EDC Program Year 7 Annual Report Template

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

Presented to:

Pennsylvania Public Utility Commission

Pennsylvania Act 129 of 2008
Energy Efficiency and Conservation Plan

Prepared for:

Duquesne Light Company

November 15, 2016

Prepared by:

NAVIGANT CONSULTING, INC.

NAVIGANT

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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.

