstream Lighting)	2,792	0	100%	0.656	0.000	100%
Healthcare EE	3,424	26	99%	0.573	0.006	99%
Industrial Sector Umbrella EE	1,536	157	90%	0.258	0.040	84%
Chemical Products EE	3,803	209	94%	0.639	0.033	95%
Mixed Industrial EE	3,399	8,002	-135%	0.571	1.326	-132%
Office Building – Large – EE	6,042	21,392	-256%	1.012	2.083	-109%
Office Building – Small EE		115			0.032	
Primary Metals EE	10,467	8,314	21%	1.758	1.035	41%
Public Agency / Non-Profit	9,224	12,998	-41%	1.371	2.503	-83%
Retail Stores – Small EE	2,776	5,362	-304%	0.465	0.768	-255%
Retail Stores – Large EE		5,847			0.883	
Multifamily Housing Retrofit	1,437	2,171	-51%	0.067	0.196	-194%
Small Commercial Direct Install	1,702	5,429	-219%	0.286	0.731	-156%
TOTAL	**85,890**	**110,216**	**-28%**	**10.353**	**13.789**	**-33%**

The percentage difference in the tables above shows the percent of savings that are still required in order for Duquesne Light to reach their goal. About half of the programs have exceeded their targets for the year (programs showing negative "% Difference" numbers) and half have achieved less than their targets for PY6 (programs showing positive "% Difference" numbers). However, at the portfolio level, Duquesne Light has exceeded its targets for the year.

Some residential programs did not meet their PY6 savings targets. Duquesne Light reports that the School Energy Pledge program has few schools at which to implement the program, having reached most schools during Phase I of the program and in the PY5 program year. As noted in the Residential process evaluation report, miscommunications between the Whole House Energy Audit Program CSP and Duquesne Light resulted in certain participants that were low-income being classified as not low-income. As a result, the utility believed it was close to achieving its target for this program. When the evaluation effort identified

the issue, significant savings from the program were shifted to LIEEP, resulting in a substantial difference between projected savings for the program and what was actually achieved by market rate (i.e., non-low-income) participants.

Projections for the low-income program (LIEEP) likely included assumptions about the percentage of PY6 Upstream Lighting participation that would be allocated to LIEEP based on research conducted at the end of Phase I. That research was refreshed in PY6 and a much lower low-income percentage was estimated, resulting a substantial reduction in total LIEEP savings relative to the projections (i.e., what those savings would have been if the low-income allocation from Upstream Lighting had remained constant). The same was true for the Commercial Sector Umbrella Program, which the new research indicated should receive a 0% allocation of Upstream Lighting program savings.

In recent years, the evaluation team has seen increasing repeat participation by individual large non-residential customers in Duquesne Light's programs, across multiple program/market segments, due to the condensed nature of the utility's service territory. According to the utility, the simpler projects have been completed at these customer sites and there is a need to pursue projects that are more complex, involve significant up-front engineering and M&V work (sometimes having to be conducted over multiple seasons), and have a longer implementation cycle from initiation to completion than do projects in the past. In addition, there is a window of opportunity with the customer for some of these complex projects that, once missed, does not appear again for months, further delaying project implementation. Duquesne Light reports that these projects are not being entered into the tracking system until the needed research has been completed. These factors have resulted in the reporting of significant up-front costs with much less significant reported savings. The utility maintains that this phenomenon contributes strongly to the Healthcare and Chemical Products programs having much lower PYTD savings and TRC ratios than originally estimated for them according the Phase II Act 129 EE&C filing. In any case, on average, the Commercial Programs are exceeding their savings goals and the Industrial Programs are close to 80% of projected savings goals. All non-residential CSPs report that savings goals are highly likely to be met by the end of Phase II.

1.9 PORTFOLIO LEVEL/CROSS-CUTTING PROCESS AND IMPACT EVALUATION SUMMARY FOR PROGRAM YEAR 6

A number of process evaluation activities were completed in PY6 for both residential and C&I programs. These activities are summarized below in Table 1-16.

Table 1-16: PY6 Process Evaluation Activities

Program	Activity	Number of Completed Surveys/Interviews
REEP	Participant Surveys	43 Rebate participants 26 Kit participants
REEP	General Population Lighting Survey In-store Lighting Intercept Survey	1,547 137
RARP	Participant Surveys	63
SEP	Participant Surveys	31
LIEEP	Participant Surveys	7 Kit participants 14 RARP participants 6 SEP participants 35 WHEAP* participants 8 Smart strip participants 12 Refrigerator Replacement participants
WHEAP*	Participant Surveys	17
WHEAP*	Duquesne Light Program Manager and CSP Interviews	5
WHEAP*	CSP Sub-contractors Interviews	4
Commerical & Industrial Programs	Duquesne Light Program Manager and CSP Interviews	7
SCDI	Participant Surveys	35
SCDI	Trade Ally Interviews	7
Multifamily	Participant Surveys	16

*Throughout this report, this program is referred to as the Whole House Energy Audit Program (WHEAP), as it is called on the utility website and is commonly known in the market. However, it was actually filed as the Whole House Retrofit Program (WHRP).

Table 1-17 provides overarching process and impact evaluation recommendations affecting multiple programs or the portfolio.

Table 1-17: Phase II Process and Impact Evaluation Recommendations from PY6 Evaluations

Applicability	Recommendations
Portfolio Level	Duquesne Light should ensure that any issues related to missing data fields, or incomplete data fields, and functionality for interface with CSPs in PMRS be addressed in time for Phase III so that all projects can easily be linked to CSP data and CSPs can rely on the system. We recommend that the utility obtain feedback directly from the CSPs regarding these issues and how/whether they can be effectively addressed given the constraints the utility and CSP each face.

1.10 SITE INSPECTIONS SUMMARY

Please fill out Table 1-18 below with the information requested on site insepctions conducted during PY6.

Table 1-18: Summary of PY6 Site Visits

Program	Measure	Inspection Firm	Number of Inspections Planned	Number of Inspections Conducted	Number of Sites with Discrepancies from Reports	Resolution of Discrepancies
Commercial [1]	Lighting, VFDs, whole building, custom	Navigant	20	13	0	None
GNI	Lighting, VFDs, whole building, custom	Navigant	12	8	1	None
Industrial [2]	Lighting, VFDs, whole building, custom	Navigant	27	13	3	None
SCDI	Lighting, refrigeration	Navigant	19	6	2	None
Multifamily	Lighting, refrigeration	Navigant	14	4	1	None
TOTAL			**92**	**44**	**7**	
[1] One planned GNI site visit was not completed because sufficient post installation data was not yet available. This site visit will be completed in PY7.						
[2] Industrial completed inspections is much higher than planned because sampling was completed at the the measure level. A significant number of "bonus" (non-sampled) measures were verified because they were installed as part of projects that had been sampled and they able to be verified while the verification team was on-site.						

2 RESIDENTIAL ENERGY EFFICIENCY PROGRAM (REEP)

The Residential Energy Efficiency Rebate Program (REEP) is designed to encourage customers to make an energy efficient choice when purchasing and installing household appliance and equipment measures, by offering customers educational materials on energy efficiency options and financial incentives. Program educational materials and an online survey help to promote the availability of the REEP rebates. REEP also provides energy efficiency measures in the form of Energy Efficiency Kits, provided free of charge to Duquesne Light customers attending targeted community outreach events and available online. Energy Efficiency Kits contain CFL bulbs and in most cases also smart strips and LED nightlights.

In addition to the Equipment Rebate and Efficiency Kit program components, a third REEP program component – an Upstream Lighting program component –provides point of purchase discounts on CFLs and LEDs for customers. This is a more streamlined approach to discounting and is more readily engaged by customers, because no rebate forms are necessary. Processing costs are significantly lower by virtue of the elimination of rebate forms at the transaction level, in favor of bulk processing. In addition, events are held regularly within some of the stores to educate consumers on energy efficiency products as well as provide a platform to more broadly educate on other programs falling under the Watt Choices brand.

2.1 PROGRAM UPDATES

No significant changes were made to REEP for PY6. For the rebate portion of the program, the equipment list and rebate dollar amounts remained the same between PY5 and PY6 for all equipment except pool pumps. Rebates no longer are offered for two-speed pool pumps, and the rebate component of the program includes only variable speed pool pumps.

2.1.1 Definition of Participant

A participant for this program is a customer participating in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique participant account number within the tracking system. Participants counted in Table 2-1 represent a summation of the unique customer participant account numbers in the tracking system for the program in each of the four quarters of PY6. Customers participating more than once within a quarter are counted once; customers participating more than once but in different quarters are counted more than once (once in each quarter).

2.2 IMPACT EVALUATION GROSS SAVINGS

The Residential Energy Efficiency Program is exceeding its goals. By the end of PY6, Duquesne Light reported savings totaling 123% of its PY6 gross savings goal of 28,021 MWh. Table 2-1 shows REEP participation, savings and incentives for PY6.

Table 2-1: Phase II REEP Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	32,540	86,083	6.266	$3,740
Phase II Total	**32,540**	**86,083**	**6.266**	**$3,740**

Measurement and Verification Methodology

Consistent with Duquesne Light's EM&V Plan, the basic level of verification rigor was to be used for TRM deemed savings measures and measures with rebates less than $2,000. According to that plan, the basic level of verification rigor methods for TRM deemed measures involves two basic tasks:

- Survey a random sample of participants to verify installations and estimate verification rates.
- The claimed ex ante gross kWh and kW impacts for each PMRS record in the population from which the sample was drawn are then multiplied by this verification rate.

The verification used for TRM deemed measures generally consists of a five-step process:

Step 1. A simple random sample of participants is selected from the PMRS database.

Step 2. Relevant documentation from PMRS or other hardcopy documentation is then obtained for the sample of participants to check against the PMRS records. The verification checklist for deemed or partially deemed savings measures includes:

1. Participant has valid utility account number.
2. Measure(s) is on approved list and all parameters necessary for calculating savings are present.
3. Rebate payment date is in the current program period being verified, or is in the past but the project has not yet been reported.
4. Proof of purchase identifies qualifying measure and is dated within the period being verified, or is dated within a previous period and the project savings has not yet been reported.
5. Unit kWh and kW are correct for each listed measure. For partially deemed measures this involves reviewing the additional inputs required by the TRM. This data is not provided in PMRS. This information was obtained for the sample of participants by reviewing the application files and receipts indicating measure details.
6. Measure was actually installed at the customer site (telephone survey for basic level of rigor).

Step 3. Because all participants sampled met the criterion of having incentive payments less than $2,000, telephone interviews were conducted with each sampled customer to confirm that they participated in the program, received the rebate, and purchased and installed the efficient measure(s).

Step 4. Using the data collected from program files and telephone surveys, a verification savings is calculated for each respondent. The realization rate for the sample is calculated by summing the verified (ex post) savings for all sampled participants, summing the reported (ex ante) savings for all sampled participants, and then dividing the total verified savings by the total reported savings. For the REEP and LIEEP programs, which involve stratification by participation type (Rebates or Kits), the realization rate is calculated for each stratum.

Step 5. The final step involves multiplying each component's realization rate by the total reported savings in the program tracking system for that component, to obtain a total verified savings. For REEP, the total reported savings for each stratum in the program tracking system are multiplied by the appropriate stratum-specific realization rate.

REEP program-specific variances from the five-step approach and program-specific information are outlined below. These relate to the Rebate and Kit components.

REEP Measurement and Verification

Step 1 – Random Sampling: Residential programs generally use the simple ratio estimator. The reason for using a simple ratio estimator is that the vast majority of the measures installed in this program were

expected to be TRM deemed. This means that the savings are subjected to the basic level of rigor that involves only the verification of installations. The only changes to the estimated gross savings in PMRS would be due to clerical errors and installation rates, which were expected to be minor. The resulting realization rate (the ratio of the ex post savings to the ex ante savings) was therefore expected to be very high with a very low variance.

For REEP, first, two strata were defined: 1) Efficiency Kits, and 2) Efficiency Rebates (non-kits). This approach was used under the assumption that while installation rates might not vary very much for rebated products such as ENERGY STAR refrigerators, it was certainly possible that installation of each item in an Efficiency Kit might vary among the participants who received them. Upstream Lighting participants were not included in the sample design. Verification for the Upstream Lighting program comprised a detailed comparison of the program CSP invoices to the values shown in the Duquesne Light database, i.e., verification of a census of the records.

In Duquesne's PY6 Sampling Plan, the annual sample size target for REEP was 53 – including 22 Kit participants and 31 Rebate participants – with a targeted level of confidence and precision of 10% at 90% confidence.[6] Table 2-2, below, presents the targeted and achieved sample sizes for the program.

Table 2-2: REEP Sampling Strategy for Program Year 6

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Rebates	1,847	85%/13.2%	31	43	Telephone Verification
Kits	4,674	85%/15.8%	22	26	Telephone Verification
Upstream Lighting	N/A	N/A	N/A	N/A	Database Verification
Program Total	**6,521**	**85%/15%**	**53**	**69**	

Step 2 – Measure/Project Qualification: The evaluation team reviewed and confirmed relevant documentation for check list criteria item 1 through 4 described under Step 2 of the M&V methodology, or other electronic or hardcopy documentation obtained for sampled PMRS records.

1. Participant has a valid utility account number: All sampled participants had active Duquesne Light account numbers (these were found to be validated in PMRS via linkage to the Customer Information System).
2. Measure is on approved list: All sampled project measures were confirmed to be either listed in Duquesne Light's residential rebate catalog containing approved measures or provided by Duquesne Light in a community outreach energy efficiency kit.
3. Proof of Purchase: Select PY6 sampled rebate applications and supporting proof or purchase data were requested and reviewed to ensure proof of purchase supported the rebate request. Navigant received proof of purchase for all sampled participants. However, a review of the supporting information indicated that the measure specifics were not correct for all customers, which impacts the realization rate calculated for the program.

[6] The target verification sample size of 27 was thought sufficient to achieve the 85%/15% confidence and precision requirement for the program. However, because the same telephone surveys were used for net-to-gross and process evaluation purposes, assumed to have higher variation in responses, the actual sample sizes were increased to a total of 75, including 64 for kits and 11 for rebates.

Step 3 – Participation and Installation Verification: Telephone interviews of each sampled customer confirmed participation in the program, receipt of a Rebate or EE Kit, and installation of the energy saving measure(s). If the TRM included deemed or partially deemed savings values and/or protocols incorporating in-service rates (ISR), verification surveys confirmed program participation and participant purchase or otherwise receipt of subject energy efficiency products (i.e., in the case of EE Kits provided to participants at no cost). Telephone surveys were tailored to the product promotion and included questions designed to verify that participants obtained and installed the EE products. For the Upstream Lighting program component, the program administrator's invoices and related detailed documentation were reviewed to ensure that measure counts and reported savings were both accurate (per the TRM) and the same as what the utility's tracking system was reporting.

Step 4 – Deemed Savings Verification: The evaluation team first compared kWh and kW savings for specific measures in PMRS for REEP against estimates based on the 2014 PA TRM to confirm that a valid realization rate would be reported.

Savings for the measures listed in PMRS were reviewed to ensure consistency with deemed values and algorithms from the 2014 PA TRM. Where necessary, adjustments were made and updated values became the reported values. Reviews were completed for the full range of measures within PMRS, including for the following measures:

- All Kits (components within kits)
- ENERGY STAR Dehumidifiers
- ENERGY STAR Outdoor Fixtures
- ENERGY STAR Freezers
- ENERGY STAR Refrigerators
- Central Air Conditioners (SEER rated)
- Heat Pumps (SEER rated)
- ENERGY STAR Room Air Conditioners
- High Efficiency Showerheads
- Programmable Thermostat
- Whole House Fans (CAC HP Cooling)
- Televisions
- Dishwashers
- Clothes Washers
- Clothes Dryers
- Heat Pump Water Heaters
- Efficient Water Heaters
- High Efficiency Pool Pumps
- Efficient Lighting

Following this first activity in Step 4, the program realization rate was then calculated using the verified energy and demand savings from telephone interviews for the Rebate and Kit components and the review of the proof of purchase and supporting information, as follows: A realization rate (or ratio estimate) was calculated for each of the three REEP strata, the first two of which employed a simple random sampling technique. The realization rate was based on participants reported installation rates as well as the review of the proof of purchase and supportion information. Final realization rates and relative precision at the program group level (which aggregate the strata) were calculated using the stratified ratio estimation

approach, following the method outlined in Lohr (1999)[7]. Aggregation of the variance of each stratum (calculated depending on the assumed distribution type) is also calculated per Lohr (1999).

Note that, per Duquesne's approved EM&V Plan, no customer-based verification efforts were required to estimate in-service/installation rate for the third REEP stratum, the Upstream Lighting program component. Verification efforts consisted of confirming that energy and demand savings reported in Duquesne Light's PMRS (tracking system) could be documented based on invoicing details provided by the program implementation contractor, ECOVA (formerly ECOS), with respect to numbers of units, wattages and savings claims. As a result of using this approach, a verification of every database line item (a census approach) was conducted for Upstream Lighting, resulting in effectively zero *sampling uncertainty*[8] for this stratum.

Step 5 – Program Realization Rate: The final step involves multiplying the total gross ex-ante kWh and kW impacts for each record in the PMRS population from which the sample was drawn by the kWh-weighted average realization rate and the kW-weighted average realization rate, respectively, found for the appropriate stratum. The sum of this exercise, the ex-post impacts, are divided by the reported, ex-ante, savings to calculate the program level realization rate.

As Upstream Lighting accounts for a large fraction of total REEP savings, the result of this approach is such that the relative precision value calculated for the program group was found to be very low (i.e., very precise). These results are shown in Table 2-3 and Table 2-4.

Table 2-3: Program Year 6 REEP 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 (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Rebates	438	79%	347	0.93	16.7%
Kits	1,319	63%	828	0.54	15.8%
Upstream Lighting	32,793	100%	32,951	0.00	0.0%
Program Total	**34,550**	**99%**	**34,127**		**0.4%**

[7] Lohr, Sharon. *Sampling: Design and Analysis*. Pacific Grove, CA: Duxbury Press, 1999, 69-101.

[8] Of course, other sources of uncertainty exist beyond *sampling* uncertainty. For instance, uncertainty of actual savings for each CFL exists due to variance in operating hours, assumed baseline wattage, etc. As the approved evaluation technique used *deemed* values for CFL savings, however, that uncertainty is not reflected in the reported relative precision for these measures.

Table 2-4: Program Year 6 REEP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Rebates	0.248	64%	0.160	1.02	20.8%
Kits	0.114	62%	0.070	0.61	17.8%
Upstream Lighting	3.045	107%	3.273	0.00	0.0%
Program Total	**3.408**	**103%**	**3.504**		**1.0%**

As in past years, no on-site inspections were performed as part of the REEP evaluation.

2.3 IMPACT EVALUATION NET SAVINGS

Although the confidence/precision target for the net savings analysis is 85 percent/15 percent at the program level, because the Net-to-Gross (NTG) analysis for REEP used the same phone surveys as for the gross impact verification, the sample size for the phone surveys were increased to target 90/10 confidence and precision. This was done to properly account for variability that has been found in previous evaluations in NTG data, as compared to the gross impact data.

The upstream lighting sampling strategy was developed separately from the remaining portions of REEP with the intent of achieve 90/10 for both the general population survey and the intercept survey. In both cases the assumed CV was 0.67 and the target for each was 93. However, since multiple data sources are being combined to determine the overall Upstream Lighting stratum NTG (intercept survey, general population survey and delphi panel) a target sample is not specified in the table below.

Table 2-5: REEP Sampling Strategy for Program Year 6 NTG Research

Stratum	Stratum Boundaries	Population Size	Assumed CV or Proportion in Sample Design	Assumed Levels of Confidence & Precision	Target Sample size	Achieved Sample Size	Percent of Sample Frame Contacted[9] to Achieve Sample
Rebates	All	1,847	0.5	90%/12.7%	43	43	97%
Kits	All	4,674	0.5	90%/16.6%	26	26	96%
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Program Total		**6,521**		**90%/10%**	**69**	**69**	**97%**

[9] Sample frame is a list of contacts that have a chance to be selected into the sample. Percent contacted means of all the sample frame how many were called to get the completes.

Navigant's free ridership and spillover research adhered closely to the methodologies required by the Statewide Evaluator (SWE). Further, this methodology used for PY6 is similar to the approaches used for PY5 and provides a means for a useful comparison between the two years. A separate effort to estimate free ridership for the Upstream Lighting Program was initiated.

Free Ridership

The free ridership estimates presented in this section provide an estimation of the extent to which participants would have installed the rebated equipment/equipment they received through the program on their own. Navigant completed the estimation of free ridership separately for the Rebate and Kit participants. These free ridership estimation methods followed the approach required by the SWE's guidance memos.

For the Upstream Lighting program, Navigant conducted multiple research efforts to estimate free ridership and spillover.

Rebate Free Ridership

The steps taken to evaluate the free ridership for the REEP Equipment Rebate purchases are as follows:

1. A free ridership percentage was estimated for each survey respondent, based on the respondent's answers to a series of key survey questions:
    a. What is likely to have happened if the respondent had not received the program rebate or seen program advertisements?
    b. How much of the product would the respondent have bought in absence of the program?
    c. When would the respondent have purchased the equipment without the program?
    d. How influential was the program rebate in the participant's decision to purchase the rebated equipment?
    e. How influential was the program advertising/promotion in the participant's decision to purchase the rebated equipment?
    f. How influential was any contact with Duquesne Light staff in the participant's decision to purchase the rebated equipment?

2. Participants were assigned an intention score and an influence score, each representing 50 percent of the total free ridership score. The intention score was based on questions designed to determine how the upgrade or equipment replacement likely would have differed if the respondent had not received the program assistance. The influence score was assessed by asking the respondent how much influence – from 1 (no influence) to 5 (great influence) – various program elements had on the decision to make the efficiency improvement.
    a. The influence score was determined based on the maximum influence score of the three influence questions respondents were asked. Participants who reported a maximum influence of 1 (no program influence) received an influence score of 50; those who reported a maximum influence of 5 (great program influence) were assigned an influence score of 0.
    b. The intention score was determined based on what participants reported would have been likely to happen if they had not received the program rebate or seen program advertisements.

Navigant scaled the calculated free ridership values based on the verified savings achieved by each rebated item participants were asked about. Note that some Rebate respondents purchased more than one item. The counts reflect the number of items respondents were asked about. Table 2-6 shows the free ridership results for the REEP program.

Table 2-6: REEP Rebate Free Ridership Results

Rebated Equipment	Respondent Installation Measure Count in PY6	Average FR	Energy Savings (kWh) (Gross verified for weighting final FR)
Energy Star Refrigerator	13	69%	1,095
Energy Star Freezer	2	63%	164
Energy Star Clothes Washer	1	50%	215
Clothes Dryer with Moisture Sensor	4	59%	555
Energy Star Dehumidifier	6	78%	926
Energy Star Dishwasher	2	38%	60
Programmable Thermostat	12	64%	319
Heat Pump	1	63%	677
Central Air Conditioner or Heat Pump	11	79%	2,696
Energy Star Room Air Conditioner	2	50%	26
High Efficiency Fan Heating	9	78%	3,231
Occupancy Sensor	1	63%	95
REEP Rebates	**64**	**73%**	**10,059**

Navigant found an overall free ridership of 52 percent during PY5 for REEP Rebates. Free ridership rose to 73 percent in PY6, a 21 percent increase.

Efficiency Kit Free Ridership

Similar to the REEP Rebate free ridership score, the REEP Kit free ridership score is based on an intention and influence score, each representing 50 percent of the total score.

1. The free ridership percentage was estimated for each survey respondent, based on the respondent's answers to a series of key survey questions:
    a. What is likely to have happened if the respondent had not received the kit or seen program advertisements?
    b. How influential were program education materials in the participant's decision to receive and install kit measures?
    c. How influential were program advertisements in the participant's decision to receiving and install kit measures?
    d. How influential was any contact with Duquesne Light staff in the participant's decision to received and install kit measures?
2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
    a. The influence score was determined based on the maximum influence score of the three influence questions respondents were asked. Participants who reported a maximum influence of 1 (no influence) received an influence score of 50, those who reported a maximum influence of 5 (great influence) were assigned an influence score of 0.

b. The intention score was determined based on what participants reported would have been likely to happen if they had not received the kit and program education materials or seen program advertisements.

Navigant calculated free ridership values both for each item received in the kit and for the kit overall. The overall kit free ridership value is developed by weighting each measure level free ridership by its associated verified gross energy savings. Table 2-7 shows the free ridership results by measure and for the overall kit. The CFLs contribute the largest portion of savings and therefore influence the overall free ridership the most.

Free ridership between PY5 and PY6 was fairly consistent at 37 percent and 44 percent, respectively. CFL and smart strip free ridership values were essentially unchanged across program years. CFLs increased from 42 percent to 44 percent, and smart strips decreased from 35 percent to 33 percent. LED nightlights saw a larger shift. PY5 free ridership was 33 percent and that increased to 44 percent in PY6.

Table 2-7: REEP Kit Free Ridership Results

Kit Items	Gross Energy Savings (kWh)		Average FR
	Reported	Verified (for weighting final FR)	
CFLs (two 13W, one 20W, one 23W)	152	90.3	44%
Smart Strips (one)	74.5	48.7	33%
LED Nightlights (two)	51	35.3	44%
Total Kit	**277.5**	**174.3**	**40%**

Upstream Lighting Free Ridership

Navigant conducted three research activities to estimate free ridership for the Upstream Lighting component of REEP. These efforts included in-store intercept surveys with 137 customers buying program bulbs, online surveys with 1,547 recent CFL and LED bulb purchasers, and a Delphi Panel in which 13 industry experts reviewed the research data and then offered their own educated opinions regarding the free ridership rates for the various bulb types included in the program.

For both survey efforts, the free ridership value for each respondent was based on an influence score and an intention score, which were then added together (following SWE guidelines for other residential measures).

- The influence score was based on respondents responses to the following questions:
  - What was the influence of bulb price on the respondent's decision to purchase the bulbs?
  - What was the influence of program advertisements on the respondent's decision to purchase the bulbs?
- The intention score was based on respondents responses to the following question:
  - What would the respondent have purchased if the bulb prices were increased by an amount equal to the average upstream incentive (i.e., discount) paid by Duquesne Light?

Results of both surveys indicated that the intention score estimates tended to be higher and the influence score estimates tended to be lower. Per the SWE required methodology, these estimates were then averaged to obtain a final free ridership estimate for each survey. The two sets of survey results were then averaged and produced the result shown in Table 2-8.

Table 2-8: Survey-based Free Ridership Estimates

Survey Method	Standard CFLs	Specialty CFLs	LEDs
In-store Intercept Survey	67%	N/A	71%
Online Recent Purchaser Survey	68%	68%	55%
Average of Survey-Based Estimates	**68%**	**68%**	**63%**

A Panel of industry experts was convened, including representatives of:

- Program implementers – organizations that implement residential lighting programs
- Product retailers and manufacturers – businesses involved in selling efficient and inefficient lighting products
- Market support organizations – organizations providing guidance for energy efficiency programs and lighting industry experts
- Industry experts – impartial organizations with deep evaluation and/or lighting industry experience

This "Delphi Panel" was provided with information about Duquesne Light's Upstream Lighting program, as well as lighting market data and the evaluation free ridership research methods and results described above. They were then asked to provide their educated opinions regarding what the free ridership estimate should be for each bulb type along with their rationale for each estimate. These estimates and rationales were then compiled and summarized by the research team and sent back to the panelists so that they could benefit from the opinions of other panelists. If they wanted to, they then could modify their estimates and provide revised rationale for them. All panelists thought that the survey-based results were significantly too high, on average, providing estimates that were about 20 percentage points lower than the survey-based estimates.

The research team then averaged the results of the survey-based estimates and the panel estimates to arrive at the final estimates for the program, as shown in Table 2-9.

Table 2-9: Upstream Lighting Free Ridership Results

Source	Standard CFLs	Specialty CFLs	LEDs	Overall Lighting
Survey-based Average Free Ridership	68%	68%	63%	66%
Panel-based Average Free Ridership	44%	43%	35%	42%
Average of Surveys and Panel	**56%**	**56%**	**49%**	**54%**

Additional detail regarding free ridership estimation for the REEP Upstream Lighting program component can be found in PY6 Residential Process Evaluation Report.

In order to determine the total free ridership for REEP (all three program components combined), Navigant weighted the free riderships of the individual components (Rebates, Kits, and Upstream Lighting) by their verified savings achievements. Table 2-10 shows the overall REEP program free ridership. Navigant's analysis found a free ridership rate of 54 percent for the REEP program in PY6. This is the same as the free ridership rate that was found in PY5 (54 percent). Additional detail regarding the free ridership estimation for all REEP components can be found in the PY6 Residential Process Evaluation Report.

Table 2-10: REEP Total Free Ridership Ratio

REEP Sub-program	Gross Verified Savings (MWh)	Percent of Savings	Individual FR
Kits	828	2%	40%
Rebates	347	1%	73%
Upstream Lighting	32,915	97%	54%
		REEP Total Free Ridership:	**54%**

Spillover

In the NTG surveys administered to REEP customers, Navigant also asked whether or not the customer had taken any additional energy saving actions after participating in the Duquesne Light program. If the respondent had made additional energy efficiency improvements as a result of the program, these would be spillover savings. Navigant asked these questions of respondents who participated in both the REEP Rebate and Kit program components. Navigant based the methodology for estimating spillover savings on the approach outlined by the SWE Guidance Memorandum GM-025.[10] The spillover savings for each program participant are determined by assessing the type and number of spillover measures installed, the energy savings associated with each measure, and the influence of the program on the participants decision to take these additional energy savings actions. Navigant sourced measure savings amounts from Duquesne Light's PY6 tracking data (PMRS) that references deemed savings values from the 2014 Pennsylvania TRM. Generally, savings for a given spillover action rely on either a specific 2014 TRM value or the average of the reported savings for a given measure group within the tracking data in order to represent the mix of equipment installed in PY6. For example, central air conditioner installations reference the average savings for the range of SEER levels installed through the REEP Rebate program.

For each participant, spillover savings are calculated as:

$$Participant\ SO = Measure\ Savings * Number\ of\ Units * Program\ Influence$$

Navigant relied on the PY6 Upstream Lighting general population survey effort to inform the spillover estimate for the PY6 Upstream Lighting component. Specifically, Navigant used the 1,547-respondent online survey to identify customers who had purchased program eligible bulb types and asked these customers if they had taken any additional energy savings actions as a result of purchasing bulbs through the Duquesne Light program. Navigant based the methodology for estimating spillover savings on the approach outlined by the SWE Guidance Memorandum GM-025.[10]

In order to determine a spillover factor for the total population of each component of the REEP program Navigant multiplied the savings per participant by the number of unique PY6 participants for each

[10] Common Approach for Measuring Spillover (SO) for Downstream Programs, February 28, 2014.

program component. For example, Navigant did not count a Duquesne Light customer twice if they received two rebates. This leads to a total spillover savings for each component. The total spillover savings is then divided by the total program verified gross energy savings to determine a spillover factor.

Additional detail about the spillover analysis can be found in the PY6 Residential Process Evaluation Report.

Table 2-11: REEP Spillover Factors

REEP Component	Spillover Savings per Participant (kWh)	Total PY6 Participants	Total Spillover Savings (kWh)	Total Gross Savings (kWh, verified)	Spillover %
REEP Rebate	44.2	1,847	81,576	347,159	24%
REEP Kits	33.2	4,674	155,191	828,362	19%
Upstream Lighting	71.2	N/A	7,771,585	32,915,192	24%
				Total REEP Spillover Factor	**23%**

REEP Net-to-Gross Estimate

Navigant determined the NTG ratio for each program component with the following:

NTG = 1-FR+Spillover

Table 2-12: summarizes the NTG ratio for each program component and the overall REEP NTG. Navigant determined the overall REEP NTG by weighting the NTG for each program component by the savings associated with that program component.

Table 2-12: Program Year 6 REEP Summary of Evaluation Results for NTG Research

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
Rebates	73%	24%	51%	1.56	29.3%
Kits	40%	19%	79%	0.62	18.8%
Upstream Lighting	54%	24%	69%	0.00	7.4%
Program Total[11]	**54%**	**23%**	**69%**		**7.3%**

2.4 PROCESS EVALUATION

The process evaluation for the REEP program group in PY6 included the following activities:

- Review of the 2014 Pennsylvania TRM and program materials
- Surveys with 43 REEP Rebate and 26 REEP Kits participants sampled randomly from the entire PY6 population for each program segment (Rebates and Kits) between March 23 and April 4 and July 1 and September 22, 2015. These surveys included both verification questions and selected process evaluation questions.

[11] NTG ratio at program level developed using stratum weight and stratum NTG ratios.

The process evaluation participant interviews were conducted in conjunction with the impact telephone verification activities. The same participants drawn for the impact samples were used for the process evaluation.

Table 2-13: REEP Sampling Strategy for Process Evaluation for Program Year 6

Target Group or Stratum (if appro-- priate)	Stratum Boundaries (if appropriate)	Popula-- tion Size	Assumed Proportion or CV in Sample Design	Assumed Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Percent of Population Frame Contacted to Achieve Sample	Used For Evaluation Activities (Impact, Process, NTG)
Rebates	N/A	1,847	0.5	90%/12.7%	43	43	97%	Impact, Process, NTG
Kits	N/A	4,674	0.5	90%/16.6%	26	26	96%	Impact, Process, NTG
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Impact, Process, NTG
Program Total		**6,521**		**90%/10%**	**69**	**69**	**97%**	

The activities examined the program design, program administration, program implementation and delivery, and market response.

Navigant conducted supplemental research to investigate the residential lighting market in greater detail. These activities included:

- Residential Lighting Delphi Panel: A Delphi Panel was convened electronically to obtain the informed opinions of residential lighting experts regarding the residential lighting market (on CFLs and LEDs in particular), based on data provided to them and their own understanding of residential lighting markets. Panelists were provided data about recent pricing trends and socket penetrations and asked a number of questions about their views on the future of the Pennsylvania lighting market. The Delphi Panel was completed in two phases; panelists were able to review other panelist's responses and justifications and modify their responses in the second phase.
- General Population Survey: An online general population survey was implemented to investigate residential customer's attitudes toward LEDs and CFLs and halogens, and data on CFL and LED socket penetration and awareness of CFL and LED features/benefits. The sample frame for the survey was all residential customers. A random sample of 30,000 residential customers were either mailed or emailed an invitation to complete the survey. The survey included questions to identify all respondents who had purchased CFLs in the previous three months and LEDs in the previous six months.

The process evaluation findings and details can be found in the Residential Energy Efficiency Programs PY6 Process Evaluation report. Highlights of the process evaluation findings are summarized below:

- REEP Rebates free ridership increased from 52 percent in PY5 to 73 percent in PY6. Also, the NTG ratio decreased from 81 percent to 46 percent. A decrease in spillover contributed to the NTG decrease; spillover in PY5 was 34 percent and in PY6 it was 19 percent.
    - Energy Star regularly increases the efficiency thresholds for the products it addresses. During PY6, the majority of product options currently available to consumers for certain products were Energy Star rated. Navigant also found instances where Energy Star nearly represented the entire market. For example, 92 percent of dishwashers and 89 percent of dehumidifiers were Energy Star rated.
- The overall customer satisfaction level for all of PY6 was high, which is consistent with that of PY5. Participant satisfaction with the Rebate component of REEP appears to have fallen somewhat from a high level in Q1/Q2 to a moderate level in Q3/Q4. However, the survey sample sizes on which this finding is based were relatively small.
- More than 10% of the respondents surveyed reported dissatisfaction with having their applications initially rejected due to what they thought were minor errors they had made.
- REEP Kits free ridership stayed essentially the same as in PY5, increasing only slightly from 37 percent in PY5 to 40 percent in PY6. The NTG factor increased from 73 percent to 79 percent based partially on a spillover increase from 10 percent in PY5 to 19 percent in PY6.
- When asked, 22 percent of respondents suggested the Kits component should offer different products. This suggestion was made by approximately the same percentage of respondents in the PY5 evaluation. Suggestions and other feedback most often alluded to different lamp options beyond the CFLs currently supplied.
- Participant satisfaction with the Kit component of REEP remains high. However, satisfaction with the energy savings resulting from the installation of kit items was consistently rated lower than for other program aspects. Again, satisfaction with savings was generally high and was 3.6 and 3.9 on the 5 point scale for PY5 and PY6, respectively. However, all other aspects were rated at 4 and above. This condition is not unique to REEP Kits, but rather generally observed among all programs.
- A number of key findings were obtained through the lighting general population survey. These include:
    - Importance of different factors in purchasing light bulbs: Bulb life and light quality/brightness were reported as the most important factors in purchasing light bulbs.
    - Awareness of CFLs and LEDs: Almost all customers know what a CFL is (98%), and most know what an LED is (66%).
    - Estimated penetration of CFLs and LEDs: Only 14% of customers reported having no CFLs in light sockets and 46% of customers reported having no LEDs in light sockets. This represents an increased CFL and LED penetration over PY5.
    - Satisfaction with various LED characteristics/attributes: About two thirds or more of DLC customers reported being satisfied with their LEDs with respect to the color, brightness and lifetime of the bulbs.
    - Understanding of LED attributes: Less than 10% of Duquesne Light customers surveyed knew that LEDs typically last more than 15 years. Only approximately 50% of Duquesne Light customers knew about LEDs energy savings potential. Customers reported that knowing about both LED attributes would result in them being substantially more likely to purchase LEDs in the future.

2.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The REEP program achieved an energy savings realization rate of 99% and the evaluation found a 0.69 NTG ratio. Table 2-14 shows the evaluation's recommendations and additional details can be found in the PY6 Process Evaluation report.

Table 2-14: REEP Status Report on Process and Impact Recommendations

Recommendations	DLC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Monitor Energy Star for criteria changes and estimates on market penetration rates. Consider additional criteria or tiered incentives for increased savings and reduced free ridership.	Being Considered
Monitor call center activities, rebate rejection rates, and time duration between application submission and incentive payment to quantify program performance in PY7, to ensure that the possible decrease in satisfaction in the second half of PY6 does not reflect an ongoing problem.	Being Considered
Consider emphasizing on the application form the critical importance of participants filling out the applications properly, to set expectations regarding completion of applications by participants.	Being Considered
Consider leveraging the REEP, LIEEP, and SEP kits to introduce LEDs to participants, perhaps includingan LED to the kits. However, the cost effectiveness of such an addition should be reviewed first.	Being Considered
Consider using program collateral to place more emphasis on non-energy benefits of kit items, in addition to continuing to promote the energy benefits. For example, efficient lamps such CFLs or LEDs have longer lifetimes and require less frequent replacements due to burnouts.	Being Considered

2.6 FINANCIAL REPORTING

REEP is performing above plan levels, achieving 123% of the PY6 energy savings goal and spending 81% of the targeted budget for the year. This result is mostly due to the success of the Upstream Lighting component of the program. Participation for Upstream Lighting has been overwhelming and program acceptance with retailers has been growing steadily. A breakdown of the program finances is presented in Table 2-15.

Table 2-15: Summary of REEP Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$6,321**	**$10,116**
2	EDC Incentives to Participants	$1,952	$3,740
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$4,369	$6,376
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$2,958**	**$7,598**
6	Design & Development	$0	$52
7	Administration, Management, and Technical Assistance[1]	$2,431	$5,937
8	Marketing[2]	$140	$965
9	EDC Evaluation Costs	$196	$291
10	SWE Audit Costs	$191	$353
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)	$9,279	$17,714
13	Total NPV Lifetime Energy Benefits	$15,153	$31,193
14	Total NPV Lifetime Capacity Benefits	$937	$1,480
15	Total NPV TRC Benefits[4]	$20,069	$38,622
16	TRC Benefit-Cost Ratio[5]	2.16	2.18

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
[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. Total does not match sum of energy and capacity benefits due to the inclusion of avoided incandescent bulb replacement costs included in the total NPV TRC Benefits values. NOTE: Savings carried over from Phase I are not 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.

Duquesne Light reported costs for the Home Energy Report (HER) program athough no savings are reported for PY6 or Phase II. Table 2-16 shows how those costs are broken down for that program.

Table 2-16: Summary of HER Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 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, 7, 8, 9, 10)	**$1,039**	**$1,627**
6	Design & Development	$0	$0
7	Administration, Management, and Technical Assistance[1]	$1,039	$1,627
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		
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$1,039	$1,627
13	Total NPV Lifetime Energy Benefits	$0	$0
14	Total NPV Lifetime Capacity Benefits	$0	$0
15	Total NPV TRC Benefits[4]	$0	$0
16	TRC Benefit-Cost Ratio[5]	0.00	0.00

NOTES

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.

3 RESIDENTIAL APPLIANCE RECYCLING PROGRAM (RARP)

The Residential Appliance Recycling Program (RARP) seeks to produce cost-effective, long-term, coincident peak demand reduction and annual energy savings in residential market sector by removing operable, inefficient, primary and secondary refrigerators and freezers from the power grid in an environmentally safe manner.

To stimulate participation, RARP offers incentives for eligible refrigerators ($35) and freezers ($35). In addition, the program collaborates with other utility programs such Low Income Energy Efficiency Program, the Public Agency Partnership Program and is implemented in a manner consistent with appliance recycling programs across Pennsylvania by using a common implementation contractor (JACO).

3.1 PROGRAM UPDATES

The Residential Appliance Recycling Program (RARP) remained unchanged between PY5 and PY6.

3.1.1 Definition of Participant

A participant for this program is a customer participating in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique participant account number within the tracking system. Participants in Table 3-1 represent a summation of the unique customer participant account numbers in the tracking system for the program in each of the four quarters of PY6. Customers participating more than once within a quarter are counted once; customers participating more than once but in different quarters are counted more than once (once in each quarter).

3.2 IMPACT EVALUATION GROSS SAVINGS

RARP is performing above plan levels, having achieved 191 percent of the energy savings target for PY6 but spent 380 percent of the targeted budget[12] to achieve those savings. Table 3-1 shows RARP participation, savings and incentives for PY6.

Table 3-1: Phase II RARP Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	4,960	4,380	0.570	$185
Phase II Total	**4,960**	**4,380**	**0.570**	**$185**

Measurement and Verification Methodology

Consistent with Duquesne Light's EM&V Plan Section 3.2, the basic level of verification rigor was to be used for TRM deemed savings measures and measures with rebates less than $2,000. According to that plan:

The basic level of verification rigor methods for TRM deemed measures involves two basic tasks:

[12]Duquesne Light reports that its EE&C Plan understated certain RARP implementation costs by including them under the Residential Energy Efficiency Program, and that costs will be adjusted in the PY7 final report. Program costs incurred to-date are in accordance with Commission approved program implementation contracts with the implementing CSP.

- Survey a random sample of participants to verify installations and estimate verification rates.
- The claimed ex ante gross kWh and kW impacts for each PMRS record in the population from which the sample was drawn are then multiplied by this verification rate.

The verification used for TRM deemed measures consists of a five-step process described in Section 2.2. RARP program-specific variances from the five-step approach and program-specific information are outlined below.

RARP Measurement and Verification

Step 1 – Random Sampling: Residential programs generally use the simple ratio estimator. The reasons for using a simple ratio estimator were the measure for this program is TRM deemed. This means that the savings are subjected to the basic level of rigor that involves only the verification of installations. The only changes to the estimated gross savings in PMRS would be due to clerical errors and installation rates, which were expected to be minor. The resulting realization rate (the ratio of the ex post savings to the ex ante savings) was therefore expected to be very high with a very low variance.

The sample design for the RARP program involved the use of the simple ratio estimator. In Duquesne Light's PY6 Sampling Plan, the annual sample size target for RARP was 53 participants, with a targeted level of precision of 15% at 85% confidence. Table 3-2, below, presents the targeted and achieved sample sizes for the program.

Table 3-2: RARP Sampling Strategy for Program Year 6

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
RARP	2,788	85%/10%	53	63	Telephone Verification
Program Total	**2,788**	**85%/10%**	**53**	**63**	

This high sample size was targeted to refine estimates on the distribution of refrigerators and freezers recycled and replaced with ENERGY STAR units vs. non-ENERGY STAR units for future reporting. The PY6 estimate is currently 93% ENERGY STAR and 7% non-ENERGY STAR. This is based on surveys completed during PY6 through which participants were asked if their replacement units were ENERGY STAR.

Step 2 – Measure/Project Qualification: Performed as described in Section 2.2. The evaluation team reviewed and confirmed relevant documentation for check list criteria items 1 through 3 described under Step 2 in Section 2.2 above, using PMRS data and/or other electronic or hardcopy documentation obtained for a sample of PMRS records.

1. Participant has a valid utility account number: All sampled participants had active Duquesne Light account numbers (these were found to be validated in PMRS via linkage to the Customer Information System).
2. Proof of Participation: PY6 RARP detailed data were requested from JACO and reviewed as a check on the accuracy of the participant database. In PY6 no exceptions were noted.
3. Rebate payment date is in the current program period being verified. No exceptions.

Step 3 – Participation and Installation Verification: Telephone surveys were employed for impact verification of measures receiving basic level of rigor verification (i.e., deemed savings measures with rebates less than $2,000). RARP telephone interview surveys were performed with sampled customers to confirm participation in the program (i.e., that their refrigerator/freezer was recycled through the program). Further for recycled appliances that were replaced, the installation verification confirmed if new units were ENERGY STAR or non-ENERGY STAR.

Step 4 – Deemed Savings Verification: All energy efficiency measures delivered by the RARP have deemed savings specified in the 2014 TRM. The TRM provides a value specific to the appliance type and to the retirement or replacement activity associated with the appliance removal. Unit savings are defined as below:

Table 3-3: Refrigerator/Freezer Recycling – References

Appliance	Activity Component	kWh Savings	kW Savings
Refrigerator	Retirement	1,036	0.113
Refrigerator	Replaced with ENERGY STAR	753	0.096
Refrigerator	Replaced with Non-ENERGY STAR	636	0.081
Freezer	Retirement	1,103	0.139
Freezer	Replaced with ENERGY STAR	627	0.079
Freezer	Replaced with Non-ENERGY STAR	542	0.068

When the refrigerator or freezer is picked up, the implementation contractor JACO records whether the appliance is a primary or secondary unit, and whether or not it was replaced. Based on the responses to these two questions, the resulting energy and demand savings are determined. For primary refrigerators, it is assumed that every unit is replaced (100%). For secondary units, if they were not reported as replaced, they are assumed to be retired. For replaced units, data from telephone verification surveys conducted with program participants from PY6 were used to estimate the percentage of refrigerator/freezer replacement participants who replaced their refrigerator/freezer with an ENERGY STAR refrigerator/freezer versus a non-ENERGY STAR refrigerator/freezer. As previously stated, that survey found that 93% of replacements were ENERGY STAR while the remaining 7% were non-ENERGY STAR. For replacement refrigerators, for example, PMRS would report the weighted average energy savings of replacing with an ENERGY STAR unit or a non-ENERGY STAR/standard unit, or (93% x 753 + 7% x 636) = 745 kWh. Table 3-4 shows the reported energy savings assigned to each participant based on the type of unit recycled and the replacement action.

Table 3-4: Refrigerator/Freezer Recycling – Reported Savings

Appliance	Unit	Action	Replacement Type	kWh Savings per unit	kW Savings per Unit
Refrigerator	Primary Unit	Replace	ENERGY STAR (93%)	(93% * 753) + (7% * 636) = 745	(93% * 0.096) + (7% * 0.081) = 0.095
			Standard (7%)		
	Secondary Unit	Replace	ENERGY STAR (93%)	745	0.095
			Standard (7%)		
		Retire	N/A	1,036	0.133
Freezer	Primary Unit	Replace	ENERGY STAR (93%)	(93% * 627) + (7% * 542) = 621	(93% * 0.079) + (7% * 0.068) = 0.078
			Standard (7%)		
	Secondary Unit	Replace	ENERGY STAR (93%)	621	0.078
			Standard (7%)		
		Retire	N/A	1,103	0.139

For example, if a participant recycled a primary unit, their reported savings are 745 kWh and 0.095 kW. If a participant recycled a secondary unit and said that they did not replace it (the secondary unit was retired), their savings are 1,036 kWh and 0.133 kW.

Step 5 – Program Realization Rate: As related in the M&V methodology in Section 2.2, the program realization rate is calculated using the verified energy and demand savings from telephone interviews. The survey effort confirmed the type and quantity of appliance which was recycled and estimated the Energy Star vs non Energy Star percentage which is applied to all participants who were reported as having replaced their appliances based on the JACO data. Induced replacement is accounted for in the net savings analysis.

A realization rate (or ratio estimate) was calculated for the entire RARP sample, which employed a simple random sampling technique. These results are shown in Table 3-5 and Table 3-6.

Generally, the verification efforts confirm that appliances were recycled. Realization rates differing from 100% reflect differing quantities or appliance types recycled.

These results are shown in Table 3-5 and Table 3-6.

Table 3-5: Program Year 6 RARP 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 (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
RARP	2,531	101%	2,562	0.10	1.8%
Program Total	**2,531**	**101%**	**2,562**		**1.8%**

Table 3-6: Program Year 6 RARP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
RARP	0.347	101%	0.351	0.10	1.8%
Program Total	**0.347**	**101%**	**0.351**		**1.8%**

As in past years, no on-site inspections were performed as part of the RARP evaluation.

3.3 IMPACT EVALUATION NET SAVINGS

Although the target for confidence and precision is confidence of 85 percent and precision of 15 percent at the program level, the Net-to-Gross (NTG) analysis for RARP utilized the same phone surveys as for the gross impact verification. The sample size for the phone surveys was increased by targeting a confidence of 90 percent and precision of 10 percent. This is done to better account for variability that has been found in previous evaluations in NTG data, as compared to the gross impact data.

Table 3-7: RARP Sampling Strategy for Program Year 6 NTG Research

Stratum	Stratum Boundaries	Population Size	Assumed CV or Proportion in Sample Design	Assumed Levels of Confidence & Precision	Target Sample size	Achieved Sample Size	Percent of Sample Frame Contacted[13] to Achieve Sample
RARP	All	2,788	0.5	90%/10%	69	63	90%
Program Total		**2,788**		**90%/10%**	**69**	**63**	**90%**

Navigant's free ridership and spillover research aligned to the methodologies required by the SWE.[14] This methodology, however, was somewhat different from that used in previous years. As a result, it is not clear whether changes in free ridership or spillover, year-to-year, are due to actual changes in the market or to changes in the methodologies being used. Specifically, Navigant modified its analysis based on feedback from the SWE in order to adhere more closely to the SWE's intended approach.

Free Ridership

Navigant determined the free ridership for RARP by evaluating participants' responses to several questions relating to their motivation for participating in RARP. Questions were asked about each appliance if participants recycled more than one appliance. Navigant based the methodology on SWE guidance, which is summarized here:

[13] Sample frame is a list of contacts that have a chance to be selected into the sample. Percent contacted means of all the sample frame how many were called to get the completes.

[14] See SWE guidance memorandum GM-026: Common Approach for Measuring Net Savings for Appliance Retirement Programs, March 14, 2014.

1. A free ridership percentage was estimated for each respondent who completed a survey. The percentage was based on the respondent's responses to a series of key survey questions:
    a. If the Duquesne Light appliance recycling program had not been available, would the respondent have removed or kept the appliance?
    b. If the Duquesne Light appliance recycling program had not been available, what would you most likely have done with your appliance when you were ready to dispose of it?
    c. Would you have purchased a replacement appliance if the Duquesne Light program had not been available?
2. In estimating free ridership for this program, Navigant made the following assumptions regarding survey responses and participant actions:
    a. Participants were first classified into either keepers or removers.
    b. Removers were further classified into those who would have had their unit permanently removed from the electric grid and those whose units would have continued to be used.
    c. Each respondent's appliance was then assigned a net savings value based on what would have happened to the appliance in absence of the program based on the diagram in Figure 3-1:

Figure 3-1: RARP Free Ridership Scenario Diagram

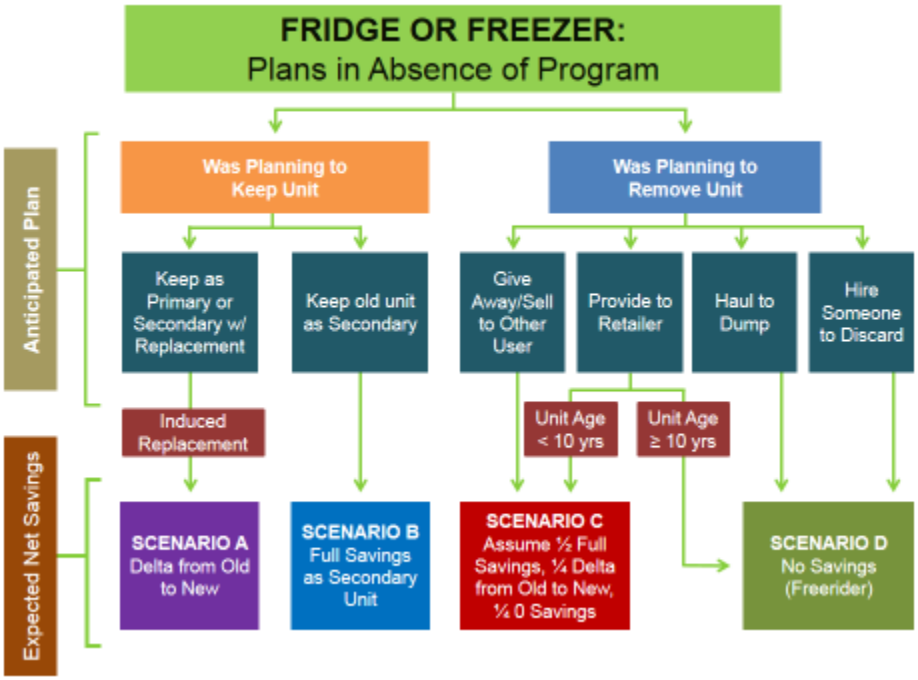


Table 3-8 shows the free ridership results for RARP. Navigant followed SWE guidance by first calculating the total net savings for each surveyed program participant's appliance, based on which of Figure 3-1's paths was appropriate for that participant's appliance. Most participants only recycled one appliance, but six surveyed participants recycled two units. For these cases, net savings were calculated separately for each appliance.

For each of the two appliance types (refrigerators and freezers) the net savings of the surveyed participants were then summed and divided by the total number of appliances associated with those surveyed participants for that appliance, to obtain an average net savings per appliance. These average net savings values were then applied to the total population of each appliance, to obtain a total net savings for the program. Navigant then divided the total program net savings by the total verified gross savings to find the net to gross savings ratio (less any spillover consideration). The free ridership rate is equal to 100 percent less this ratio. The RARP free ridership rate for PY6 was 51 percent for both refrigerators and freezers. This is lower than the PY5 estimate of 65 percent. Additional detail about the RARP free ridership estimation can be found in the PY6 Residential Process Evaluation Report.

Table 3-8: RARP Total FR Ratio

Metric	Value
Reported Gross Savings (MWh)	2,531
Realization Rate	101%
Verified Gross Savings (MWh)	2,565
Reported Units (refrigerators and freezers)	2,957
Unit Net Savings (MWh)	420
Verified Net Savings (MWh)	1,260
Preliminary Net-to-Gross Ratio (not including spillover)	49%
Free ridership rate	**51%**

Spillover

Navigant asked RARP customers whether or not they had taken any additional energy saving actions after participating in the Duquesne Light program. If the respondent had made additional energy efficiency improvements as a result of the program, the resulting energy savings would be considered spillover. Navigant applied the SWE methodology, as outlined in the REEP spillover section, to RARP survey responses to determine spillover.

The total spillover savings for surveyed RARP participants is 8,766 kWh for all spillover actions, or 139 kWh per respondent. These results indicate that the RARP program raises awareness about energy efficiency and encourages customers to make additional efficiency upgrades similar to other Duquesne Light residential programs. Further, the spillover in PY6 is slightly greater than the 103 kWh of spillover per participant found in PY5. Additional detail about the spillover analysis can be found in the PY6 Residential Process Evaluation Report.

In order to determine a spillover factor for RARP, Navigant multiplied the savings per participant by the number of PY6 participants. This leads to a total spillover savings for RARP, which is then divided by the verified gross program energy savings to determine a spillover factor. The spillover factor for PY6 is 15 percent. In PY5, Navigant found a spillover factor of 12 percent, indicating that spillover has remained constant across the two years.

Table 3-9: RARP Spillover Factor

	Spillover Savings per Participant (kWh)	Total PY6 Participants	Total Spillover Savings (kWh)	Total Gross Savings (kWh, verified)	Spillover %
RARP Program	139.1	2,788	387,950	2,565,803	15%

Navigant calculated the NTG ratio for the RARP program shown in Table 3-10 with the following equation:

(*NTG=1-FR+Spillover*)

Table 3-10: Program Year 6 RARP Summary of Evaluation Results for NTG Research

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
RARP	51%	15%	64%	1.11	17.1%
Program Total[15]	**51%**	**15%**	**64%**		**17.1%**

3.4 PROCESS EVALUATION

The process evaluation for the RARP program group in PY6 included the following activities:

- Review of the 2014 Pennsylvania TRM and program materials
- Surveys with 63 RARP participants sampled randomly from the entire PY6 population between March 23 and April 4, and July 1 and July 28, 2015. These surveys included verification, net-to-gross and selected process evaluation questions.

Table 3-11: RARP Sampling Strategy for Program Year 6

Target Group or Stratum (if appropriate)	Stratum Boundaries (if appropriate)	Population Size	Assumed Proportion or CV in Sample Design	Assumed Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Percent of Population Frame Contacted to Achieve Sample	Used For Evaluation Activities (Impact, Process, NTG)
RARP	N/A	2,788	0.5	90%/10%	69	63	90%	Impact, Process, NTG
Program Total		**2,788**		**90%/10%**	**69**	**63**	**90%**	

The activities examined the program design, program administration, program implementation and delivery, and market response.

The process evaluation findings and details can be found in the PY6 Residential Process Evaluation report. Highlights of the process evaluation are summarized below:

- Free ridership decreased from 65 percent to 51 percent across PY5 and PY6. NTG ratio increased from 47 percent to 65 percent. A change in spillover from 12 percent in PY5 to 15 percent in PY6

[15] NTG ratio at program level should be developed using stratum weight and stratum NTG ratios.

contributed slightly as well. While this is an improvement for the program, this may also reflect a refinement of the application of the SWE's NTG methodology.

- While savings are about 90 percent higher than planned for PY6, expenditures for this program are nearly four times higher than budgeted for PY6. Duquesne Light reports that what appears to be "high" actual expenditures is actually a result of the budgeted numbers being too low. The utility has indicated that its EE&C Plan understated certain RARP implementation costs by including them under the Residential Energy Efficiency Program, and that costs will be adjusted in the PY7 final report.
- While Duquesne Light scaled marketing back in PY6 relative to PY5, the program is very established and benefitted from participants recommending the program to family and friends. Over the PY5 to PY6 period participation in RARP increased from 2,172 participants to 2,788.
- Navigant's participant survey found that the cash incentive was named as a reason to participate most of the time. However, the convenience and the offer of a free, in-home pick-up by the program were reported as the aspects *most influencing* the decision to participate in the program. These PY6 findings are consistent with the evaluation team's findings in PY5.

3.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The RARP program achieved an energy savings realization rate of 101% and the evaluation found a 0.64 NTG ratio. Table 3-12 shows the evaluation's recommendations and additional details can be found in the PY6 Residential Process Evaluation report.

Table 3-12: RARP Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne should adjust its cost accounting for REEP and RARP to support proper tracking of program costs.	Being Considered
Monitor the influence of the incentive on the decision to participate in RARP. The program may be capable of maintaining participation levels with reduced incentives. Further, the offer to remove the appliance might be sufficient to gain participation, even without a rebate.	Being Considered

3.6 FINANCIAL REPORTING

RARP is performing well above plan levels, achieving 191% of the PY6 energy savings goal and spending 397% of the targeted budget for the year. A breakdown of the program finances (by program) is presented in Table 3-13.

Table 3-13: Summary of RARP Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$104**	**$185**
2	EDC Incentives to Participants	$104	$185
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, 7, 8, 9, 10)	**$456**	**$933**
6	Design & Development	$0	$6
7	Administration, Management, and Technical Assistance[1]	$410	$852
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$23	$34
10	SWE Audit Costs	$23	$41
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)	$559	$1,118
13	Total NPV Lifetime Energy Benefits	$1,058	$1,723
14	Total NPV Lifetime Capacity Benefits	$93	$144
15	Total NPV TRC Benefits[4]	$1,151	$1,867
16	TRC Benefit-Cost Ratio[5]	2.06	1.67

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
[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.

4 SCHOOL ENERGY PLEDGE PROGRAM (SEP)

The School Energy Pledge (SEP) program is designed to teach students about energy efficiency, have them participate in a school fundraising drive, and help their families to implement energy-saving measures at home. Energy efficiency impacts take place in student homes when families adopt energy efficiency measures that students learn about at school. Through the SEP program, families complete a pledge form wherein they commit to install energy efficiency measures provided in an SEP Energy Efficiency Tool Kit (SEP EE Kit) provided free of charge. In return for a family's commitment to install, the participating school receives an incentive of $25.

4.1 PROGRAM UPDATES

No changes occurred for the SEP program in PY6.

4.1.1 Definition of Participant

A participant for this program is a customer participating in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique participant account number within the tracking system. Participants in Table 4-1 represent a summation of the unique customer participant account numbers in the tracking system for the program in each of the four quarters of PY6. Customers participating more than once within a quarter are counted once; customers participating more than once but in different quarters are counted more than once (once in each quarter).

4.2 IMPACT EVALUATION GROSS SAVINGS

SEP is performing below planned levels, having achieved only 7 percent of the energy savings target for PY6 but spent 30 percent of the targeted budget to achieve those savings. Table 4-1 shows SEP participation, savings and incentives for PY6.

Table 4-1: Phase II SEP Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	1,573	582	0.035	$0
Phase II Total	**1,573**	**582**	**0.035**	**$0**

Measurement and Verification Methodology

Consistent with Duquesne Light's EM&V Plan, the basic level of verification rigor was to be used for TRM deemed savings measures and measures with rebates less than $2,000. According to that plan, the basic level of verification rigor methods for TRM deemed measures involves two basic tasks:

- Survey a random sample of participants to verify installations and estimate verification rates.
- The claimed ex ante gross kWh and kW impacts for each PMRS record in the population from which the sample was drawn are then multiplied by this verification rate.

The verification used for TRM deemed measures consists of a five-step process described in Section 2.2 SEP program-specific variances from the five-step approach and program-specific information are outlined below.

SEP Measurement and Verification

Step 1 – Random Sampling: Residential programs generally use the simple ratio estimator. The reasons for using a simple ratio estimator were the measure for this program is TRM deemed. This means that the savings are subjected to the basic level of rigor that involves only the verification of installations. The only changes to the estimated gross savings in PMRS would be due to clerical errors and installation rates, which were expected to be minor. The resulting realization rate (the ratio of the ex post savings to the ex ante savings) was therefore expected to be very high with a very low variance.

The sample design for the SEP program involved the use of the simple ratio estimator. In Duquesne Light's PY6 Sampling Plan, the annual sample size target for SEP was 53 participants, with a targeted level of precision of 15% at 85% confidence. Table 4-2 below, presents the targeted and achieved (actual) sample sizes for the program. The achieved sample was smaller than expected because participation was much lower than the planned PY6 participation level that was used in the sampling design.

Table 4-2: SEP Sampling Strategy for Program Year 6

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
SEP	289	85%/9.8%	53	31	Telephone Verification
Program Total	**289**	**85%/9.8%**	**53**	**31**	

Step 2 – Measure/Project Qualification: Performed as described in Section 2.2. The evaluation team reviewed and confirmed relevant documentation, using PMRS data and/or other electronic or hardcopy documentation obtained for sampled PMRS records.

1. Participant has a valid utility account number: All sampled participants had active Duquesne Light account numbers (these were found to be validated in PMRS via linkage to the Customer Information System).
2. Measure is on approved list: All sampled project measures were approved measures provided by Duquesne Light in an SEP Energy Efficiency Kit.
3. Rebate payment date is in the current program period being verified. No exceptions.

Step 3 – Participation and Installation Verification: Telephone interviews of each sampled customer confirmed participation in the program and installation of the energy saving measures from the EE Kit. The TRM included deemed savings values and verification surveys confirmed program participation and receipt of subject energy efficiency products (i.e., in the case of EE Kits, these were provided to participants at no cost). Telephone surveys were tailored to the product promotion and included questions designed to verify that participants obtained and installed the EE products from the Kit.

Step 4 – Deemed Savings Verification: The evaluation team first compared kWh and kW savings for the specific measures included within the SEP Kits and reported in PMRS against the 2014 PA TRM to confirm that a valid realization rate would be reported.

Following this first activity in Step 4, the sample realization rate was then calculated using the verified energy and demand savings from telephone interviews for each measure item, or component, within the EE Kit (CFLs, smart strip, LED limelights), similar to the approach used for REEP Kits.

Step 5 – Program Realization Rate: As related in the methodology in Section 2.2, the final step involves multiplying the total gross ex-ante kWh and kW impacts for each record in the PMRS population from which the sample was drawn by the kWh-weighted average realization rate and the kW-weighted average realization rate, respectively, found for sample. The sum of this exercise, the ex-post impacts, are divided by the reported, ex-ante, savings to calculate the program level realization rate.

A realization rate (or ratio estimate) was calculated for the entire SEP sample, which employed a simple random sampling technique. These results are shown in Table 4-3 and Table 4-4.

Table 4-3: Program Year 6 SEP 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 (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
SEP	83	56%	47	0.55	13.9%
Program Total	**83**	**56%**	**47**		**13.9%**

Table 4-4: Program Year 6 SEP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
SEP	0.007	58%	0.004	0.57	14.4%
Program Total	**0.007**	**58%**	**0.004**		**14.4%**

As in past years, no on-site inspections were performed as part of the SEP evaluation.

4.3 IMPACT EVALUATION NET SAVINGS

Although the target for confidence and precision is 85 percent confidence and 15 percent precision at the program level, the Net-to-Gross (NTG) analysis for SEP utilized the same phone surveys as for the gross impact evaluation. The sample size for the phone surveys were increased by targeting a confidence of 90 percent and precision of 10 percent.[16] This is done to properly account for variability that has been found in previous evaluations in NTG data, as compared to the gross impact data.

[16] During planning, the SEP sample targeted 53 surveys for gross impact evaluations and that number was increased to 69 for net impact evaluations. However, program activities were limited in PY6 and only Duquesne Light achieved 7 percent of planned goals for SEP. The program population was smaller than anticipated and only 31 surveys were achieved with the smaller pool of potential respondents.

Table 4-5: SEP Sampling Strategy for Program Year 6 NTG Research

Stratum	Stratum Boundaries	Population Size	Assumed CV or Proportion in Sample Design	Assumed Levels of Confidence & Precision	Target Sample size	Achieved Sample Size	Percent of Sample Frame Contacted[17] to Achieve Sample
SEP	All	289	0.5	90%/9.8%	69	31	88%
Program Total		**289**		**90%/9.8%**	**69**	**31**	**88%**

Navigant's free ridership and spillover research followed the methodologies required by the SWE. Further, this methodology used for PY6 is similar to the approaches used for PY5 and provides a means for a useful comparison between the two years.

Free Ridership

Calculation of the SEP program free ridership follows the same approach outlined for the REEP Kits:

1. The free ridership percentage was estimated for each survey respondent, based on the respondent's answers to a series of key survey questions:
   a. What is likely to have happened if the respondent had not received the kit or seen program materials?
   b. How influential were program education materials in the participant's decision to receive and install kit measures?
   c. How influential was any contact with Duquesne Light staff in the participant's decision to receive and install kit measures?
2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
   a. The influence score was determined based on the maximum influence score of the two influence questions respondents were asked. Participants who reported a maximum influence of 1 (no influence) received an influence score of 50, those who reported a maximum influence of 5 (great influence) were assigned an influence score of 0.
   b. The intention score was determined based on what participants reported would have been likely to happen if they had not received program education materials or the program kit.

Similar to the approach for REEP Kits, Navigant calculated free ridership values for each item received in the kit and the overall free ridership value by weighting measure level free ridership values by the verified gross energy savings for each measure. Table 4-6 shows the free ridership results by measure and for the overall kit. Between PY5 and PY6, the reported savings, used to weight the overall free ridership, changed from 389 kWh to 288 kWh. This shifted the contributions of each component and

[17] Sample frame is a list of contacts that have a chance to be selected into the sample. Percent contacted means of all the sample frame how many were called to get the completes.

placed less emphasis on smart strips where the 2013 PA TRM estimated savings of 184 kWh, and now the 2014 PA TRM estimates savings of 74.5 kWh.

Free ridership increased from 36 percent in PY5 to 42 percent in PY6, essentially staying about the same. The individual component free riderships only shift slightly from PY5 to PY6. CFL free ridership was 49 percent in PY5 and decreased to 47 percent in PY6. Smart strips increased from 25 percent in PY5 to 29 percent in PY6. Finally, the LED Limelight free ridership also increased slightly from 37 percent in PY5 to 40 percent in PY6.

Table 4-6: SEP Free Ridership Results

Kit Items	Savings per Measure Group (kWh)	Average FR
CFLs (two 13W, one 18W, one 23W)	154.2	47%
Smart Strips (one)	74.5	29%
LED Limelight Nightlights (two)	59.0	40%
Total Kit	**287.7**	**42%**

Spillover

Navigant asked SEP participants whether or not they had taken any additional energy saving actions after participating in the Duquesne Light program. If the respondent had made additional energy efficiency improvements as a result of the program, these would be spillover savings. Navigant applied the SWE methodology, as outlined in the REEP spillover section, to SEP survey findings to determine spillover. Navigant also found 64 instances of CFLs being installed by SEP respondents. However, these are excluded from spillover savings and Navigant conservatively assumes that those CFLs are purchased and captured within the Upstream Lighting component. Additional detail about the spillover analysis can be found in the PY6 Residential Process Evaluation Report.

In order to determine a spillover factor for the SEP program Navigant multiplied the savings per participant by the number of PY6 participants. This leads to a total spillover savings for the SEP program which is then divided by the gross verified program energy savings to determine a spillover factor.

Table 4-7: SEP Spillover Factor

	Spillover Savings per Participant (kWh)	Total PY6 Participants	Total Spillover Savings (kWh)	Total Gross Savings (kWh, verified)	Spillover %
SEP Program	55.1	289	15,913	46,543	34%

Navigant calculated the NTG ratio for the SEP program with the following equation in Table 4-8:

(*NTG=1-FR+Spillover*).

Table 4-8: Program Year 6 SEP Summary of Evaluation Results for NTG Research

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
SEP	42%	34%	92%	0.90	23.0%
Program Total[18]	**42%**	**34%**	**92%**		**23.0%**

4.4 PROCESS EVALUATION

The process evaluation for the SEP program group in PY6 included the following activities:

- Review of the 2014 Pennsylvania TRM and program materials
- Surveys with 31 SEP participants sampled randomly from the entire PY6 population between June 29 and July 28, 2015. These surveys included both verification questions and selected process evaluation questions.

The process evaluation participant interviews were conducted in conjunction with the impact telephone verification activities. The same participants drawn for the impact samples were used for the process evaluation.

Table 4-9: SEP Process Evaluation Sampling Strategy for Program Year 6

Target Group or Stratum (if appropriate)	Stratum Boundaries (if appropriate)	Population Size	Assumed Proportion or CV in Sample Design	Assumed Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Percent of Population Frame Contacted to Achieve Sample	Used For Evaluation Activities (Impact, Process, NTG)
SEP	N/A	289	0.5	90%/9.8%	69	31	88%	Impact, Process, NTG
Program Total		**289**		**90%/9.8%**	**69**	**31**	**88%**	

The activities examined the program design, program administration, program implementation and delivery, and market response.

[18] NTG ratio at program level developed using stratum weight and stratum NTG ratios.

The SEP process evaluation findings and details can be found in the Residential Energy Efficiency Programs PY6 Process Evaluation report. Highlights of the process evaluation are summarized below:

- SEP achieved only 7 percent of its PY6 goals and spent only 30 percent of its PY6 budget.
- Free ridership remained about the same in PY6 as it was in PY5, increasing slightly from 36 percent in PY5 to 42 percent in PY6. However, spillover increased from 21 percent to 34 percent over the same period and, as a result, NTG increased slightly from 85 percent to 92 percent.
- The SEP program saw the largest amount of spillover for any program in PY6. This suggests that participants and their children are adopting energy efficiency behaviors as a result of their experiences with the program.
- Similar to REEP Kits, Navigant asked respondents how the SEP program could be improved, if at all. Twelve percent of SEP participants called for different items to be included in the kit.

4.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The SEP program achieved an energy savings realization rate of 56% and the evaluation found a 0.92 NTG ratio. Table 4-10 shows the evaluation's recommendations and additional details can be found in the PY6 Process Evaluation report.

Table 4-10: SEP Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Navigant understands that SEP has been implemented at a significant number of schools throughout Duquesne Light's territory and that repeating implementations at the same schools can risk low realization rates and high free ridership. This is one reason for the low program achievements. Duquesne Light should consider revisiting certain schools where participant students of SEP have "graduated out" of the targeted grades, such as schools that participated when the program first began.	Being Considered
Similar to the recommendation made for REEP, Duquesne Light should consider leveraging the various kits to introduce LEDs to participants. However, the cost effectiveness of such an addition should be reviewed first.	Being Considered

4.6 FINANCIAL REPORTING

SEP is performing below plan levels, achieving only 7% of the PY6 energy savings goal and spending 36% of the targeted budget for the year. A breakdown of the program finances is presented in Table 4-11.

Table 4-11: Summary of SEP Program Finances

Row #	Cost Category	Actual PYTD Costs	Actual Phase II Costs*
		($1,000)	($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 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, 7, 8, 9, 10)	**$176**	**$411**
6	Design & Development	$0	$6
7	Administration, Management, and Technical Assistance[1]	$128	$326
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$25	$37
10	SWE Audit Costs	$23	$42
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)	$176	$410
13	Total NPV Lifetime Energy Benefits	$16	$120
14	Total NPV Lifetime Capacity Benefits	$1	$5
15	Total NPV TRC Benefits[4]	$21	$129
16	TRC Benefit-Cost Ratio[5]	0.12	0.31

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
[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. Total does not match sum of energy and capacity benefits due to the inclusion of avoided incandescent bulb replacement costs included in the total NPV TRC Benefits values. 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.

5 WHOLE HOUSE ENERGY AUDIT PROGRAM (WHEAP)

The Whole House Energy Audit Program (WHEAP) provides in-home audits from energy efficiency experts to participating residential customers. WHEAP is designed to educate customers on energy efficient practices and improvements that can be made to their homes in order to save energy and improve home health and safety. WHEAP audits assess home conditions and historical utility records to identify opportunities for improvements. WHEAP also implements direct install measures including efficient CFLs, electroluminescent night lights, kitchen and bathroom sink faucet aerators (for homes with electric water heat), low flow showerheads (for homes with electric water heat), smart strips, and water heater pipe wrap (for homes with electric water heat).

WHEAP is also designed to provide in-depth recommendations and education to participants so that additional energy savings can be pursued following their audits. Recommendations are provided in the form of one-on-one discussions with the visiting auditor and through formal auditor reports tailored to the specific findings in the given participant's home. The majority of recommendations direct participants to the appropriate REEP Rebates if efficient equipment implementations are deemed appropriate. Recommendations also place emphasis on shell-related measures to improve overall home performance and comfort. Participants may also recieve information on Keystone Home Energy Loan Program (HELP) loans for financial assistance, if needed.

The WHEAP program offers Walkthrough and Comprehensive audits to residential customers. Comprehensive audits are conducted at a discounted rate for market rate (i.e., non-low-income) participants by a Building Performance Institute (BPI) certified auditor who, in addition to directly installing low-cost measures, performs a comprehensive inspection that includes health and safety checks of gas equipment. The program also includes a low income component, offering audits at no charge to income-qualified customers. For the free low income component Comprehensive audits are only performed for homes with electric space and water heating, while Walkthrough audits are done for homes that use gas heating. The Walkthrough audit is conducted by a trained assessor (not necessarily BPI-certified), includes a higher level home inspection, and provides the same types of direct install measures as provided in the Comprehensive audits whenever implementation is appropriate. Both types of audits are provided for free to low-income participants.

5.1 PROGRAM UPDATES

The WHEAP program is a new program with participation first occurring in PY6.

5.1.1 Definition of Participant

A participant for this program is a customer participating in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique participant account number within the tracking system. Participants in Table 5-1 represent a summation of the unique customer participant account numbers in the tracking system for the program in each of the four quarters of PY6. Participants can only participate in the program once in PY6 and the evaluation found no repeating participation.

5.2 IMPACT EVALUATION GROSS SAVINGS

WHEAP did not meet its savings goals for PY6. By the end of program year, program verified savings totaled 31% of the PY6 unverified gross savings goal of 277 MWh. This is mainly because a significant number of participants who were initially identified as market rate customers were determined to below

income customers. Consequently, the savings associated with those customers were transferred away from WHEAP and into LIEEP. Table 5-1 shows WHEAP participation and savings for PY6.

Table 5-1: Phase II WHEAP Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	122	85	0.008	$0
Phase II Total	**122**	**85**	**0.008**	**$0**

Consistent with Duquesne Light's EM&V Plan Section 3.2, the basic level of verification rigor was to be used for TRM deemed savings measures and measures with rebates less than $2,000. According to that plan:

The basic level of verification rigor methods for TRM deemed measures involves two basic tasks:

- Survey a random sample of participants to verify installations and estimate verification rates.
- The claimed ex ante gross kWh and kW impacts for each PMRS record in the population from which the sample was drawn are then multiplied by this verification rate.

The verification used for TRM deemed measures consists of a five-step process described in Section 2.2. The WHEAP program-specific five-step approach and program-specific information are outlined below.

WHEAP Measurement and Verification

Step 1 – Random Sampling: Residential programs generally use the simple ratio estimator. The reason for using a simple ratio estimator is that the vast majority of the measures installed in this program were expected to be TRM deemed. This means that the savings are subjected to the basic level of rigor that involves only the verification of installations. The only changes to the estimated gross savings in PMRS would be due to clerical errors and installation rates, which were expected to be minor. The resulting realization rate (the ratio of the ex post savings to the ex ante savings) was therefore expected to be very high with a very low variance.

For WHEAP, first, two strata were defined: 1) Whole House Small, and 2) Whole House Large. The strata are defined by total savings per project where the Whole House Large stratum includes projects with reported savings of 1,000 kWh or more. This approach was used under the assumption that installation rates and confirmations might vary based on the size of projects and where larger projects may see a more diverse and varied range of installations.

In Duquesne's PY6 Sampling Plan, the annual verification sample size target for WHEAP was 25 – including 12 Whole House Small and 13 Whole House Large participants. A sample was initially developed based on the most current program tracking data. However, later evaluation activities found that a majority of market rate customers were actually low income customers. After reclassifying market rate participants as low income participants the WHEAP population decreased from 338 to 122. As a result, the achieved sample was smaller than expected because participation was much lower than initially anticipated and lower than the level that was used in the sampling design. Table 5-2 , below, presents the targeted and achieved sample sizes for the program.

Table 5-2: WHEAP Sampling Strategy for Program Year 6

Stratum	Population Size[19]	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Whole House Small	89	85%/20.9%	12	11	Telephone Verification
Whole House Large	33	85%/16.9%	13	6	Telephone Verification
Program Total	**122**	**85%/12.8%**	**25**	**17**	

Step 2 – Measure/Project Qualification: The evaluation team reviewed and confirmed relevant documentation, using PMRS data and/or other electronic or hardcopy documentation obtained for sampled PMRS records.

1. Participant has a valid utility account number: All sampled participants had active Duquesne Light account numbers (these were found to be validated in PMRS via linkage to the Customer Information System (i.e., CSP)).
2. Measure is on approved list: All sampled project measures were confirmed to be included in the list of direct install measures offered by Duquesne Light for direct installation during in-home audits.
3. Audit date is in the current program period being verified. No exceptions were noted.

The evaluation team also reviewed CSP documentation against PMRS to confirm the appropriate classification of participants as market rate or low income. The CSPs in-take and screening process was approved by the utility and confirmed whether customers were income eligible or not. However, the classification as low income was not always reflected in PMRS. Where necessary, adjustments were made to shift certain participants and associated reported savings from WHEAP to LIEEP WHEAP.

Step 3 – Participation and Installation Verification: Telephone interviews of each sampled customer confirmed participation in the program, receipt of an audit, and the installation of any energy saving measure(s) directly installed by the in-home auditor. If the TRM included deemed savings values and/or protocols incorporating in-service rates (ISR), verification surveys confirmed program participation and and the implementation of the direct installed equipment (i.e., that the in-home auditor installed the given item and they remained in use). Telephone surveys were identical between the two strata. The types of measures and quantities directly installed by the in-home auditors varied and were unique to each participant. Therefore, the survey questions to verify installations targeted the specific direct install measures implemented in each participant's home.

Step 4 – Deemed Savings Verification: The evaluation team first compared kWh and kW savings for specific measures in PMRS installed through the audits against estimates based on the 2014 PA TRM to confirm that a valid realization rate would be reported.

Savings for the measures listed in PMRS were reviewed to ensure consistency with deemed values and algorithms from the 2014 PA TRM. Where necessary, adjustments were made and updated values became

[19] The initial review of program tracking data found 338 WHEAP participants, with 260 participants classified as WHEAP Small and 78 as WHEAP Large. Evaluation activities later confirmed that several WHEAP participants were actually low income and they were transferred to LIEEP WHEAP. The population total was revised to 122 (89 Small, 33 Large).

the reported values. Reviews were completed for the full range of measures within PMRS similar to the reviews completed for REEP measures and described in Section 2.2.

Following this first activity in Step 4, the program realization rate was then calculated using the verified energy and demand savings from telephone interviews for both WHEAP statra, as summarized below:

A realization rate (or ratio estimate) was calculated for each WHEAP stratum, each of which employed a simple random sampling technique. Final realization rates and relative precision at the program level (which aggregate the strata) were calculated using the stratified ratio estimation approach, following the method outlined in Lohr (1999).[20] Aggregation of the variance of each stratum (calculated depending on the assumed distribution type) is also calculated per Lohr (1999).

Step 5 – Program Realization Rate: The final step involves multiplying the total gross ex-ante kWh and kW impacts for each record in the PMRS population from which the sample was drawn by the kWh-weighted average realization rate and the kW-weighted average realization rate, respectively, found for the appropriate stratum. The sum of this exercise, the ex-post impacts, are divided by the reported, ex-ante, savings to calculate the program level realization rate.

As WHEAP is a direct install program, the majority of installations were confirmed through the telephone surveys. The result is a low relative precision percentage, meaning the findings are quite precise. These results are shown in Table 5-3 and Table 5-4.

Table 5-3: Program Year 6 WHEAP 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 (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Whole House Small	42	94%	39	0.23	10.3%
Whole House Large	43	98%	42	0.04	2.5%
Program Total	**85**	**96%**	**82**		**4.9%**

[20] Lohr, Sharon. *Sampling: Design and Analysis*. Pacific Grove, CA: Duxbury Press, 1999, 69-101.

Table 5-4: Program Year 6 WHEAP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Whole House Small	0.004	94%	0.004	0.23	10.3%
Whole House Large	0.004	100%	0.004	0.00	0.0%
Program Total	**0.008**	**97%**	**0.008**		**4.8%**

Realization rates at or close to 100% are typical for direct install programs because installations are completed and confirmed by trained installers instead of by the participants. The evaluation found realization rates slightly lower than 100%. For the Whole House Small stratum, one participant reported that the auditor installed 5 CFLs instead of the 14 reported in the program tracking system. Also, one Whole House Large participant reported that 4 electroluminescent night lights recorded in the tracking system were not installed by the auditor. Finally, another Whole House Large participant decided to remove two night lights claiming they were not bright enough. These findings contributed to the program's realization rate.

5.3 IMPACT EVALUATION NET SAVINGS

Although the target for confidence and precision is confidence of 85 percent and precision of 15 percent at the program level, the Net-to-Gross (NTG) analysis for WHEAP utilized the same phone surveys as for the gross impact evaluation. The sample size for the phone surveys was increased by targeting a confidence of 90 percent and precision of 10 percent. This is done to properly account for variability that has been found in previous evaluations in NTG data, as compared to the gross impact data.

Table 5-5: WHEAP Sampling Strategy for Program Year 6 NTG Research

Stratum	Stratum Boundaries	Population Size[21]	Assumed CV or Proportion in Sample Design	Assumed Levels of Confidence & Precision	Target Sample size	Achieved Sample Size	Percent of Sample Frame Contacted[22] to Achieve Sample
Whole House Small	All	89	0.5	90%/12.4%	31	11	85%
Whole House Large	All	33	0.5	90%/5.6%	29	6	97%
Program Total		**122**		**90%/6.4%**	**60**	**17**	**89%**

[21] The initial review of program tracking data found 338 WHEAP participants, with 260 participants classified as WHEAP Small and 78 as WHEAP Large. Evaluation activities later confirmed that several WHEAP participants were actually low income and they were transferred to LIEEP WHEAP. The population total was revised to 122 (89 Small, 33 Large).

[22] Sample frame is a list of contacts that have a chance to be selected into the sample. Percent contacted means of all the sample frame how many were called to get the completes.

Free Ridership

The free ridership ratios for each WHEAP stratum were determined by evaluating participant's responses to several questions relating to their motivation for participating in the programs. Free ridership rates were targeted at the measure level and dependent on the mix of direct install measures received through the participant's audit. The steps to evaluate the free ridership in the program are similar to the approaches taken for other residential programs such as REEP Rebates, REEP Kits, and SEP. The two WHEAP strata used the same survey instrument, and the estimation followed the protocols outlined by the SWE Guidance Memorandum GM-024 ("Common Approach for Measuring Free-riders for Downstream Programs").

Calculation of WHEAP free ridership followed the same approach outlined for the REEP Kits:

1. The free ridership percentage was estimated for each survey respondent, based on the respondent's answers to a series of key survey questions:
    - What is likely to have happened if the respondent had not signed up for an audit or seen program advertisements?
    - How influential were the auditor, audit report, and the fact that the direct install measures were provided at no cost in the participant's decision to accept the audit and have the measures installed?
2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
    - The influence score was determined based on the maximum influence score of the four influence questions respondents were asked. Participants who reported a maximum influence of 1 (no influence) received an influence score of 50, those who reported a maximum influence of 5 (great influence) were assigned an influence score of 0.

The intention score was determined based on what participants reported would have been likely to happen if they had not received the audit and had the direct install measures implemented.

Similar to the approach for REEP and SEP Kits, Navigant calculated free ridership values for each item received through the audit and the overall free ridership value by weighting measure level free ridership values by the verified gross energy savings for each measure. Table 5-6 shows the free ridership results by measure and by strata for the program.

Table 5-6: WHEAP Free Ridership Results

Stratum	Measure	Sample, n (participants with given measure)	Average FR
Large	CFLs	6	13%
	Night Lights	0	N/A
	Aerators	0	N/A
	Showerheads	1	0%
	Smart Strips	2	0%
	Pipe Wrap	1	0%
	Total Audits	**6**	**12%**
Small	CFLs	10	46%
	Night Lights	3	50%
	Aerators	0	N/A
	Showerheads	0	N/A
	Smart Strips	4	43%
	Pipe Wrap	0	N/A
	Total Audits	**11**	**46%**
Total		**17**	**28%**

Spillover

Similar to free ridership, the WHEAP spillover estimation followed the spillover approach deployed for each of the previously mention residential programs. The methodology for estimating spillover savings is based on the approach outlined by the SWE Guidance Memorandum GM-025.

Additional details on the spillover estimation approach and results can be found in the Residential Energy Efficiency Programs PY6 Process Evaluation report.

The NTG ratio for the program is determined as follows:

NTG = 1-FR+Spillover

Table 5-7 summarizes the NTG ratio for the WHEAP program. The free ridership for the Whole House Small stratum is significantly higher than the estimate found for Whole House Large. This is mainly related to CFLs where the evaluation found that 5 of the 11 Small stratum respondents would have installed the same number and type of CFLs at the same time or at least within six months if the program had not been available to them. However, this is somewhat balanced by a higher spillover rate found among the Small stratum. Within that stratum, the evaluation identified six instances of spillover activity ranging from adding insulation to installing major energy efficiency appliances.

Table 5-7: Program Year 6 WHEAP Summary of Evaluation Results for NTG Research

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
Whole House Small	46%	19%	74%	0.57	24.9%
Whole House Large	12%	7%	95%	0.25	15.5%
Program Total	**28%**	**13%**	**84%**		**13.1%**

5.4 PROCESS EVALUATION

The process evaluation for the WHEAP program in PY6 included the following activities:

- Review of the 2014 Pennsylvania TRM and program materials
- Interviews with Duquesne Light program staff
- In-depth interviews with the WHEAP implementer (CSP), a sub-contractor to the CSP who supports administration and implementation (sub-CSP), and two WHEAP auditors/assessors who conduct in-home inspections
- Surveys with 11 Whole House Small and 6 Whole House Large participants sampled randomly from the entire PY6 population for each stratum between August and September of 2015. These surveys were conducted in conjunction with the impact telephone verification activities. The same participants drawn for the impact samples were used for the process evaluation.

Table 5-8: WHEAP Sampling Strategy for Process Evaluation for Program Year 6

Target Group or Stratum (if appropriate)	Stratum Boundaries (if appropriate)	Population Size[23]	Assumed Proportion or CV in Sample Design	Assumed Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Percent of Population Frame Contacted to Achieve Sample	Used For Evaluation Activities (Impact, Process, NTG)
Whole House Small	N/A	89	0.5	90%/12.4%	31	11	85%	Impact, Process, NTG
Whole House Large	N/A	33	0.5	90%/5.6%	29	6	97%	Impact, Process, NTG
Program Total		**122**		**90%/6.4%**	**60**	**17**	**89%**	

The process evaluation activities examined the program design, program administration, program implementation and delivery, and market response.

The process evaluation findings and details can be found in the Residential Energy Efficiency Programs PY6 Process Evaluation report. Highlights of the process evaluation are summarized below:

- WHEAP achieved only 31% of its internal PY6 energy savings compliance target. This was due, in large part to having a significant number of participants originally thought to be market rate participants reclassified as low income. Initially the utility reported that about 92% of audits were market rate. However, the evaluation confirmed that only 33% were market rate. Also, costs for WHEAP were

[23] The initial review of program tracking data found 338 WHEAP participants, with 260 participants classified as WHEAP Small and 78 as WHEAP Large. Evaluation activities later confirmed that several WHEAP participants were actually low income and they were transferred to LIEEP WHEAP. The population total was revised to 122 (89 Small, 33 Large).

above the budgeted amount for PY6, with expenditures at 140% of the budget in this, the program's first year of implementation.

- WHEAP provides benefits to Duquesne Light customers that go beyond the savings reported for the program, and many of these originate from the highly trained auditors and assessors who conduct the in-home audits. WHEAP participants also receive many direct benefits from the program that result in improvements for energy consumption, health and safety, and comfort. These are accomplished during the home's physical inspection.
- Actions from auditors and assessors are likely resulting in some level of additional energy savings that are not being claimed by the program. These include corrective actions to home conditions or behaviors made/suggested by the auditor. Examples of sub-optimal operations resulting in corrective actions or recommendations by the auditor include running air conditioning with windows and doors open, and running a dehumidifier constantly rather than intermittently in a crawlspace to mitigate mold issues.
- The auditors for the program are BPI certified and one auditor is even a BPI trainer. These highly skilled technicians are capable of producing additional savings through their audits and through their interactions with participants by influencing actions and behavioral changes among customers.
- The program provides information on Keystone HELP (loan program) to market rate and low income participants in case they decide to pursue energy efficiency improvements and need financial support. The current rates for Keystone HELP range from 2.99 percent up to 14.99 percent for various loan types, and the rate for single Energy Star measures is 8.99 percent. However, more attractive financing alternatives exist and it is not likely that Keystone HELP loans are being pursued by participants. For example, home equity lines of credit (HELOCs) are around 4 percent (as of September 28, 2015).
- The WHEAP program recommends REEP rebates to participants who the auditors feel could benefit from making qualifying purchases. However, there is no follow up or tracking to understand what recommended REEP rebates are implemented by participants.
- Bill inserts are an effective means of outreach for this program. The evaluators observed the direct results of bill inserts for WHEAP. Based on feedback from the evaluation's in-depth interviews, bill inserts were deployed twice for WHEAP, in September 2014 and January 2015. The month following those bill inserts saw, on average, over a 60 percent increase in participation with significant participation in the second month as well. The CSPs corroborated this and reported that the program directly benefits from Duquesne Light market efforts.
- CFLs compose roughly 92 percent of WHEAP savings and those CFLs are non-dimming. The program currently excludes LEDs. An auditor interviewed as part of the in-depth interviews estimated that current year installation rates could increase by roughly 25 percent if dimmable CFLs are included in the direct install measure mix.
- For the low income portion of WHEAP the CSP initially pursued whole house (non-direct install) measures for audits conducted in all electric homes. This involved passing audit recommendations to a contractor who then developed a project budget and work plan for completing various measures. These included adding insulation, sealing air leaks, and upgrading appliances and equipment. Several estimates were sent to Duquesne Light for approval, but the costs for these projects were quite high relative to the total program budget, and the utility did not want to exhaust its budget primarily on a few very high cost projects rather than reaching significantly more customers. Consequently, these projects were not approved for implementation. The CSP indicated that in some instances this created dissatisfaction for the homeowners and the contractors submitting the bids who had anticipated improvements being implemented. Unfortunately, without notifying the utility, the CSP discontinued seeking contractor bids for non-direct install measures altogether.

- The evaluator team understands from the CSP that savings are likely being left on the table for direct install measures. Specifically, reported savings for CFLs may not reflect actual savings. For example, the 2014 TRM specifies that savings for a 13W CFL are based on a post-EISA 2007 baseline lamp wattage of 43W. The resulting savings are 32 kWh. However, as a direct install program, the installing WHEAP auditors and assessors can confirm the existing baseline wattage. The CSPs reported that in several cases the program removed existing 60W incandescents, not 43W lamps, and replaced them with 13W CFLs. The resulting savings would be 50 kWh, but the program is only claiming 32 kWh.
- A review of Duquesne Light and CSP tracking data found discrepancies between the count of low income and market rate WHEAP participants. Through additional investigation, it was found that the CSP used an utility-approved methodology to identify customers who are low income. However, these designations were not incorporated into the Duquesne Light tracking system, due to issues with the tracking system interface which the utility plans to remedy for Phase III.
- Surveyed participants provided recommendations on ways to improve the WHEAP program. One respondent asked for a list of contractors to contact for the recommended improvements.

5.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The WHEAP program achieved an energy savings realization rate of 96% and the evaluation found a 0.84 NTG ratio. Table 5-9 shows the evaluation's recommendations and additional details can be found in the PY6 Process Evaluation report.

Table 5-9: WHEAP Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne Light should track the implementation rate for REEP rebates that are recommended though WHEAP. Understanding the implementation rate will provide feedback on the effectiveness of the program as a gateway to other programs. Further, such tracking could be used to focus marketing and outreach resources on the most effective areas (i.e., should the utility invest more in marketing/promotions or the WHEAP program itself?). Should the program continue in Phase III it might be helpful to include a check box on the REEP rebate form that would indicate whether the item was purchased based on a WHEAP auditor recommendation.	Being Considered
Duquesne Light should continue to use the bill insert marketing channel strategically (there are only so many bill insert opportunities). It appears to be quite effective in garnering participation for the Whole House program in particular.	Being Considered
Duquesne Light should consider including dimmable CFLs in the program, and possibly exposing customers to LEDs. However, the cost effectiveness of such changes should be reviewed carefully before proceeding.	Being Considered
In PY7, Duquesne Light should make clear to the program CSP that whole house measures are acceptable within reason and even consider directing the CSP to attempt to return to some of the early participants for whom any reasonably priced whole house measures were recommended. A benefit/cost analysis of including more comprehensive measures should be assessed first.	Being Considered
Duquesne Light should take steps to ensure that all projects and related savings originating from the program CSP are accounted for in program tracking databases properly with regard to low-income status.	Being Considered

5.6 FINANCIAL REPORTING

WHEAP is performing below plan projections. The program achieved only 38% of its energy savings goals in PY6. The program also exceeded its PY6 budget by 44%. These savings results are due in part to the transfer of the majority of participants and their associated savings from WHEAP to LIEEP WHEAP. The expenditures over budget are due in part to WHEAP being a new program where start up costs have been higher than anticipated. A breakdown of the program finances is presented in Table 5-10.

Table 5-10: Summary of WHEAP Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$9**	**$9**
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)	$9	$9
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$367**	**$367**
6	Design & Development	$0	$0
7	Administration, Management, and Technical Assistance[1]	$350	$350
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$10	$10
10	SWE Audit Costs	$7	$7
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)	$376	$376
13	Total NPV Lifetime Energy Benefits	$28	$28
14	Total NPV Lifetime Capacity Benefits	$2	$2
15	Total NPV TRC Benefits[4]	$29	$29
16	TRC Benefit-Cost Ratio[5]	0.08	0.08

NOTES

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.

6 LOW INCOME ENERGY EFFICIENCY PROGRAM (LIEEP)

The Low-Income Energy Efficiency Program (LIEEP) is designed as an income-qualified program providing services to assist low-income households to conserve energy and reduce electricity costs. The objective of this program is to increase qualifying customers' comfort while reducing their energy consumption, costs, and economic burden.

In PY6, the LIEEP savings by income qualifying customers were delivered by the other Residential programs – the Residential Energy Efficiency Program (REEP), School Energy Pledge (SEP) Program, and the Residential Appliance Recycling Program (RARP) – and through the Public Agency/Non-profit programs which included refrigerator replacements for low-income households and smart strip installations performed by the Low Income Usage Reduction Program (LIURP) during in-home audits. The Whole House Energy Audit Program (WHEAP) also introduced income qualifying customer measures and delivered savings to LIEEP in PY6.

Additionally, a portion of the Upstream Lighting program savings is allocated to the Low Income sector based on the findings from the PY6 general population survey. This survey determined that 4.9% of CFL and 2.3% of LED bulbs purchased were installed in Low Income households.

6.1 PROGRAM UPDATES

Similar to WHEAP for market rate, the low income WHEAP component became active during PY6. WHEAP offers income eligible customers whole home audits free of charge where auditors and assessors conduct examinations of home characteristics and offer recommendations to improve energy consumption and comfort. Additionally, WHEAP offers the low income participants direct install measures at no charge which contribute to LIEEP savings. Direct install measures include CFLs, electroluminescent night lights, smart strips and, for homes with electric water heating, kitchen and bathroom sink faucet aerators, low flow showerheads, and water heater pipe wrap.

6.1.1 Definition of Participant

A participant for this program is a customer participating in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique participant account number within the tracking system. Participants in Table 6-1 represent a summation of the unique customer participant account numbers in the tracking system for the program in each of the four quarters of PY6. Customers participating more than once within a quarter are counted once; customers participating more than once but in different quarters are counted more than once (once in each quarter).

6.2 IMPACT EVALUATION GROSS SAVINGS

The Low Income Energy Efficiency Program is not exceeding its goals for PY6. By the end of PY6, Duquesne Light reported savings totaling 56% of its PY6 unverified gross savings goal of 4,151 MWh. However, Duquesne Light is currently tracking above Phase II goals since PY5 annual gross savings exceed goals by 308%. Table 6-1 shows LIEEP participation, savings and incentives for PY5.

Table 6-1: Phase II LIEEP Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	7,592	15,395	1.062	$537
Phase II Total	**7,592**	**15,395**	**1.062**	**$537**

Consistent with Duquesne Light's EM&V Plan Section 3.2, the basic level of verification rigor was to be used for TRM deemed savings measures and measures with rebates less than $2,000. According to that plan:

The basic level of verification rigor methods for TRM deemed measures involves two basic tasks:

- Survey a random sample of participants to verify installations and estimate verification rates.
- The claimed ex ante gross kWh and kW impacts for each PMRS record in the population from which the sample was drawn are then multiplied by this verification rate.

The verification used for TRM deemed measures consists of a five-step process described in Section 2.2. LIEEP program-specific variances from the five-step approach and program-specific information are outlined below.

LIEEP Measurement and Verification

Step 1 – Random Sampling: Residential programs generally use the simple ratio estimator. The reason for using a simple ratio estimator is that the vast majority of the measures installed in this program were expected to be TRM deemed. This means that the savings are subjected to the basic level of rigor that involves only the verification of installations. The only changes to the estimated gross savings in PMRS would be due to clerical errors and installation rates, which were expected to be minor. The resulting realization rate (the ratio of the ex post savings to the ex ante savings) was therefore expected to be very high with a very low variance.

For LIEEP seven strata were defined: REEP Rebates (non-kits), REEP Kits, RARP, SEP, WHEAP, Refrigerator Replacment, Smart Strips. This approach was used under the assumption that the implementation/installation rate for each of these strata could be quite different.

Upstream Lighting participants were not included in the sample design. Verification for the Upstream Lighting program comprised a detailed comparison of the program CSP invoices to the values shown in the Duquesne Light database, i.e., verification of a census of the records. The percentage of upstream lighting bulbs sold to low income customers was determined to be 4.9% for CFLs and 2.3% for LEDs through a general population telephone survey, and the associated levels of savings and incentive costs were allocated to LIEEP.

Refrigerator replacements and direct install smart strip installations were also included in the PY6 evaluation activities. These were previously excluded in PY5 due to their small contribution to overall program savings. The PY6 LIEEP evaluation also included WHEAP direct install measures which were introduced in PY6. Similar to the approach and assumptions made for the other LIEEP components, these

components were examined in their own stratum under the assumption that installation rates would differ from some of the other LIEEP components.

In Duquesne's PY6 Sampling Plan, the annual sample size target for LIEEP was 77 – including 5 Kit participants, 13 RARP participants, 18 SEP participants, 29 WHEAP participants, 10 Refrigerator Replacement participants, and 7 Smart Strip participants – with a targeted level of confidence and precision of 15% at 85% confidence.[24] The PY6 LIEEP evaluation excludes Rebates. Rebates contributed very little to overall program savings. However, those measures reported within PMRS were reviewed against the 2014 TRM to confirm deemed values were referenced correctly. Table 6-2 below, presents the targeted and achieved sample sizes for the program.

Table 6-2: LIEEP Sampling Strategy for Program Year 6

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Kits	510	85%/39.4%	5	7	Telephone Verification
RARP	218	85%/20.9%	13	14	Telephone Verification
Rebates	51	N/A	N/A	N/A	Excluded
Refrigerator Replacement	402	85%/24.4%	10	12	Telephone Verification
SEP	52	85%/17.5%	18	6	Telephone Verification
Smart Strip	717	85%/31.1%	7	8	Telephone Verification
Whole House	245	85%/14.3%	29	35	Telephone Verification
Upstream Lighting	N/A	N/A	N/A	N/A	Database Verification
Program Total	**2,195**	**85%/15%**	**82**	**82**	

Step 2 – Measure/Project Qualification: The evaluation team reviewed and confirmed relevant documentation, using PMRS data and/or other electronic or hardcopy documentation obtained for sampled PMRS records.

4. Participant has a valid utility account number: All sampled participants had active Duquesne Light account numbers (these were found to be validated in PMRS via linkage to the Customer Information System (i.e., CSP)).
5. Measure is on approved list: All sampled project measures were confirmed to be either listed in Duquesne Light's residential rebate catalog containing approved measures or provided by Duquesne Light in a community outreach energy efficiency kit.
6. Rebate payment date is in the current program period being verified. No exceptions.

[24] The target verification sample size of 77 was thought sufficient to achieve the 85%/15% confidence and precision requirement for the program. However, because the same telephone surveys were used for net-to-gross and process evaluation purposes, assumed to have higher variation in responses, the actual sample sizes were increased to a total of 97.

Step 3 – Participation and Installation Verification: Telephone interviews of each sampled customer confirmed participation in the program, receipt of a Rebate or EE/SEP Kit, removal of an appliance, and/or the installation of any energy saving measure(s) depending on the component under examination. If the TRM included deemed savings values and/or protocols incorporating in-service rates (ISR), verification surveys confirmed program participation and participant purchase or otherwise receipt of subject energy efficiency products (i.e., in the case of EE Kits provided to participants at no cost). Telephone surveys were identical to the surveys used for the market rate programs (REEP, RARP, SEP, WHEAP) and included questions designed to verify that participants obtained and installed the EE products. Refrigerator replacements and direct install Smart Strips are unique to LIEEP. However, those surveys were designed with approaches and structures similar to the other LIEEP component surveys.

In the case of LIEEP RARP, similar to RARP, the telephone survey confirmed retirements. For recycled appliances that were replaced, the installation verification confirmed if new units were ENERGY STAR or non-ENERGY STAR.

For the Upstream Lighting program component, the program administrator's invoices and related detailed documentation were reviewed to ensure that measure counts and reported savings were both accurate (per the TRM) and the same as what the utility's tracking system was reporting. Since this activity included detailed review of all documentation it also covered the bulbs purchased by low income customers.

Step 4 – Deemed Savings Verification: The evaluation team first compared kWh and kW savings for specific measures in PMRS for LIEEP components against estimates based on the 2014 PA TRM to confirm that a valid realization rate would be reported.

Savings for the measures listed in PMRS were reviewed to ensure consistency with deemed values and algorithms from the 2014 PA TRM. Where necessary, adjustments were made and updated values became the reported values. Reviews were completed for the full range of measures within PMRS similar to the reviews completed for REEP measures and described in Section 2.2.

Following this first activity in Step 4, the program realization rate was then calculated using the verified energy and demand savings from telephone interviews for all of the LIEEP components, as summarized below:

A realization rate (or ratio estimate) was calculated for each LIEEP stratum, each of which employed a simple random sampling technique. Final realization rates and relative precision at the program group level (which aggregate the strata) were calculated using the stratified ratio estimation approach, following the method outlined in Lohr (1999).[25] Aggregation of the variance of each stratum (calculated depending on the assumed distribution type) is also calculated per Lohr (1999).

Note that, per Duquesne's approved EM&V Plan, no customer-based verification efforts were required to estimate in-service/installation rate for the Upstream Lighting program component of LIEEP. Verification efforts consisted only of confirming that energy and demand savings reported in Duquesne Light's PMRS (tracking system) could be documented based on invoicing details provided by the program implementation contractor, ECOVA, with respect to numbers of units, wattages and savings claims. The 4.9% CFL and 2.3% LED low income sector lamp allocations determined from the PY6 analysis activities are then applied to the Upstream Lighting results to arrive at the LIEEP Upstream

[25] Lohr, Sharon. *Sampling: Design and Analysis*. Pacific Grove, CA: Duxbury Press, 1999, 69-101.

Lighting verified impacts. As a result of using this approach, a verification of every database line item (a census approach) was conducted for LIEEP Upstream Lighting, resulting in effectively zero *sampling uncertainty*[26] for this stratum.

Step 5 – Program Realization Rate: The final step involves multiplying the total gross ex-ante kWh and kW impacts for each record in the PMRS population from which the sample was drawn by the kWh-weighted average realization rate and the kW-weighted average realization rate, respectively, found for the appropriate stratum. The sum of this exercise, the ex-post impacts, are divided by the reported, ex-ante, savings to calculate the program level realization rate.

As LIEEP Upstream Lighting accounts for a large fraction of total LIEEP savings, the result of this approach is such that the relative precision value calculated for the program group was found to be very low (i.e., very precise). These results are shown in Table 6-3 and Table 6-4.

Table 6-3: Program Year 6 LIEEP 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 (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Kits	137	90%	123	0.17	10.3%
RARP	200	100%	200	0.00	0.0%
Rebates[27]	8	79%	6	0.93	16.7%
Refrigerator Replacement	305	100%	305	0.00	0.0%
SEP	15	57%	9	0.74	48.2%
Smart Strip	55	88%	48	0.73	41.2%
Whole House	167	91%	152	0.39	9.1%
Upstream Lighting	1,442	100%	1,449	0.00	0.0%
Program Total	**2,330**	**98%**	**2,293**		**1.1%**

[26] Of course, other sources of uncertainty exist beyond *sampling* uncertainty. For instance, uncertainty of actual savings for each CFL or LED exists due to variance in operating hours, assumed baseline wattage, etc. As the approved evaluation technique used *deemed* values for CFL and LED savings, however, that uncertainty is not reflected in the reported relative precision for these measures.

[27] The REEP rebate realization rate is used as a proxy to the LIEEP rebate realization rate as a result of being unable to survey any LIEEP rebate customers. This is expected to be a good approximation based on previous years evaluation results.

Table 6-4: Program Year 6 LIEEP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Kits	0.012	93%	0.011	0.21	13.0%
RARP	0.027	100%	0.027	0.00	0.0%
Rebates	0.004	64%	0.003	1.02	20.8%
Refrigerator Replacement	0.042	100%	0.042	0.00	0.0%
SEP	0.001	61%	0.001	0.80	52.2%
Smart Strip	0.007	88%	0.006	0.73	41.2%
Whole House	0.017	91%	0.015	0.40	9.1%
Upstream Lighting	0.134	107%	0.144	0.00	0.0%
Program Total	**0.244**	**102%**	**0.249**		**1.2%**

The lower realization rates reported for the SEP component of the LIEEP program result from participants having not installed some or all of the CFLs (3 of 3 participants), smart strips (2 of 4 participants) or any LED nightlights (2 of 4 participants). The participants not installing CFLs indicated they were waiting for existing lamps to burnout before replacing. Conversely, LIEEP REEP Kits experienced a higher realization rate and installation rate. In general, this is attributed to participants installing nearly all of the items provided in kits.

Similar to RARP, the LIEEP RARP verification effort confirmed that appliances were recycled. Realization rates are 100% and confirm that all units were recycled as reported.

6.3 IMPACT EVALUATION NET SAVINGS

The sample for net impact evaluation relied on the same surveys which were used for gross savings evaluation.

Table 6-5: LIEEP Sampling Strategy for Program Year 6 NTG Research

Stratum	Stratum Boundaries	Population Size	Assumed CV or Proportion in Sample Design	Assumed Levels of Confidence & Precision	Target Sample size	Achieved Sample Size	Percent of Sample Frame Contacted[28] to Achieve Sample
Kits	All	510	0.5	90%/36.2%	7	7	43%
RARP	All	218	0.5	90%/18.2%	21	14	87%
Rebates	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Refrigerator Replacement	All	402	0.5	90%/25.3%	12	12	84%
SEP	All	52	0.5	90%/19.1%	20	6	87%
Smart Strip	All	717	0.5	90%/33.4%	8	8	98%
Whole House	All	245	0.5	90%/9.8%	29	35	99%
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Program Total		**2,195**		**90%/10%**	**97**	**82**	**88%**

Free Ridership

The free ridership ratios for each LIEEP component were determined by evaluating participant responses to several questions relating to their motivation for participating in the programs. The steps to evaluate the free ridership in individual programs are the same as presented in the sections for each of the market rate program counterparts. The LIEEP components used the same survey instrument as the previously mentioned residential programs and targeted low income participants. Specifically, the estimation followed the protocols outlined by the SWE Guidance Memorandum GM-024 ("Common Approach for Measuring Free-riders for Downstream Programs"). Free ridership for the LIEEP Upstream Lighting program component participants relied on the same analysis conducted as part PY6 analysis for market rate Upstream Lighting.

Spillover

Similar to free ridership, the LIEEP spillover estimation duplicated the spillover approach deployed for each of the previously mention programs. The methodology for estimating spillover savings is based on the approach outlined by the SWE Guidance Memorandum GM-025.

Additional details on the spillover estimation approach and results can be found in the Residential Energy Efficiency Programs PY6 Process Evaluation report.

The NTG ratio for the program component is determined as follows:

NTG = 1-FR+Spillover

[28] Sample frame is a list of contacts that have a chance to be selected into the sample. Percent contacted means of all the sample frame how many were called to get the completes.

Table 6-6 summarizes the NTG ratio for the LIEEP program. The free ridership for the LIEEP program is significantly impacted by the high free ridership reported for the Upstream Lighting program component which represents the highest savings.

Table 6-6: Program Year 6 LIEEP Summary of Evaluation Results for NTG Research

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
Kits	25%	23%	98%	0.54	33.3%
RARP	55%	6%	51%	0.96	38.1%
Rebates[29]	73%	24%	51%	1.56	29.3%
Refrigerator Replacement	0%	1%	101%	0.04	1.9%
SEP	26%	27%	101%	0.47	35.5%
Smart Strip	23%	29%	105%	0.84	58.1%
Whole House	16%	1%	85%	0.30	7.0%
Upstream Lighting	54%	24%	69%	0.00	7.4%
Program Total	**42%**	**18%**	**76%**		**5.6%**

6.4 PROCESS EVALUATION

The process evaluation for the LIEEP program group in PY6 included the following activities:

- Review of the 2014 Pennsylvania TRM and program materials
- In-depth interviews with the WHEAP implementer (CSP) and WHEAP auditors/assessors who conduct in-home inspections
- Surveys with 7 REEP Kit participants, 14 RARP participants, 6 SEP participants, 35 WHEAP participants, 12 Refrigerator Replacement participants, and 8 Smart Strip participants sampled randomly from the entire PY6 population for each program segment between April and September of 2015. This group of 82 surveys included verification, net-to-gross and selected process evaluation questions. Survey instruments used for the similar non-low-income programs previously described were also used for LIEEP program components. While the Refrigerator Replacements and Direct Install Smart Strip components are unique to LIEEP, similarly, those survey instruments leverage the structures and approaches developed for the non-low-income programs.

[29] REEP rebate customer free ridership and spillover is used as a proxy to LIEEP rebate customer free ridership and spillover as a result of being unable to survey any LIEEP rebate customers. This is expected to be a good approximation based on previous years evaluation results.

Table 6-7: LIEEP Sampling Strategy for Program Year 6

Target Group or Stratum (if appropriate)	Stratum Boundaries (if appropriate)	Population Size	Assumed Proportion or CV in Sample Design	Assumed Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Percent of Population Frame Contacted to Achieve Sample	Used For Evaluation Activities (Impact, Process, NTG)
Kits	N/A	510	0.5	90%/36.2%	7	7	43%	Impact, Process, NTG
RARP	N/A	218	0.5	90%/18.2%	21	14	87%	Impact, Process, NTG
Rebates	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Impact, Process, NTG
Refrigerator Replacement	N/A	402	0.5	90%/25.3%	12	12	84%	Impact, Process, NTG
SEP	N/A	52	0.5	90%/19.1%	20	6	87%	Impact, Process, NTG
Smart Strip	N/A	717	0.5	90%/33.4%	8	8	98%	Impact, Process, NTG
Whole House	N/A	245	0.5	90%/9.8%	29	35	99%	Impact, Process, NTG
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Impact, Process, NTG
Program Total		**2,195**		**90%/10%**	**97**	**82**	**88%**	

The process evaluation activities examined the program design, program administration, program implementation and delivery, and market response. These activities occurred simultaneous to the market rate components for REEP, RARP, SEP, and WHEAP and included the Refrigerator Replacements and Smart Strips components.

The process evaluation findings and details can be found in the Residential Energy Efficiency Programs PY6 Process Evaluation report, and the findings highlighted in the REEP, RARP, SEP, and WHEAP sections are applicable to the low income components of those programs. Highlights of the process evaluation are summarized below:

- LIEEP WHEAP provides value to Duquesne Light customers. These benefits go beyond the savings reported for the program, and many of these originate from the highly trained auditors and assessors who conduct the in-home audits. Additionally, some of these are unique initiatives taken on by the individual auditors and assessors who draw from their own expertise and experiences. For example, one assessor provides low income participants recommendations and contact information for various community agencies and programs that offer assistance and benefits (e.g., bill payment assistance).
- The LIEEP WHEAP CSPs generally do not promote Keystone HELP to market rate or low income participants outside of the information provided in the audit reports. In addition to the rates being unattractive, it is estimated that low income participants do not have the financial means or the required FICO score to obtain such a loan.

- LIEEP WHEAP low income customers are directed to the Smart Comfort (LIURP) program instead of WHEAP their consumption exceeds 475 kWh/month during April and September. Also, only WHEAP savings (and not Smart Comfort savings) are quantified and reported towards program goals. Other LIEEP components such as Refrigerator Replacements and Direct Install Smart Strips are regularly delivered through Smart Comfort and savings are claimed by Duquesne Light. However, similar direct install measures from WHEAP that are installed via Smart Comfort (CFLs, faucet aerators, etc.) cannot be claimed by Duquesne Light towards program goals.
- The survey of Refrigerator Replacement recipients found significant dissatisfaction with the refrigerator units themselves. Five of the 12 respondents (42%) expressed discontent and issues with perceived low quality of equipment, units smaller than their original refrigerators, and damage.
- The survey of Direct Install Smart Strip recipients found that participants are generally very satisfied with the program. In particular, participants conveyed very high satisfaction with the Duquesne Light representatives who install the smart strips.

6.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The LIEEP program achieved an energy savings realization rate of 98% and the evaluation found a 0.76 NTG ratio. Because LIEEP participants are almost exclusively participants of other residential programs who happen to be identified as low-income qualified in the Duquesne Light customer information system, the recommendations for this program are the same as those for the other residential programs in which LIEEP customers participated. Additional recommendations are presented below.

Table 6-8: LIEEP Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne Light should determine whether modifications to the Refrigerator Replacement program process or marketing are warranted. This would include ensuring that details regarding the size of the refrigerator unit are communicated clearly.	Being Considered
Duquesne Light should also determine whether additional quality control checks should be incorporated into the refrigerator installation process. This would include documenting the status of equipment and noting damage, if any exists, before installations occur so that damaged equipment is not installed.	Being Considered
Duquesne Light should clarify the process with participants for seeking assistance when refrigerator issues arise.	Being Considered

6.6 FINANCIAL REPORTING

LIEEP is performing well above plan levels with respect to Phase II. While program only achieved 56% of its energy savings goals in PY6, LIEEP did achieve 308% of the PY5 energy savings goal. For both years combined, the program is achieving 182% of the LIEEP goal to-date. The program is also under budget and spent 46% of its PY6 budget. This Phase II result is mostly due to the success of the Upstream Lighting component of the program, and the PY6 result is as well (with a much lower allocation of Upstream Lighting savings occurring in PY6). A breakdown of the program finances is presented in Table 6-9.

Table 6-9: Summary of LIEEP Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$261**	**$927**
2	EDC Incentives to Participants	$89	$537
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$172	$390
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$603**	**$1,165**
6	Design & Development	$0	$15
7	Administration, Management, and Technical Assistance[1]	$486	$958
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$59	$87
10	SWE Audit Costs	$58	$105
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)	$864	$2,092
13	Total NPV Lifetime Energy Benefits	$893	$5,199
14	Total NPV Lifetime Capacity Benefits	$59	$201
15	Total NPV TRC Benefits[4]	$1,135	$6,088
16	TRC Benefit-Cost Ratio[5]	1.31	2.91

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
[1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management and legal, and technical assistance. Savings and incentives associated with the Upstream Lighting program have been allocated to LIEEP based on PY6 survey results. Allocatin of administrative costs will occur in time for the PY7/end-of-Phase II report.
[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. Total does not match sum of energy and capacity benefits due to the inclusion of avoided incandescent bulb replacement costs included in the total NPV TRC Benefits values. 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.

7 COMMERCIAL PROGRAM GROUP PROGRAMS

Duquesne's Act 129 Commercial Program Group includes an overall umbrella program and four market segment programs. The umbrella program provides energy efficiency services to smaller customer segments not directly served by specific market segment programs. The market segment programs, including Office, Public Agency, Retail, and Healthcare, are implemented by specialized contractors or Duquesne staff implementing programs tailored to overcome known segment-specific barriers to program participation. All programs provide the same measures and incentive levels to ensure fair and transparent treatment of customers across all segments. Two additional programs – the Small Commercial Direct Install program and the Multi-family Housing Retrofit program – fall within the commercial sector, but these programs received separate treatment in PY6 because they were new this year and are described in later sections of this report.

The commercial programs are designed to help commercial customers assess the potential for energy-efficiency project implementation, cost and energy savings, and, for appropriate customers, provide follow-through by installing measures and verifying savings. The following program services are offered in each sub-program:

- Auditing of building energy use
- Provision of targeted financing and incentives
- Project management and installation of retrofit measures
- Training, and technical assistance

The following organizations are responsible for implementing the commercial sector programs:

- Commercial Umbrella: Duquesne Light
- Office Buildings: Enerlogics Networks, Inc.
- Retail: Encentiv Energy
- Healthcare: Duquesne Light
- Governmental and Non-Profit Programs: Duquesne Light

7.1 PROGRAM UPDATES

No updates have been made to the Commercial Program Group in PY6. As ntoed above, two new commercial programs have been introduced but will be discussed separately in sections 9 and 10

7.1.1 Definition of Participant

A participant for this program is a single project in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique project number within the tracking system. Participants in Table 7-1 represent a summation of the unique project numbers in the tracking system for the program in each of the four quarters of PY6. Customers having more than one project within a specific quarter are counted more than once.

7.2 IMPACT EVALUATION GROSS SAVINGS

At the end of PY6, Duquesne reported cumulative (CPITD) Commercial Program gross savings totaling 165% of the 28,069 MWh cumulative estimate projected for Phase II in the utility's EE&C Plan.

Table 7-1: Phase II Commercial Program Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Small Commercial	420	36,266	9.092	$810
Large Commercial	189	39,060	5.064	$3,866
Government and Non-Profit	104	13,610	2.661	$2,288
Phase II Total	**713**	**88,936**	**16.818**	**$6,964**

The sample design for the Commercial Program Group used the stratified ratio estimator approach (Lohr 1999)[30]. The approach is similar to that used for the residential programs except that the sample is stratified by ex ante energy savings (kWh) rather than by sub-program. Additionally, unlike with residential, all strata standard errors are estimated consistent with Lohr (1999) assuming a continuous distribution of the realization rate. The stratified ratio estimation approach takes advantage of information that is reported in the PMRS tracking system for each project in the program. The two key parameters in the stratified ratio estimate are a) the ratio between ex post and ex ante savings and b) the standard error of the estimate. The ratio between ex post and ex ante savings, known as the realization rate, measures the accuracy of the tracking estimates from project to project across the sample of projects. The standard error of the ratio estimate is a measure of the variability in the relationship between the ex post and ex ante estimates. Both estimates help to define the relationship (e.g., the ratio as well as the relative precision of the ratio) between the tracking estimates of savings and the actual project savings.

Ratios are calculated within each stratum and strata weights are applied to arrive at a program-level ratio. A stratum is a subset of the projects in the population that are grouped together based on ex ante savings that are known information. In other words, a disaggregattion of the population into strata is a classification of all units in the population into mutually exclusive strata that span the population. Under this design, each stratum is sampled according to simple random sampling protocols and the weighted estimates of parameters are then applied to the entire population.

Per the utility's EM&V Plan and PY6 Commercial/Industrial Sample Design Memorandum, for the purpose of conducting cost-effective EM&V, certain industrial and commercial programs were grouped based on shared characteristics. Commercial sector umbrella, large retail, small retail, healthcare, large office, and small office were similar enough in structure to be treated as one evaluation group. The Government, Non-Profit and Institutional (GNI) was treated as its own evaluation group, per the SWE directive to do so if savings exceeded 20% of the non-residential sector savings in the previous year.
In PY6, impact evaluation verification work was completed in three phases: in spring of 2015 for projects reported in the first two quarters of PY6, in summer of 2015 for projects completed in the third quarter of PY6, and in fall of 2015 for projects completed in the fourth quarter of PY6. Commercial Evaluation Group projects completed between 6/1/2014 and 11/30/2014 (Q1 and Q2), between 12/1/2014 and

[30] Lohr, Sharon. *Sampling: Design and Analysis*. Pacific Grove, CA: Duxbury Press, 1999, 69-101.

2/28/2015 (Q3) and between 3/1/2015 and 5/31/2015 (Q4), were extracted from Duquesne Light's program tracking system and placed into strata based on each project's reported kWh savings.

The strata used in calculating the overall realization rate and relative precision are described below in Table 7-2.

Table 7-2: Commercial Program Sampling Strategy for Program Year 6

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Commercial – Large	4	85%/0%	4	3	Onsite Verification
Commercial – Medium	17	85%/28.8%	6	7	Onsite Verification
Commercial – Small	330	85%/29.4%	10	10	Onsite and Telephone Verification
GNI – Small	66	85%/29.9%	3	2	Onsite and Telephone Verification
GNI – Large	2	85%/25.9%	9	9	Onsite and Telephone Verification
Program Total	**419**	**85%/15%**	**32**	**31**	

Per the utility's EM&V Plan[31], for projects with rebates less than $2,000, the basic level of verification rigor (telephone verification) was employed. The enhanced level of rigor verification (on-site verification) was applied when measure rebates were equal to or greater than $2,000. The sampling unit for the commercial program was the project, each project having a project ID in the Duquesne tracking system.

Basic Level of Rigor Verification: For Commercial programs, the basic level of verification rigor included obtaining and analyzing hardcopy and electronic documentation for each sampled participant installation. Interviews were conducted, as needed, with designated customer contacts, as well as facility managers, program implementers, equipment suppliers and installation contractors, to verify project documentation. Where documentation was inadequate, secondary research was conducted to ascertain required pre- and post-equipment definition as well as operating conditions. Project planning documentation was compared with applicable TRM deemed and partially deemed measure values and algorithm inputs. Based upon the review of the aforementioned, reported *ex ante* savings were assessed, corroborated or revised to reflect assessment findings. Telephone surveys were used to verify equipment installation and operation.

Enhanced Level of Rigor Verification: Enhanced rigor verification included all basic level of rigor tasks, plus on- site verification and sometimes metering of installed equipment. Building configuration and business operations were researched to confirm key savings determinants such as operating hours and the presence or absence of space cooling or refrigeration. Where documentation was inadequate, secondary research was conducted to ascertain required pre- and post-equipment definition as well as operating conditions.

Results of the Commercial Program group verification effort are shown below.

[31] Evaluation Measurement and Verification Plan: Duquesne Light Act 129—Phase II Energy Efficiency and Conservation Portfolio Programs 5 to 7 (Revised), March 6, 2015 (EM&V Plan), Section 2.1, Page 6.

Table 7-3: Program Year 6 Commercial Program 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 (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Commercial – Large	11,603	86%	10,028	0.45	29.5%
Commercial – Medium	9,570	81%	7,718	0.44	21.2%
Commercial – Small	12,183	110%	13,402	0.16	8.0%
GNI – Small	6,580	87%	5,719	1.29	63.7%
GNI – Large	6,417	100%	6,414	0.00	0.0%
Program Total	**46,354**	**93%**	**43,281**		**8.5%**

Table 7-4: Program Year 6 Commercial Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Commercial – Large	0.501	332%	1.662	0.81	168.8%
Commercial – Medium	1.286	108%	1.383	0.49	27.3%
Commercial – Small	2.124	140%	2.979	0.55	27.2%
GNI – Small	1.291	110%	1.418	0.21	11.5%
GNI – Large	1.212	107%	1.303	0.09	0.0%
Program Total	**6.415**	**136%**	**8.745**		**14.6%**

Navigant completed a total of 21 sites visits for the 31 projects in the commercial program that were selected in PY6 for verification, 11 of which were government/non-profit projects. The Navigant field staff included: Chris Yoder, Steven Nguyen, Lisa Cassell, Emily Merchant, and Jamie Falk. Navigant followed our Phase II Evaluation Plan in order to determine which sites required an on-site visit. As noted above, the approved evaluation plan states that all projects will receive an on-site visit unless the incentive associated with the project/measure is below $2,000, in which case it will receive telephone verification only. There were 10 commercial and government/non-profit projects sampled in PY6 that had an incentive less than $2,000 and received telephone verification with no on-site visit.

In general, Navigant found that most of the projects were installed as reported. The most common adjustment to the ex-ante savings was due to adjusting the hours of use and coincidence factors using customer reported information. SWE Guidance Memo 27 was released in July of 2014, which was after

some of the PY6 projects were submitted. In accordance with the SWE guidance memo, when Navigant used customer reported information to adjust the hours of use, Navigant also adjusted the coincidence factors based on the operation of the measure during the PJM peak demand period. In some instances where the CSPs used customer reported hours of use, they used the deemed coincidence factors because the SWE guidance memo was released after some of the projects were submitted.

Another significant impact on the ex ante savings was due to the CSP deviating from the TRM for projects with savings less than 20 kW in demand savings. Navigant came to an agreement with Duquesne and the CSPs that Navigant and the CSPs would use one whole building deemed hours of use and coincidence factor from the TRM for projects with savings less than 20 kW, regardless of the percent difference between the customer reported hours of use and the deemed hours of use in the TRM. However, the CSPs often split out the fixtures into usage groups instead of using one whole building value from the TRM.

Lastly, the other common adjustment to the ex ante savings was the CSP using a different version of the TRM than what was in effect when the project was installed. This primarily impacted lighting control measures because the 2013 TRM only takes into account the energy savings from lighting controls whereas the 2014 TRM takes into account both energy and demand savings.

Navigant found one project with a fixture quantity discrepancy that was greater than five percent different than reported. All other fixture quantity discrepancies were either within 5 percent of reported or Navigant verified more fixtures on-site than report. In the instances where Navigant found more fixtures than reported Navigant used the reported quantity, which is in accordance with the TRM.

7.3 IMPACT EVALUATION NET SAVINGS

Because the PY5 net-to-gross/process evaluation survey effort was an attempted census and because Duquesne Light's non-residential population is so limited and repeated contacts risk antagonizing this population, Navigant did not conduct net-to-gross or process evaluation survey research with participating customers in PY6. Net-to-gross research results from PY5 are being applied in PY6 for the Commercial Program Group.

In PY5, the evaluation team assessed free ridership using a customer self-report approach following the SWE framework.[32] The results being applied in PY6 are summarized below in Table 7-5.

Table 7-5: Program Year 6 Commercial Program Summary of Evaluation Results for NTG Research

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
All Commercial	0.49	0.01	0.52	2.78	47.70%
Program Total[33]	**0.49**	**0.01**	**0.52**	**2.78**	**47.70%**

Source: Navigant Survey Analysis, PY5

[32] SWE Guidance memorandum GM-024: Common Approach for Measuring Free riders for Downstream Programs, October 4, 2013.

[33] NTG ratio estimated through PY5 research and applied to PY6 programs

7.4 PROCESS EVALUATION

As noted above, in PY6 no Commercial Program Group participant surveys were conducted for either net-to-gross estimation or process evaluation purposes. However, Navigant did conduct in-depth interviews with Duquesne Light's Commercial and Industrial program managers and each of the active CSPs for the Commercial and Industrial sector programs. Our interviews covered program design, reporting and tracking process, marketing, outreach, program participation and quality control processes for each Program with a focus on any changes that have occurred since the PY5 evaluation. Key findings from these interviews are summarized below:

- According to CSPs, the individual sector programs have either met their Phase II goals or are on track to do so. Several programs have had to shut down or are anticipating having to do so shortly, when they reach their savings goals and expend their program budget.
- Customer eligibility queries and program applications are still reviewed and processed manually by the CSP and Duquesne Light staff.
- CSPs expressed frustration with the PMRS tracking system, which they say makes process automation and streamlining difficult or impossible.
- The CSPs for ongoing sector programs with the exception of the Retail segment report that they have identified and reached out to most of the customers in their respective sectors and all of the customers with annual usage over 500 MWh per year.
- Duquesne Light reported being deeply involved in assisting customers with in-depth analyses for projects with exceptionally long lead times, which has driven up program costs. Multiple large projects are in the measurement and verification phase, and savings are expected to be reported in PY7. This has been an issue particularly in the healthcare sector in PY6.

7.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

Table 7-6 provides program specific recommendations based on Navigant's findings in PY6, as well as the status of the recommendations being implemented by Duquesne Light.

Table 7-6: Commercial Program Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne Light should consider enhancing the PMRS tracking system with a more robust and functional system before the start of Phase III. The manual data transfer and database queries impose an unnecessary burden on the CSPs based on their feedback.	Being Considered
Since most of the customer base for certain sectors has been identified and the most cost-effective energy opportunities exploited in Phase II, Duquesne Light should be very careful about the setting of Phase III savings goals for sectors that have drawn significant participation in Phase II and expect to need to pursue deeper retrofit possibilities at customer sites.	Being Considered

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne Light should reiterate to CSPs the evaluation approach Navigant will take regarding projects having <20 kW of savings, to maximize the chances of project realization rates being 100%.	Being Considered

7.6 FINANCIAL REPORTING

The Commercial programs as a group are performing above plan projections. They achieved 165% of the energy savings goal for the group in PY6. They also exceeded the Commercial group PY6 budget by 49%. In addition to the finding above regarding costs preceding savings for healthcare projects with long sales/implementation cycles, the Commercial Umbrella program did not receive its anticipated allocation of very cost effective Upstream Lighting savings in PY6, due to survey results showing that no Upstream Lighting program purchases were being installed in non-residential facilities. A breakdown of the program finances (by program) is presented in Table 7-7 to Table 7-11.

Table 7-7: Summary of Commercial Sector Umbrella Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$52**	**$382**
2	EDC Incentives to Participants	$25	$309
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$27	$73
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$647**	**$963**
6	Design & Development	$0	$10
7	Administration, Management, and Technical Assistance[1]	$584	$835
8	Marketing[2]	$0	$7
9	EDC Evaluation Costs	$32	$50
10	SWE Audit Costs	$31	$61
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)	$699	$1,345
13	Total NPV Lifetime Energy Benefits	$417	$8,875
14	Total NPV Lifetime Capacity Benefits	$94	$1,454
15	Total NPV TRC Benefits[4]	$511	$10,642
16	TRC Benefit-Cost Ratio[5]	0.73	7.91

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
[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.

Table 7-8: Summary of Healthcare Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$525**	**$1,626**
2	EDC Incentives to Participants**	$524	$1,601
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$1	$25
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$190**	**$295**
6	Design & Development	$0	$13
7	Administration, Management, and Technical Assistance[1]	$85	$110
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$53	$78
10	SWE Audit Costs	$52	$94
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)	$715	$1,921
13	Total NPV Lifetime Energy Benefits	$17	$185
14	Total NPV Lifetime Capacity Benefits	$4	$32
15	Total NPV TRC Benefits[4]	$21	$216
16	TRC Benefit-Cost Ratio[5]	0.03	0.11

NOTES

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.

* Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
**Includes incentives paid to customers to cover implementation analyses for projects whose savings are expected to be reported in PY7.
[1] Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management and legal, and technical assistance. Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
[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.

Table 7-9: Summary of Office Buildings Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$7,321**	**$8,399**
2	EDC Incentives to Participants	$1,431	$1,900
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$5,890	$6,499
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$750**	**$1,675**
6	Design & Development	$0	$36
7	Administration, Management, and Technical Assistance[1]	$533	$1,242
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$110	$177
10	SWE Audit Costs	$107	$220
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)	$8,071	$10,074
13	Total NPV Lifetime Energy Benefits	$12,054	$17,060
14	Total NPV Lifetime Capacity Benefits	$1,333	$1,916
15	Total NPV TRC Benefits[4]	$13,387	$18,976
16	TRC Benefit-Cost Ratio[5]	1.66	1.88

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
[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.

Table 7-10: Summary of Retail Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$3,727**	**$4,245**
2	EDC Incentives to Participants	$653	$866
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$3,074	$3,379
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$436**	**$838**
6	Design & Development	$0	$14
7	Administration, Management, and Technical Assistance[1]	$323	$640
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$57	$83
10	SWE Audit Costs	$56	$101
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)	$4,163	$5,084
13	Total NPV Lifetime Energy Benefits	$6,330	$7,954
14	Total NPV Lifetime Capacity Benefits	$951	$1,172
15	Total NPV TRC Benefits[4]	$7,280	$9,125
16	TRC Benefit-Cost Ratio[5]	1.75	1.80

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
[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.

Table 7-11: Summary of Government, Non-Profit, Institutional (GNI) Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$4,292**	**$4,648**
2	EDC Incentives to Participants	$2,227	$2,288
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$2,065	$2,360
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$1,019**	**$1,618**
6	Design & Development	$0	$42
7	Administration, Management, and Technical Assistance[1]	$730	$1,078
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$147	$224
10	SWE Audit Costs	$142	$274
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)	$5,311	$6,266
13	Total NPV Lifetime Energy Benefits	$8,515	$8,970
14	Total NPV Lifetime Capacity Benefits	$1,177	$1,245
15	Total NPV TRC Benefits[4]	$9,692	$10,215
16	TRC Benefit-Cost Ratio[5]	1.83	1.63

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table.
[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.

8 INDUSTRIAL PROGRAM GROUP PROGRAMS

The Industrial Program Group includes an overall umbrella program and three specialized programs that address the following market segments: primary metals, chemical products and mixed industrials. Under this approach, specialized programs are designed to promote specific technologies or target specific market segments while incorporating the umbrella program savings impacts and incentive levels. In this manner, all industrial programs present a consistent and common offering.

The industrial programs are intended to provide a comprehensive approach to energy savings and permanent demand reduction, and address a full range of efficiency opportunities from low cost improvements to entire system upgrades. Each program provides the following services:

- Targeted and comprehensive on-site walk-through assessments and professional grade audits to identify energy savings opportunities.
- Efficiency studies/reports that detail process and equipment upgrades that present the greatest potential for energy/cost savings.
- Support to access rebates and incentives available across electric measures designed to help defray upfront costs of installing the equipment.
- Coordination with local chapters of key industry associations to promote energy efficiency improvements through trusted sources and encourage market-transforming practices among equipment vendors and purchasers

Duquesne Light has chosen the following Conservation Service Providers (CSPs) to implement industrial sector programs:

- Primary Metals Program: Enerlogics Networks, Inc.
- Chemical Products: Enernoc
- Mixed Industrial: Enernoc
- Industrial Umbrella: Duquesne Light

8.1 PROGRAM UPDATES

No changes occurred for the Industrial Program Group in PY6.

8.1.1 Definition of Participant

A participant for this program is a single project in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique project number within the tracking system. Participants in Table 8-1 represent a summation of the unique project numbers in the tracking system for the program in each of the four quarters of PY6. Customers having more than one project within a specific quarter are counted more than once.

8.2 IMPACT EVALUATION GROSS SAVINGS

At the end of PY6, Duquesne reported cumulative (CPITD) gross savings totaling 87% of the 19,205 MWh cumulative estimate projected for Phase II in the utility's EE&C Plan.

Table 8-1: Phase II Industrial Program Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Small Industrial	55	10,734	1.829	$531
Large Industrial	39	26,234	3.227	$907
Phase II Total	**94**	**36,967**	**5.056**	**$1,438**

As with the Commercial Program Group, the sample design for the Industrial Program Group used the stratified ratio estimator approach (Lohr 1999)[34]. The Industrial Program Group sample design was essentially the same as that used for the commercial program. However, because industrial projects may have very large numbers of measures within a single project, the sampling unit was a project measure[35], rather than an entire project. The actual sample size for the small industrial sample is significantly greater than the targeted sample size for that stratum. Navigant performed verification at the measure level for industrial projects, but an attempt was made not only to verify the specific measure selected for verification but also any additional measures that could easily be verified while on-site. This approach was implemented in order to maximize the usefulness of each site visit without unduly using up valuable evaluation resources. The level of verification rigor and estimation of realization rates followed the same guidelines as those used for the Commercial Program Group.

In PY6, impact evaluation verification work was completed in three phases: in spring of 2015 for installed measures reported in the first two quarters of PY6, in summer of 2015 for measures completed in the third quarter of PY6, and in fall of 2015 for measures completed in the fourth quarter of PY6. Industrial Evaluation Group measures completed between 6/1/2014 and 11/30/2014 (Q1 and Q2), between 12/1/2014 and 2/28/2015 (Q3) and between 3/1/2015 and 5/31/2015 (Q4), were extracted from Duquesne Light's program tracking system and placed into strata based on each measure's reported kWh savings.

Table 8-2: Industrial Program Sampling Strategy for Program Year 6

Stratum	Population Size (Measures)	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Industrial – Small	319	85%/25.9%	16	86	Onsite and Telephone Verification
Industrial – Medium	31	85%/27.9%	7	11	Onsite Verification
Industrial – Large	5	85%/19.2%	4	4	Onsite Verification
Program Total	**355**	**85%/15%**	**27**	**101**	

[34] Lohr, Sharon. *Sampling: Design and Analysis*. Pacific Grove, CA: Duxbury Press, 1999, 69-101.

[35] Measure here refers to a set of equipment installed for which the savings values are the same, such as for a specific type of lighting retrofit occurring within a location having a specific hours of use.

Per the Navigant's EM&V Plan[36], for projects with rebates less than $2,000, the basic level of verification rigor (telephone verification) was employed. The enhanced level of rigor verification (on-site verification) was applied when measure rebates were equal to or greater than $2,000. Guidelines for determining whether specific projects were assessed at the basic level or enhanced level of rigor were identical to those described earlier for Commercial program Group verifications.

The table below shows the results of the verification process.

Table 8-3: Program Year 6 Industrial Program 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 (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Industrial – Small	4,743	105%	4,963	0.57	8.0%
Industrial – Medium	6,208	88%	5,477	0.40	15.1%
Industrial – Large	5,731	112%	6,432	0.96	41.2%
Program Total	**16,682**	**101%**	**16,872**		**12.9%**

Table 8-4: Program Year 6 Industrial Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Industrial – Small	0.755	101%	0.762	0.29	4.3%
Industrial – Medium	0.897	89%	0.802	0.56	21.0%
Industrial – Large	0.782	110%	0.860	0.89	38.3%
Program Total	**2.433**	**100%**	**2.423**		**12.2%**

Navigant completed a total of 13 sites visits for the 20 projects in the industrial program with measures that were selected in PY6 for verification. The Navigant field staff included: Chris Yoder, Steven Nguyen, Lisa Cassell, Emily Merchant, and Jamie Falk. Navigant staff followed our Phase II Evaluation Plan in order to determine which sites required an on-site visit. As noted above, the approved evaluation plan states that all projects will receive an on-site visit unless the incentive associated with the project/measure is below $2,000, in which case it will receive telephone verification only. There were 7 industrial projects

[36] Evaluation Measurement and Verification Plan, 2010-2012 Energy Efficiency & Conservation Programs, July 15, 2010 (EM&V Plan), sections 2.5 and 2.5.1, pages 21 and 22.

sampled in PY6 that had an incentive less than $2,000 and received telephone verification with no on-site visit.

In general, Navigant found that most of the measures were installed as reported. The most common adjustment to the ex-ante savings was due to adjusting the hours of use and coincidence factors using customer reported information. SWE Guidance Memo 27 was released in July of 2014, which was after some of the PY6 projects were submitted. In accordance with the SWE guidance memo, when Navigant used customer reported information to adjust the hours of use, Navigant also adjusted the coincidence factors based on the operation of the measure during the PJM peak demand period rather than using a deemed coincidence factor. In some instances where the CSPs used customer-reported hours of use, they used the deemed coincidence factors because the SWE guidance memo was released after some of the projects were submitted.

Another significant impact on the ex ante savings was due to the CSP deviating from the TRM for projects with demand savings less than 20 kW. Navigant came to an agreement with Duquesne and the CSPs that Navigant and the CSPs would use one whole building deemed hours of use and coincidence factor from the TRM for projects with savings less than 20 kW, regardless of the percent difference between the customer reported hours of use and the deemed hours of use in the TRM. However, the CSPs often split out the fixtures into usage groups instead of using one whole building value from the TRM.

Lastly, the other common adjustment to the ex ante savings was the CSP using a different version of the TRM than what was in effect when the project was installed. This primarily impacted lighting control measures because the 2013 TRM only takes into account the energy savings from lighting controls whereas the 2014 TRM takes into account the energy and demand savings.

Navigant found two projects with a fixture quantity discrepancy that was greater than five percent different than reported. All other fixture quantity discrepancies were either within 5 percent of reported or Navigant verified more fixtures on-site than report. In the instances where Navigant found more fixtures than reported Navigant used the reported quantity, which is in accordance with the TRM. For one of the projects with a discrepancy the customer had installed significantly fewer fixtures than reported. In the other instance the customer did not have the funds to complete the project and therefore the rebated lights were not installed yet. The project was just below the threshold for a post-installation visit by the CSP; therefore, the CSP was not aware that the project was never installed.

8.3 IMPACT EVALUATION NET SAVINGS

Because the PY5 net-to-gross/process evaluation survey effort was an attempted census and because Duquesne Light's non-residential population is so limited and repeated contacts risks antagonizing this population, Navigant did not conduct net-to-gross or process evaluation survey research with participating customers in PY6. Net-to-gross research results from PY5 are being applied in PY6 for the Industrial Program Group. These results are summarized below in Table 8-5.

Table 8-5: Program Year 6 Industrial Program Summary of Evaluation Results for NTG Research

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
All Industrial	0.24	0.02	0.78	0.24	9.50%
Program Total[37]	**0.24**	**0.02**	**0.78**	**0.24**	**9.50%**

8.4 PROCESS EVALUATION

The process evaluation activities summarized in the Commerical Program Group section (7.4) are applicable here as well. Key findings from these interviews are summarized below:

- CSPs reported that the individual sector programs have either met their Phase II goals or are on track to do so. Several programs have had to shut down or are anticipating having to do so shortly, when they reach their savings goals and expend their program budget.
- Customer eligibility queries and program applications are still reviewed and processed manually by the CSP and Duquesne Light staff.
- CSPs expressed frustration with the PMRS tracking system, which they say makes process automation and streamlining difficult or impossible.
- The CSPs for the Industrial Program Group programs report that they have identified and reached out to most of the customers in their respective sectors and all of the customers with annual usage over 500 MWh per year.

8.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The recommendations for the programs, summarized in the Commerical Program Group section, 7.4, are applicable here as well.

Table 8-6 provides program specific recommendations based on Navigant's findings in PY6, as well as the status of the recommendations being implemented by Duquesne Light.

Table 8-6: Industrial Program Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne Light should consider enhancing the PMRS tracking system with a more robust and functional system before the start of Phase III. The manual data transfer and database queries impose an unnecessary burden on the program.	Being Considered
Since most of the customer base for certain sectors has been identified and the most cost-effective energy opportunities exploited in Phase II, Duquesne Light should be very careful	Being Considered

[37] NTG ratio at program level should be developed using stratum weight and stratum NTG ratios.

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
about the setting of Phase III savings goals for sectors that have drawn significant participation in Phase II and expect to need to pursue deeper retrofit possibilities at customer sites.	
Duquesne Light should reiterate to CSPs the evaluation approach Navigant will take regarding projects having <20 kW of savings, to maximize the chances of project realization rates being 100%.	Being Considered

8.6 FINANCIAL REPORTING

The Industrial programs as a group are performing somehat below plan projections. They achieved 87% of the energy savings goal for the group in PY6, and they expended 73% of the planned budget. While the Chemicals Program had the lowest cost effectiveness results (0.41 for PY6), the CSP maintains that it is on target to achieve its savings goals. A breakdown of the program finances (by program) is presented in Table 8-7 through Table 8-10.

Table 8-7: Summary of Primary Metals Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$1,327**	**$3,076**
2	EDC Incentives to Participants	$412	$866
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$915	$2,210
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$1,575**	**$2,454**
6	Design & Development	$0	$24
7	Administration, Management, and Technical Assistance[1]	$1,386	$2,121
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$95	$139
10	SWE Audit Costs	$94	$170
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)	$2,902	$5,530
13	Total NPV Lifetime Energy Benefits	$4,997	$9,535
14	Total NPV Lifetime Capacity Benefits	$379	$697
15	Total NPV TRC Benefits[4]	$5,376	$10,232
16	TRC Benefit-Cost Ratio[5]	1.85	1.85

NOTES

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*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table

[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.

Table 8-8: Summary of Primary Mixed Industrial Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$1,056**	**$1,158**
2	EDC Incentives to Participants	$341	$386
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$715	$772
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$565**	**$849**
6	Design & Development	$0	$8
7	Administration, Management, and Technical Assistance[1]	$502	$738
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$31	$46
10	SWE Audit Costs	$32	$57
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)	$1,621	$2,006
13	Total NPV Lifetime Energy Benefits	$5,767	$6,491
14	Total NPV Lifetime Capacity Benefits	$575	$640
15	Total NPV TRC Benefits[4]	$6,342	$7,131
16	TRC Benefit-Cost Ratio[5]	3.91	3.55

NOTES

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.

Table 8-9: Summary of Chemicals Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$47**	**$149**
2	EDC Incentives to Participants	$13	$41
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$34	$108
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$347**	**$503**
6	Design & Development	$0	$9
7	Administration, Management, and Technical Assistance[1]	$278	$380
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$35	$51
10	SWE Audit Costs	$34	$63
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)	$394	$652
13	Total NPV Lifetime Energy Benefits	$146	$406
14	Total NPV Lifetime Capacity Benefits	$14	$39
15	Total NPV TRC Benefits[4]	$160	$445
16	TRC Benefit-Cost Ratio[5]	0.41	0.68

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table

[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.

Table 8-10: Summary of Industrial Umbrella Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs* ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$50**	**$391**
2	EDC Incentives to Participants	$17	$145
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$33	$246
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$77**	**$146**
6	Design & Development	$0	$4
7	Administration, Management, and Technical Assistance[1]	$47	$93
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$15	$22
10	SWE Audit Costs	$15	$27
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)	$127	$536
13	Total NPV Lifetime Energy Benefits	$101	$1,104
14	Total NPV Lifetime Capacity Benefits	$16	$134
15	Total NPV TRC Benefits[4]	$117	$1,238
16	TRC Benefit-Cost Ratio[5]	0.92	2.31

NOTES

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.

*Includes corrections made to PY5 values such that reported PY5 values plus PY6 values will not necessarily equal Phase II totals shown in table

[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.

9 SMALL COMMERCIAL DIRECT INSTALL PROGRAM

The Small Commercial Direct Install (SCDI) Program was designed to overcome barriers to participation demonstrated in previous years in the small office and small retail market segments. The qualifying participant was a small business with 300 kW or less peak demand that was not being served by other DLC Programs. The program offers to install cost-effective energy efficiency measures, most commonly lighting retrofits and refrigeration controls, free of charge to the customer. CLEAResult is the Conservation Services Provider (CSP) for the program and recruited eight qualified sub-contractors to recruit customers, produce comprehensive work scopes for each project and install the approved measures on behalf of the program. The program launched in October 2014 and had achieved its goals and shut down by May of 2015.

9.1 PROGRAM UPDATES

There are no updates to this program because this is the first year that it was offered.

9.1.1 Definition of Participant

A participant for this program is a single project in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique project number within the tracking system. Participants in Table 9-1 represent a summation of the unique project numbers in the tracking system for the program in each of the four quarters of PY6. Customers having more than one project within a specific quarter are counted more than once.

9.2 IMPACT EVALUATION GROSS SAVINGS

At the end of PY6, Duquesne reported cumulative (CPITD) Small Commercial Direct Install Program gross savings totaling 319% of the 1,702 MWh cumulative estimate projected for Phase II in the utility's EE&C Plan.

Table 9-1: Phase II Small Commercial Direct Install Program Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Small Commercial and Industrial	88	5,429	0.731	$0
Phase II Total	**88**	**5,429**	**0.731**	**$0**

The sample design for the Small Commercial Direct Install Program Group used the stratified ratio estimator (Lohr 1999)[38]. A stratified ratio estimator is used to adjust the ex ante savings contained in PMRS. The approach is similar to that used for the residential programs except that the sample is stratified by ex ante energy savings (kWh) rather than by sub-program. Additionally, unlike with residential, all strata standard errors are estimated consistent with Lohr (1999) assuming a continuous distribution of the realization rate. The stratified ratio estimation approach takes advantage of information that is reported in the PMRS tracking system for each project in the program. The two key parameters in the

[38] Lohr, Sharon. *Sampling: Design and Analysis*. Pacific Grove, CA: Duxbury Press, 1999, 69-101.

stratified ratio estimate are a) the ratio between ex post and ex ante savings and b) the standard error of the estimate. The ratio between ex post and ex ante savings, which is sometimes referred to as the realization rate, measures the accuracy of the tracking estimates from project to project across the sample of projects. The standard error of the ratio estimate is a measure of the variability in the relationship between the ex post and ex ante estimates. Both estimates help to define the relationship (e.g., the ratio as well as the relative precision of the ratio) between the tracking estimates of savings and the actual project savings.

Ratios are calculated within each stratum and strata weights are applied to arrive at a program-level ratio. A stratum is a subset of the projects in the population that are grouped together based on ex ante savings that are known information. In other words, a stratification of the population into strata is a classification of all units in the population into mutually exclusive strata that span the population. Under this design, each stratum is sampled according to simple random sampling protocols and the weighted estimates of parameters are then applied to the entire population.

In PY6, Navigant completed the impact evaluation work for the small commercial direct install program all at once during the fall of 2015, which is different than the commercial and industrial programs which were evaluated over three time periods: spring of 2015, summer of 2015, and fall of 2015.

The strata used in calculating the overall realization rate and relative precision are described below in Table 9-2.

Table 9-2: Small Commercial Direct Install Program Sampling Strategy for Program Year 6

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Small Commercial Direct Install – Large	6	85%/0%	6	6	Onsite and Telephone Verification
Small Commercial Direct Install – Medium	18	85%/25.1%	7	9	Onsite Verification
Small Commercial Direct Install – Small	64	85%/33.3%	6	4	Onsite Verification
Program Total	**88**	**85%/15%**	**19**	**19**	

Projects with savings less than 150,000 kWh received a basic level of verification rigor (telephone verification) was employed. The enhanced level of rigor verification (on-site verification) was applied when project savings were equal to or greater than 150,000 kWh. The sampling unit for the small commercial direct install program was the project, each project having a project ID in the Duquesne tracking system. This kWh savings threshold was derived from the program's verification stratification created for EM&V sampling purposes. The stratification was based on the participant population, such that approximately one third of the program savings were represented in each stratum, while also taking into account natural break-points in the population dataset. Ultimately, this was done to create an efficient sample.

Basic Level of Rigor Verification: For the Small Commercial Direct Install Program, the basic level of verification rigor included obtaining and analyzing hardcopy and electronic documentation for each sampled participant installation. Interviews were conducted, as needed, with designated customer contacts, as well as facility managers, program implementers, equipment suppliers and installation

contractors, to verify project documentation. Where documentation was inadequate, secondary research was conducted to ascertain required pre- and post-equipment definition as well as operating conditions. Project planning documentation was compared with applicable TRM deemed and partially deemed measure values and algorithm inputs. Based upon the review of the aforementioned, reported *ex ante* savings were assessed, corroborated or revised to reflect assessment findings.

Enhanced Level of Rigor Verification: Enhanced rigor verification included all basic level of rigor tasks, plus on-site verification and sometimes metering of installed equipment. Building configuration and business operations were researched to confirm key savings determinants such as operating hours and the presence or absence of space cooling or refrigeration. Where documentation was inadequate, secondary research was conducted to ascertain required pre- and post-equipment definition as well as operating conditions.

Results of the Small Commercial Direct Install Program group verification effort are shown below.

Table 9-3: Program Year 6 Small Commercial Direct Install Program 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 (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Small Commercial Direct Install – Large	1,397	92%	1,288	0.12	0.0%
Small Commercial Direct Install – Medium	2,199	96%	2,111	0.15	5.6%
Small Commercial Direct Install – Small	1,833	98%	1,796	0.04	4.0%
Program Total	**5,429**	**96%**	**5,195**		**2.4%**

Table 9-4: Program Year 6 Small Commercial Direct Install Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Small Commercial Direct Install – Large	0.143	119%	0.170	0.23	0.0%
Small Commercial Direct Install – Medium	0.305	90%	0.276	0.33	12.4%
Small Commercial Direct Install – Small	0.283	96%	0.271	0.08	7.2%
Program Total	**0.731**	**98%**	**0.717**		**5.0%**

Navigant completed a total of six site visits for the 19 projects in the Small Commercial Direct Install program that were selected in PY6 for verification. The Navigant field staff included: Chris Yoder, Steven Nguyen, Lisa Cassell, Emily Merchant, and Jamie Falk. As noted above, all projects with savings are less than 150,000 kWh received telephone verification, and all projects with savings 150,000 kWh or higher received on-site visits. There were 13 small commercial direct install projects sampled in PY6 that had project savings less than 150,000 kWh and received telephone verification with no on-site visit.

In general, Navigant found that most of the projects were installed as reported. The most common adjustment to the ex-ante savings was due to adjusting the hours of use and coincidence factors using customer reported information. SWE Guidance Memo 27 was released in July of 2014, which was after some of the PY6 projects were submitted. In accordance with the SWE guidance memo, when Navigant used customer reported information to adjust the hours of use Navigant also adjust the coincidence factors based on the operation of the measure during the PJM peak demand period. In some instances where the CSPs used customer reported hours of use they used the deemed coincidence factors because the SWE guidance memo was released after some of the projects were submitted.

Another impact on the ex ante savings was due to the CSP deviating from the TRM for projects with savings less than 20 kW in demand savings. Navigant came to an agreement with Duquesne and the CSPs that Navigant and the CSPs would use one whole building deemed hours of and coincidence factor from the TRM for projects with savings less than 20 kW, regardless of the percent difference between the customer reported hours of use and the deemed hours of use in the TRM. The CSP often split out the fixtures into usage groups instead of using one whole building value from the TRM.

Navigant found two projects with a fixture quantity discrepancy that was greater than five percent different than reported. Making the adjustment to the fixture quantity caused a less than one percent impact on the savings for both projects. All other fixture quantity discrepancies were either within 5 percent of reported or Navigant verified more fixtures on-site than report. In the instances where Navigant found more fixtures than reported Navigant used the reported quantity, which is in accordance with the TRM.

Navigant attempted a phone verification for one of the projects and found that the store had closed after the retrofit was installed. The CSP had done a post-inspection and verified that the project was installed and operating. During the post-inspection the customer did not mention plans to close the store. Becausee Navigant was able to confirm that the project was installed and operating at one point, the project received full savings.

9.3 IMPACT EVALUATION NET SAVINGS

The Net-to-Gross (NTG) analysis for SCDI utilized the same phone surveys as for the process evaluation. As a result of the small population size and a desire to gather as much information as possible to support the NTG analysis and process evaluation, an attempted census was targeted for these surveys.

Table 9-5: Small Commercial Direct Install Program Sampling Strategy for Program Year 6 NTG Research

Stratum	Stratum Boundaries	Population Size	Assumed CV or Proportion in Sample Design	Assumed Levels of Confidence & Precision	Target Sample size	Achieved Sample Size	Percent of Sample Frame Contacted[39] to Achieve Sample
Small Commercial Direct Install – Large	All	6	N/A	N/A	6	4	100%
Small Commercial Direct Install – Medium	All	18	N/A	N/A	18	12	100%
Small Commercial Direct Install – Small	All	64	N/A	N/A	64	21	100%
Program Total		**88**		N/A	**88**	**37**	**100%**

Free Ridership

The evaluation team assessed free ridership using a customer self-report approach following the SWE framework.[40] 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 SWE 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) *influence* of the program in the decision to carry out the energy-efficient improvements.

Calculation of the SCDI program free ridership was based on responses to the following questions:

1. The free ridership percentage was estimated for each survey respondent, based on the respondent's answers to a series of key survey questions:
   a. What is likely to have happened if you had not received the program assistance?
   b. By how much would you have reduced the size, scope, or efficiency?
   c. Would your business have paid the entire cost of the upgrade?
   d. How influential was the program in your decision to have the measures installed?
2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
   a. The influence score was determined based on the maximum influence score of the two influence questions respondents were asked. Participants who reported a maximum influence of 1 (no influence) received an influence score of 50, those who reported a maximum influence of 5 (great influence) were assigned an influence score of 0.

[39] Sample frame is a list of contacts that have a chance to be selected into the sample. Percent contacted means of all the sample frame how many were called to get the completes.

[40] SWE Guidance memorandum GM-024: Common Approach for Measuring Free riders for Downstream Programs, October 4, 2013.

b. The intention score was determined based on what participants reported would have been likely to happen if they had not received program assistance

Spillover

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 or track as part of its gross savings. The evaluation team asked program participants a battery of questions to quantitatively assess spillover. The spillover questions used are:

1. Since your participation in the program, did you install any additional energy-efficient measures at this facility that did not receive incentives through a Duquesne Light program?
2. Please describe the energy efficient equipment or energy efficiency improvement that was implemented without a Duquesne Light incentive at the [ADDRESS] facility?
3. How influential was your experience in Duquesne Light's [SMALL COMMERCIAL DIRECT INSTALL] Program in your decision to make this energy efficiency improvement, using a scale of 1 to 5, where 1 is not at all influential and 5 is extremely influential?
4. Would you say the energy savings from the ADDITIONAL energy efficiency improvement you made WITHOUT a Duquesne Light incentive at this same facility was more or less than the savings from the equipment you installed at this same facility for which you DID receive a Duquesne Light incentive?
5. About what percentage [MORE/LESS] was the energy savings of the ADDITIONAL efficiency improvement?
6. What were the reasons that you chose not to pursue obtaining a Duquesne Light incentive for this ADDITIONAL energy efficiency improvement?

This battery of questions was then repeated with respect to additional efficiency improvements made to *other* facilities in the Duquesne service territory operated by the same customer.

The battery of questions attempted to quantify all the savings from additional non-incented equipment installed after the respondent's participation in the program.

The results of the free ridership and spillover research for the SCDI program are summarized below in Table 9-6.

Table 9-6: Program Year 6 Small Commercial Direct Install Program Summary of Evaluation Results for NTG Research

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
Small Commercial Direct Install – Large	1%	7%	106%	0.02	1.1%
Small Commercial Direct Install – Medium	11%	7%	96%	0.16	3.8%
Small Commercial Direct Install – Small	8%	7%	99%	0.14	3.4%
Program Total[41]	**7%**	**7%**	**99%**		**1.9%**

9.4 PROCESS EVALUATION

The process evaluation for the Small Commercial Direct Install program in PY6 included the following activities:

- Review of the 2014 Pennsylvania TRM and program materials
- Project tracking system and project file review
- Interviews with Duquesne program staff
- In-depth interviews with Program CSP
- In-depth Interviews with Trade Allies working under the CSP's direction
- Best Practices Assessment
- Surveys with 37 SCDI participants from an attempted census of the entire PY6 population in September and October of 2015. These surveys included net-to-gross and selected process evaluation questions.

[41] NTG ratio at program level should be developed using stratum weight and stratum NTG ratios.

Table 9-7: Small Commercial Direct Install Program Sampling Strategy for Program Year 6

Target Group or Stratum (if appropriate)	Stratum Boundaries (if appropriate)	Population Size	Assumed Proportion or CV in Sample Design	Assumed Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Percent of Population Frame Contacted to Achieve Sample	Used For Evaluation Activities (Impact, Process, NTG)
Small Commercial Direct Install – Large	All	6	N/A	N/A	6	4	100%	All
Small Commercial Direct Install – Medium	All	18	N/A	N/A	18	12	100%	All
Small Commercial Direct Install – Small	All	64	N/A	N/A	64	21	100%	All
Program Total		**88**		N/A	**88**	**37**	**100%**	

The SCDI process evaluation findings and details can be found in the PY6 Commercial Industrial Process Evaluation report. Highlights of the process evaluation are summarized below:

- The SCDI program has shut down, having met the Phase II savings goals and expended its program budget. The CSP for the SCDI Program estimates that it had served only a small fraction of the eligible market by the conclusion of the program.
- The program has a well-documented implementation plan produced by the CSP.
- According to the CSP and program Trade Allies the program database and tracking system ("PMRS") makes process automation and streamlining difficult or impossible. The SCDI CSP indicated that it does not use PMRS due to its lack of functionality. The CSP Trade Allies reported issues with long delays before getting paid, due to delays they believe were caused by this system.
- Most participants have not seen the website, and more than half have not seen any marketing material for the SCDI Program.
- The satisfaction level with all the different aspects of the program and with Duquesne Light is high. Those who are less satisfied listed the following reasons:
    - Their expectations regarding the energy savings they would get from the projects have not been met yet.
    - Problems with the equipment installed or bad experience with the contractor used and not knowing what to do in order to get the assistance needed.
- According to participants, the top three barriers to program participation are lack of awareness, program is too complicated, paperwork too burdensome and difficulty qualifying.
- Trade Allies for the SCDI Program were generally satisfied with the ease of participation in the Program. Most mentioned the length of time it took for reimbursement as the aspect that most needs improvement.

- Some Trade Allies in the SCDI Program felt that it was more difficult to recruit participants to a free program than if there were a modest co-pay from the customer.
- Most respondents find it easy to both identify the energy efficiency improvements needed and to install the equipment. Those few participants who reported having difficulties in making energy efficiency improvements (4 respondents, or 11 percent) reported lack knowledge on how to save energy, how to identify the equipment needed and quantifying the savings as the three most problematic areas for them.
- Participants most frequently pointed to the need for more detailed information and more proactive communications from Duquesne Light, when asked how the program could be improved. They also indicated the program needs more promotion in order to increase awareness.

9.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

Table 9-8 provides program specific recommendations based on Navigant's findings in PY6, as well as the status of the recommendations being implemented by Duquesne Light.

Table 9-8: Small Commercial Direct Install Program Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Should Duquesne Light continue the program in Phase III, it should consider enhancing the interface between the CSP/contractors and the program tracking system, whether that be in the form of modifications to PMRS or maintaining a separate tracking system for the program. Further discussions with the PY6 CSP and/or Trade Allies may be warranted in figuring out options that may be practical and cost effective for all parties.	Being Considered
In any future SCDI program, Duquesne Light should ensure that participating customers have a specific path to contacting the CSP or Duquesne Light if they run into problems after installation has been completed. This could help maintain participant satisfaction; however, participants are generally very satisfied with the program.	Being Considered
Any future SCDI program should consider increasing promotional activities both before and after participation, such as sending periodic email updates about the program or using bill inserts to raise program awareness. Another option is to develop marketing materials that the contractors can use to promote the program, perhaps including follow-up contact information for any post-installation problems that may arise.	Being Considered
For any future SCDI program, Duquesne Light should evaluate including a requirement for co-payment by the customer – or possibly transitioning to one, once initial participation levels are assessed – which could stretch the	Being Considered

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
program budget further, potentially allow more customers in this underserved sector to be served, and potentially improve customer satisfaction and brand recognition.	
Duquesne Light should consider continuing the SCDI program in Phase III. The CSP for the program estimates that it has served only a small fraction of the eligible market thus far.	Being Considered

9.6 FINANCIAL REPORTING

The performance of the SCDI program greatly exceeded expectations and program plans. It achieved 319% of the PY6 energy savings goal while expending 151% of the planned budget. A breakdown of the program finances is presented in Table 9-9.

Table 9-9: Summary of SCDI Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$1,012**	**$1,012**
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)	$1,012	$1,012
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$1,754**	**$1,754**
6	Design & Development	$0	$0
7	Administration, Management, and Technical Assistance[1]	$1,678	$1,678
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$37	$37
10	SWE Audit Costs	$39	$39
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)	$2,766	$2,766
13	Total NPV Lifetime Energy Benefits	$2,766	$2,766
14	Total NPV Lifetime Capacity Benefits	$238	$238
15	Total NPV TRC Benefits[4]	$3,004	$3,004
16	TRC Benefit-Cost Ratio[5]	1.09	1.09

NOTES

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.

10 MULTIFAMILY PROGRAM

The Multifamily Housing Retrofit (MFHR) Program targets multifamily housing for income qualified occupants and provides a "one-stop shop" simplifying program participation and energy efficiency measure adoption for this specialized target market. The program will serve the portion of any income-qualified multifamily building that is master metered, typically just the common areas of the property, but the program will serve the dwelling units of a qualified building if they are also served by a master meter.

Program services include the administration of energy efficiency audits, technical assistance for measure level project review and bundling, property aggregation, contractor negotiation and equipment bulk purchasing. The CSP integrates funding sources to include program and agency co-funding, performance contracting, grant funding and available financing options. The DLC Program Manager described the program as "direct install with customer buy-in." The scope and cost of the overall project is developed by the CSP, and an agreement is reached between the CSP, Duquesne Light and the customer regarding the portion of the cost that the CSP will cover, using program funds to buy down the cost to some extent. The level of buy down and the scope of the project can vary customer to customer. The CSP also offers 12-month zero percent interest financing to customers to help overcome any remaining financial barriers (e.g., allowing a project to show positive cash flow from day one).

10.1 PROGRAM UPDATES

There are no updates to this program because this is the first year that it was offered.

10.1.1 Definition of Participant

A participant for this program is a single project in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique project number within the tracking system. Participants in Table 10-1 represent a summation of the unique project numbers in the tracking system for the program in each of the four quarters of PY6. Customers having more than one project within a specific quarter are counted more than once.

10.2 IMPACT EVALUATION GROSS SAVINGS

At the end of PY6, Duquesne reported cumulative (CPITD) Multifamily Program gross savings totaling 151% of the 1,437 MWh cumulative estimate projected for Phase II in the utility's EE&C Plan.

Table 10-1: Phase II Multifamily Program Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Government, Non-Profit, and Institutional	39	2,171	0.196	$0
Phase II Total	**39**	**2,171**	**0.196**	**$0**

The sample design for the Multifamily Program Group used the stratified ratio estimator (Lohr 1999)[42]. A stratified ratio estimator is used to adjust the ex ante savings contained in PMRS. The approach is similar

[42] Lohr, Sharon. *Sampling: Design and Analysis*. Pacific Grove, CA: Duxbury Press, 1999, 69-101.

to that used for the residential programs except that the sample is stratified by ex ante energy savings (kWh) rather than by sub-program. Additionally, unlike with residential, all strata standard errors are estimated consistent with Lohr (1999) assuming a continuous distribution of the realization rate. The stratified ratio estimation approach takes advantage of information that is reported in the PMRS tracking system for each project in the program. The two key parameters in the stratified ratio estimate are a) the ratio between ex post and ex ante savings and b) the standard error of the estimate. The ratio between ex post and ex ante savings, which is sometimes referred to as the realization rate, measures the accuracy of the tracking estimates from project to project across the sample of projects. The standard error of the ratio estimate is a measure of the variability in the relationship between the ex post and ex ante estimates. Both estimates help to define the relationship (e.g., the ratio as well as the relative precision of the ratio) between the tracking estimates of savings and the actual project savings.

Ratios are calculated within each stratum and strata weights are applied to arrive at a program-level ratio. A stratum is a subset of the projects in the population that are grouped together based on ex ante savings that are known information. In other words, a stratification of the population into strata is a classification of all units in the population into mutually exclusive strata that span the population. Under this design, each stratum is sampled according to simple random sampling protocols and the weighted estimates of parameters are then applied to the entire population.

The strata used in calculating the overall realization rate and relative precision are described below in Table 10-2.

Table 10-2: Multifamily Program Sampling Strategy for Program Year 6

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Multifamily – Small	22	85%/35.8%	5	5	Onsite and Telephone Verification
Multifamily – Medium	13	85%/32.5%	5	5	Onsite Verification
Multifamily – Large	4	85%/0%	4	4	Onsite Verification
Program Total	**39**	**85%/15%**	**14**	**14**	

Projects with savings less than 100,000 kWh received a basic level of verification rigor (telephone verification) was employed. The enhanced level of rigor verification (on-site verification) was applied when project savings were equal to or greater than 100,000 kWh. The sampling unit for the multifamily program was the project, each project having a project ID in the Duquesne tracking system. The kWh threshold was based on the stratification strategy created for EM&V sampling purposes. The strata selection was based on the program population, such that approximately one third of the program savings fell into each strata, while also taking into account natural break-points in the population set. Ultimately, this was done to create and efficient sample.

Basic Level of Rigor Verification: For the Multifamily Program, the basic level of verification rigor included obtaining and analyzing hardcopy and electronic documentation for each sampled participant installation. Interviews were conducted, as needed, with designated customer contacts, as well as facility managers, program implementers, equipment suppliers and installation contractors, to verify project

documentation. Where documentation was inadequate, secondary research was conducted to ascertain required pre- and post-equipment definition as well as operating conditions. Project planning documentation was compared with applicable TRM deemed and partially deemed measure values and algorithm inputs. Based upon the review of the aforementioned, reported *ex ante* savings were assessed, corroborated or revised to reflect assessment findings.

Enhanced Level of Rigor Verification: Enhanced rigor verification included all basic level of rigor tasks, plus on- site verification and sometimes metering of installed equipment. Building configuration and business operations were researched to confirm key savings determinants such as operating hours and the presence or absence of space cooling or refrigeration. Where documentation was inadequate, secondary research was conducted to ascertain required pre- and post-equipment definition as well as operating conditions.

Results of the Multifamily Program group verification effort are shown below.

Table 10-3: Program Year 6 Multifamily Program 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 (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Multifamily – Small	543	103%	558	0.13	8.8%
Multifamily – Medium	949	89%	844	0.10	5.9%
Multifamily – Large	680	102%	693	0.02	0.0%
Program Total	**2,171**	**96%**	**2,095**		**2.9%**

Table 10-4: Program Year 6 Multifamily Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Multifamily – Small	0.048	84%	0.041	0.08	7.2%
Multifamily – Medium	0.097	69%	0.067	0.17	10.7%
Multifamily – Large	0.050	104%	0.052	0.23	0.0%
Program Total	**0.196**	**82%**	**0.160**		**4.1%**

Navigant completed a total of 4 site visits for the 14 projects in the Multifamily program that were selected in PY6 for verification. The Navigant field staff included: Chris Yoder, Steven Nguyen, Lisa Cassell, Emily Merchant, and Jamie Falk. As noted above, projects with savings less than 100,000 kWh received telephone verifications, while projects at or above received on-site verifications. There were 10

multifamily projects sampled in PY6 that had project savings less than 100,000 kWh and received telephone verification with no on-site visit.

In general, Navigant found that most of the projects were installed as reported. The most common adjustment to the ex-ante savings was due to adjusting the hours of use and coincidence factors using customer reported information. SWE Guidance Memo 27 was released in July of 2014, which was after some of the PY6 projects were submitted. In accordance with the SWE guidance memo, when Navigant used customer reported information to adjust the hours of use Navigant also adjust the coincidence factors based on the operation of the measure during the PJM peak demand period. In some instances where the CSPs used customer reported hours of use they used the deemed coincidence factors because the SWE guidance memo was released after some of the projects were submitted.

Another significant impact on the ex ante savings was due to the CSP deviating from the TRM for projects with savings less than 20 kW in demand savings. Navigant came to an agreement with Duquesne and the CSPs that Navigant and the CSPs would use one whole building deemed hours of and coincidence factor from the TRM for projects with savings less than 20 kW, regardless of the percent difference between the customer reported hours of use and the deemed hours of use in the TRM. The CSP often split out the fixtures into usage groups instead of using one whole building value from the TRM.

Navigant found one project with a fixture quantity discrepancy that was greater than five percent different than reported. All other fixture quantity discrepancies were either within 5 percent of reported or Navigant verified more fixtures on-site than report. In the instances where Navigant found more fixtures than reported Navigant used the reported quantity, which is in accordance with the TRM.

10.3 IMPACT EVALUATION NET SAVINGS

The Net-to-Gross (NTG) analysis for the Multifamily program utilized the same telephone surveys that were used for the process evaluation. As a result of the small sample size and a desire to gather as much information as possible to support the process evaluation, a census was attemptedfor these surveys.

Table 10-5: Multifamily Program Sampling Strategy for Program Year 6 NTG Research

Stratum	Stratum Boundaries	Population Size	Assumed CV or Proportion in Sample Design	Assumed Levels of Confidence & Precision	Target Sample size	Achieved Sample Size	Percent of Sample Frame Contacted[43] to Achieve Sample
Multifamily – Small	All	22	N/A	N/A	22	6	100%
Multifamily – Medium	All	13	N/A	N/A	13	9	100%
Multifamily – Large	All	4	N/A	N/A	4	1	100%
Program Total		**39**		**N/A**	**39**	**16**	**100%**

[43] Sample frame is a list of contacts that have a chance to be selected into the sample. Percent contacted means of all the sample frame how many were called to get the completes.

Free Ridership

The evaluation team assessed free ridership using a customer self-report approach following the SWE framework.[44] 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 SWE 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) *influence* of the program in the decision to carry out the energy-efficient improvements.

Calculation of the MF program free ridership was based on responses to the following questions:

3. The free ridership percentage was estimated for each survey respondent, based on the respondent's answers to a series of key survey questions:
    e. What is likely to have happened if you had not received the program assistance?
    f. By how much would you have reduced the size, scope, or efficiency?
    g. Would your business have paid the entire cost of the upgrade?
    h. How influential was the program in your decision to have the measures installed?
4. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
    c. The influence score was determined based on the maximum influence score of the two influence questions respondents were asked. Participants who reported a maximum influence of 1 (no influence) received an influence score of 50, those who reported a maximum influence of 5 (great influence) were assigned an influence score of 0.
    d. The intention score was determined based on what participants reported would have been likely to happen if they had not received program assistance

Spillover

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 or track as part of its gross savings. The evaluation team asked program participants a battery of questions to quantitatively assess spillover. The spillover questions used are:

7. Since your participation in the program, did you install any additional energy-efficient measures at this facility that did not receive incentives through a Duquesne Light program?
8. Please describe the energy efficient equipment or energy efficiency improvement that was implemented without a Duquesne Light incentive at the [ADDRESS] facility?
9. How influential was your experience in Duquesne Light's [MULTIFAMILY HOUSING RETROFIT] Program in your decision to make this energy efficiency improvement, using a scale of 1 to 5, where 1 is not at all influential and 5 is extremely influential?
10. Would you say the energy savings from the ADDITIONAL energy efficiency improvement you made WITHOUT a Duquesne Light incentive at this same facility was more or less than the savings from the equipment you installed at this same facility for which you DID receive a Duquesne Light incentive?

[44] SWE Guidance memorandum GM-024: Common Approach for Measuring Free riders for Downstream Programs, October 4, 2013.

11. About what percentage [MORE/LESS] was the energy savings of the ADDITIONAL efficiency improvement?
12. What were the reasons that you chose not to pursue obtaining a Duquesne Light incentive for this ADDITIONAL energy efficiency improvement?

This battery of questions was then repeated with respect to additional efficiency improvements made to *other* facilities in the Duquesne service territory operated by the same customer.

The battery of questions attempted to quantify all the savings from additional non-incented equipment installed after the respondent's participation in the program.

The results of the PY6 free ridership and spillover analysis for the Multifamily program can be found below in Table 10-6.

Table 10-6: Program Year 6 Multifamily Program Summary of Evaluation Results for NTG Research

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
Multifamily – Small	1%	0%	99%	0.03	1.7%
Multifamily – Medium	13%	0%	87%	0.20	5.8%
Multifamily – Large	0%	0%	100%	0.00	0.0%
Program Total	**5%**	**0%**	**95%**		**2.0%**

10.4 PROCESS EVALUATION

The process evaluation for the Multifamily program group in PY6 included the following activities:

- Review of the 2014 Pennsylvania TRM and program materials
- Project tracking system and project file review
- Interviews with Duquesne program staff
- In-depth interviews with Program CSPs
- Best Practices Assessment
- Surveys with 16 MF participants as part of an attempted census of the entire PY6 population in October 2015. These surveys included both net-to-gross questions and selected process evaluation questions.

Table 10-7: Multifamily Program Sampling Strategy for Program Year 6

Target Group or Stratum (if appropriate)	Stratum Boundaries (if appropriate)	Population Size	Assumed Proportion or CV in Sample Design	Assumed Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Percent of Population Frame Contacted to Achieve Sample	Used For Evaluation Activities (Impact, Process, NTG)
Multifamily – Small	All	22	N/A	N/A	22	6	100%	Process, NTG
Multifamily – Medium	All	18	N/A	N/A	18	9	100%	Process, NTG
Multifamily – Large	All	64	N/A	N/A	64	1	100%	Process, NTG
Program Total		**104**		**N/A**	**104**	**16**	**100%**	

The Multifamily program process evaluation findings and details can be found in the PY6 Commercial Industrial Process Evaluation report. Highlights of the process evaluation are summarized below:

- The program has a well-documented implementation plan and tracking system.
- Customer eligibility queries and program applications are reviewed and processed manually by the CSP and Duquesne Light staff.
- According to the CSP the program tracking system ("PMRS") is outdated and makes process automation and streamlining difficult or impossible. PMRS is not used by the MFHR CSP due to lack of functionality. The CSP also reports not yet being able to access the tracking system, for uploading project data or querying the database.
- Program participants have a single point of contact, the CSP representative, assigned throughout the entire program application process. The CSP is also the installer which eliminates the market barrier of finding a contractor.
- More than two thirds of program participants have not seen the program website. About one fourth of respondents surveyed reported that the website was useful in providing information about the variety of energy efficiency opportunities in their buildings.
- The satisfaction level with all of the different aspects of the program and with Duquesne Light is high. The few who reporting being less than very satisfied indicated dissatisfaction because of lack of direct contact with Duquesne Light or because a contractor was unprofessional.
- In terms of project implementation, most respondents found it easy to identify the energy efficiency improvements needed and to install the equipment. Those who had difficulties reported a lack of understanding of how to estimate energy savings and costs.
- Respondents most frequently pointed to a desire for more detailed information and more proactive communications from Duquesne Light, when asked how the program could be improved. They also indicated the program needs more promotion in order to increase awareness.
- The CSP for the MFHR Program estimates that it will have served only a small fraction of their markets at the conclusion of the program.

10.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

Table 10-8 provides program specific recommendations based on Navigant's findings in PY6, as well as the status of the recommendations being implemented by Duquesne Light.

Table 10-8: Multifamily Program Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Program management should continue to use the MFHR project reimbursement process that has been so successful to date. The process eliminates the financial barriers to participation by ensuring positive cash flow from day one.	Being Considered
Duquesne Light should review the interface between the CSP and the program tracking system, to determine whether there are ways to make it sufficiently functional for the CSP to use it or whether there are other ways to facilitate reporting by the CSP. (See similar recommendation for Small Commercial Direct Install program.)	Being Considered
Duquesne Light should consider continuing the MFHR program in Phase III. The CSP for the program estimates that it has served only a small fraction of the eligible market thus far.	Being Considered

10.6 FINANCIAL REPORTING

The performance of the MFHR program exceeded expectations and program plans. It achieved 151% of the PY6 energy savings goal while expending 109% of the planned budget. A breakdown of the program finances (by program) is presented in Table 10-9.

Table 10-9: Summary of MFHR Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 to 4)	**$653**	**$653**
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)	$653	$653
5	Program Overhead Costs (Sum of rows 6, 7, 8, 9, 10)	**$656**	**$656**
6	Design & Development	$0	$0
7	Administration, Management, and Technical Assistance[1]	$616	$616
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$19	$19
10	SWE Audit Costs	$21	$21
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)	$1,309	$1,309
13	Total NPV Lifetime Energy Benefits	$1,111	$1,111
14	Total NPV Lifetime Capacity Benefits	$45	$45
15	Total NPV TRC Benefits[4]	$1,156	$1,156
16	TRC Benefit-Cost Ratio[5]	0.88	0.88

NOTES

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.

APPENDIX A | EM&V INFORMATION

Participant Definitions

Table A-0-1: Program Year 6 Participant Definition by Program

Program	Participant Definition	Can there be more than one measure per participant?	Sample Defined By:
Commercial	Unique project number per quarter	Yes	Project
Industrial	Unique project number per quarter	Yes	Measure
SCDI	Unique project number per quarter	Yes	Project
MF	Unique project number per quarter	Yes	Project
REEP	Unique customer account number per quarter	Yes	Project
RARP	Unique customer account number per quarter	Yes	Project
SEP	Unique customer account number per quarter	Yes	Project
WHEAP	Unique customer account number per quarter	Yes	Project

Program Year 6 Evaluation Activities

Table A-0-2: Program Year 6 Actual Evaluation Activities

Programs (Sub Programs if necessary)	Sectors	Records Review	Participant Surveys	Non-participant Surveys	Phone Verifications	Site Visits	Metering
Commercial	C/I	20	0	0	7	13	5
Government/Non-profit	C/I	11	0	0	3	8	6
Industrial	C/I	20	0	0	7	13	6
SCDI	C/I	19	37	0	13	6	0
MF	C/I	14	16	0	10	4	5
REEP	Res	43	69	0	69	0	0
RARP	Res	63	63	0	63	0	0

Programs (Sub Programs if necessary)	Sectors	Records Review	Participant Surveys	Non-participant Surveys	Phone Verifications	Site Visits	Metering
SEP	Res	31	31	0	31	0	0
LIEEP	Res	49	82	0	82	0	0
WHEAP	Res	17	17	0	17	0	0

APPENDIX B | TRC INCREMENTAL COSTS

Table B-0-1, below, provides measure incremental cost data only for those measures where the cost was not obtained from the SWE incremental cost database. Also provided is the source of the cost estimate.

Table B-0-1. Measure Incremental Costs Not Taken from SWE Resources

Program(s)	Measure	Incremental Cost	Incremental Cost Source
REEP & LIEEP - Upstream Lighting	ECOVA CFL	$2.54	Unit cost of average PY6 CFLs sold
REEP & LIEEP - Upstream Lighting	ECOVA LED	$16.34	Unit cost of average PY6 LEDs sold
LIEEP, REEP, & SEP	EE Kit: 2-13W, 1-20W, 1-23W, 2-LED NL, 1-Smart Strip (APOGEE)	$28.20	Duquesne Light Contract Price (Baden 11-4-2014)
REEP & LIEEP	ENERGY STAR Television	$14.30	ITRON CPUC Work Order 017, pg 3-13
RARP	Refrigerator Recycling - Retire	$82.50	Contract amount
RARP	Refrigerator Recycling - Replace	$82.50	Contract amount
RARP	Freezer Recycling - Retire	$82.50	Contract amount
RARP	Freezer Recycling - Replace	$82.50	Contract amount
LIEEP	Refrigerator Recycling - LI Replace (DI - DLC Cost Share)	$82.50	Contract amount
REEP & LIEEP	Solar Water Heater	Actual	Invoice amount
Commercial, GNI, and Industrial	Custom, C&I	Actual	Invoice amount
Commercial, GNI, and Industrial	Insulated Holding Cabinet-Half Size ≤ 0.2 kW	Actual	Invoice amount
Commercial, GNI, and Industrial	Solid-Door Freezer/1 door/19-30 ft.	Actual	Invoice amount
Commercial, GNI, and Industrial	Solid-Door Freezer/2 door/31-60 ft.	Actual	Invoice amount
Commercial, GNI, and Industrial	Solid-Door Freezer/3 door/61-90 ft.	Actual	Invoice amount
Commercial, GNI, and Industrial	Solid-Door Refrigerator/1 door/19-30 ft.	Actual	Invoice amount
Commercial, GNI, and Industrial	Solid-Door Refrigerator/2 door/31-60 ft.	Actual	Invoice amount
Commercial, GNI, and Industrial	Screw-in CFL Reflector, 14 to 26 watts (ENERGY STAR)	Actual	Invoice amount

Program(s)	Measure	Incremental Cost	Incremental Cost Source
Commercial, GNI, and Industrial	T5-4 ft 1 Lamp - HO - Electronic Ballast	$67.45	C&I Fluorescent Lighting Cost Study (C&I FLS)-1
Commercial, GNI, and Industrial	T5-4 ft 2 lamp - HO Electronic ballast	$57.23	C&I Fluorescent Lighting Cost Study (C&I FLS)-2
Commercial, GNI, and Industrial	T5 4 ft 3 lamp HO electronic ballast	$67.45	C&I Fluorescent Lighting Cost Study (C&I FLS)-3
Commercial, GNI, and Industrial	T5 4 ft 4 Lamp HO Electronic ballast	$49.05	C&I Fluorescent Lighting Cost Study (C&I FLS)-4
Commercial, GNI, and Industrial	T5 4 ft 6 lamp HO electronic ballast	$14.31	C&I Fluorescent Lighting Cost Study (C&I FLS)-5
Commercial, GNI, and Industrial	T8-17W 2 ft 1 lamp electronic ballast	$44.94	C&I Fluorescent Lighting Cost Study (C&I FLS)-7
Commercial, GNI, and Industrial	T8-17W 2 ft 2 lamp electronic ballast	$51.35	C&I Fluorescent Lighting Cost Study (C&I FLS)-8
Commercial, GNI, and Industrial	T8-17W 2 ft 3 lamp electronic ballast	$56.17	C&I Fluorescent Lighting Cost Study (C&I FLS)-9
Commercial, GNI, and Industrial	T8-17W 2 ft 4 lamp - electronic Ballast	$75.44	C&I Fluorescent Lighting Cost Study (C&I FLS)-10
Commercial, GNI, and Industrial	T8-25W 3 ft 1 lamp electronic ballast	$47.59	C&I Fluorescent Lighting Cost Study (C&I FLS)-11
Commercial, GNI, and Industrial	T8-25W 3 ft 2 lamp electronic ballast	$57.16	C&I Fluorescent Lighting Cost Study (C&I FLS)-12
Commercial, GNI, and Industrial	T8-25W 3 ft 4 lamp - electronic ballast	$67.86	C&I Fluorescent Lighting Cost Study (C&I FLS)-14
Commercial, GNI, and Industrial	T8-30W 4 ft 1 lamp (or 24" U tube) electronic ballast	$48.62	C&I Fluorescent Lighting Cost Study (C&I FLS)-15
Commercial, GNI, and Industrial	T8-28W 4 ft 1 lamp (or 24" U tube) electronic ballast	$50.02	C&I Fluorescent Lighting Cost Study (C&I FLS)-20
Commercial, GNI, and Industrial	T8-25W 4 ft 1 lamp - electronic ballast	$50.95	C&I Fluorescent Lighting Cost Study (C&I FLS)-25
Commercial, GNI, and Industrial	T8-30W 4 ft 2 lamp - electronic ballast	$49.15	C&I Fluorescent Lighting Cost Study (C&I FLS)-16
Commercial, GNI, and Industrial	T8-28W 4 ft 2 lamp - electronic ballast	$51.95	C&I Fluorescent Lighting Cost Study (C&I FLS)-21
Commercial, GNI, and Industrial	T8-25W 4 ft 2 lamp - electronic Ballast	$53.81	C&I Fluorescent Lighting Cost Study (C&I FLS)-26
Commercial, GNI, and Industrial	T8-30W 4 ft 3 lamp electronic ballast	$55.09	C&I Fluorescent Lighting Cost Study (C&I FLS)-17
Commercial, GNI, and Industrial	T8-28W 4 ft 3 lamp electronic ballast	$59.29	C&I Fluorescent Lighting Cost Study (C&I FLS)-22
Commercial, GNI, and Industrial	T8-30W 4 ft 4 lamp electronic ballast	$58.45	C&I Fluorescent Lighting Cost Study (C&I FLS)-18

Program(s)	Measure	Incremental Cost	Incremental Cost Source
Commercial, GNI, and Industrial	T8-28W 4 ft 4 lamp electronic ballast	$64.05	C&I Fluorescent Lighting Cost Study (C&I FLS)-23
Commercial, GNI, and Industrial	T8-25W 4 ft 4 lamp electronic ballast	$76.66	C&I Fluorescent Lighting Cost Study (C&I FLS)-28
Commercial, GNI, and Industrial	T8-30W 4 ft 6 lamp electronic ballast	$80.33	C&I Fluorescent Lighting Cost Study (C&I FLS)-19
Commercial, GNI, and Industrial	T8-28W 4 ft 6 lamp electronic ballast	$80.30	C&I Fluorescent Lighting Cost Study (C&I FLS)-24
Commercial, GNI, and Industrial	T8 8 ft 2 lamp electronic ballast	$69.40	C&I Fluorescent Lighting Cost Study (C&I FLS)-32
Commercial, GNI, and Industrial	T8 8 ft 2 lamp HO electronic ballast	$148.93	C&I Fluorescent Lighting Cost Study (C&I FLS)-35
Commercial, GNI, and Industrial	Remove 4 ft linear fluorescent lamp	$27.27	C&I Fluorescent Lighting Cost Study (C&I FLS)-39
Commercial, GNI, and Industrial	Remove 8 ft linear fluorescent lamp	$27.27	C&I Fluorescent Lighting Cost Study (C&I FLS)-40
Commercial, GNI, and Industrial	Metal Halide, Pulse-Start Fixture, Exterior, 175W-320W	$186.93	Internet costing research, included in TRC data request
Commercial, GNI, and Industrial	Metal Halide, Pulse-Start Fixture, Exterior >320W	$478.85	Internet costing research, included in TRC data request
Commercial, GNI, and Industrial	Interior Pulse Start Metal Halide 175W	$189.15	Internet costing research, included in TRC data request
Commercial, GNI, and Industrial	Metal Halide, Pulse-Start Fixture, Interior 250 W	$197.99	Internet costing research, included in TRC data request
Commercial, GNI, and Industrial	Interior Pulse Start Metal Halide 350W	$193.99	Internet costing research, included in TRC data request
Commercial, GNI, and Industrial	Interior Pulse Start Metal Halide 750W	$666.66	Internet costing research, included in TRC data request
Commercial, GNI, and Industrial	Dimming electronic ballast, for daylighting	Actual	Invoiced amount
Commercial, GNI, and Industrial	Photocell	Actual	Invoiced amount
Commercial, GNI, and Industrial	Timeclock	Actual	Invoiced amount
Commercial, GNI, and Industrial	LED PAR 20 7-9W	$25.33	ECOVA Upstream LEDs
Commercial, GNI, and Industrial	LED PAR 30 10-13W	$18.09	ECOVA Upstream LEDs
Commercial, GNI, and Industrial	LED PAR 38 10-21W	$20.41	ECOVA Upstream LEDs
Commercial, GNI, and Industrial	LED MR16 4-7W	$7.70	ECOVA Upstream LEDs

Program(s)	Measure	Incremental Cost	Incremental Cost Source
Commercial, GNI, and Industrial	LED A-Line 8-12W	$12.23	ECOVA Upstream LEDs
Commercial, GNI, and Industrial	LED Decorative 2-4W	$10.03	ECOVA Upstream LEDs
Multifamily	Custom, C&I, Interior Lighting	$0.22	Direct-Install Performance Payment, All-in cost $/kWh
Multifamily	Custom, C&I, Exterior Lighting	$0.22	Direct-Install Performance Payment, All-in cost $/kWh
Whole House Retrofit	Whole Home 16W R30 CFL	$9.80	SWE Potential Study

Note: C&I Fluorescent Lighting Cost Study (C&I FLS) refers to primary pricing research conducted by Duquesne Light. ECOVA Upstream LEDs refers to pricing data from ECOVA, the CSP for Duquesne Light's Upstream Lighting program.

APPENDIX C | LOW-INCOME PARTICIPATION IN NON-LOW-INCOME PROGRAMS

Low-income savings were derived from the following sources:

- Participation by low-income households in other residential programs. Duquesne Light's customer information system includes a "flag" indicating low-income status for households who have been identified as qualified for other low-income programs (e.g., LIURP). When one of these customers participates in a residential Act 129 program the costs and savings associated with their participation are automatically categorized as part of the Low-income Energy Efficiency program (LIEEP). This includes participation by these customers in REEP, RARP, and SEP.
- Participation by low-income households in WHEAP were categorized based on detailed income classification completed by the program CSP, PSD. This analysis was used to adjust customers who were not "flagged" as low-income in PMRS but still qualified as low-income households.
- Participation by low-income households in the utility's LIURP. This program sometimes implements initiatives aimed at making efficiency improvements (e.g., installation of Smart Strips and refrigerator replacements) in low-income homes, for example, through an arrangement with a public housing agency. Costs and savings from these measures are counted as part of LIEEP.
- Savings associated with the Upstream Lighting program component of REEP. Navigant conducted a survey of the general residential population in PY6 that estimated the percentage of efficient lighting purchasers who qualified as low-income for both CFL and LED purchases. This survey determined that 4.9% of CFL and 2.3% of LED bulbs purchased were installed in Low Income households.

APPENDIX D | RESIDENTIAL LIGHTING UPSTREAM PROGRAM CROSS-SECTOR SALES

Navigant completed in-store intercepts in PY6 to re-evaluate cross sector sales. These surveys were used not only to estimate free ridership for the program but also to determine the extent to which bulbs being sold through the program were destined for non-residential facilities and, if so, which types of facilities. These surveys found that none of the program bulbs purchased were reported to be destined for non-residential facilities. As a result, no cross-sector sales are being applied to the upstream lighting program savings.

APPENDIX E | GLOSSARY OF TERMS

This Glossary of Terms was provided by the SWE.

-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 *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: 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 and 6 PM.

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 kW (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. Demand response 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 percent 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.

Percent of Estimate Committed: The program year-to-date total committed savings as a percent 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 demand response 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 percent 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 percent 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 coefficient of variation 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.

References

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.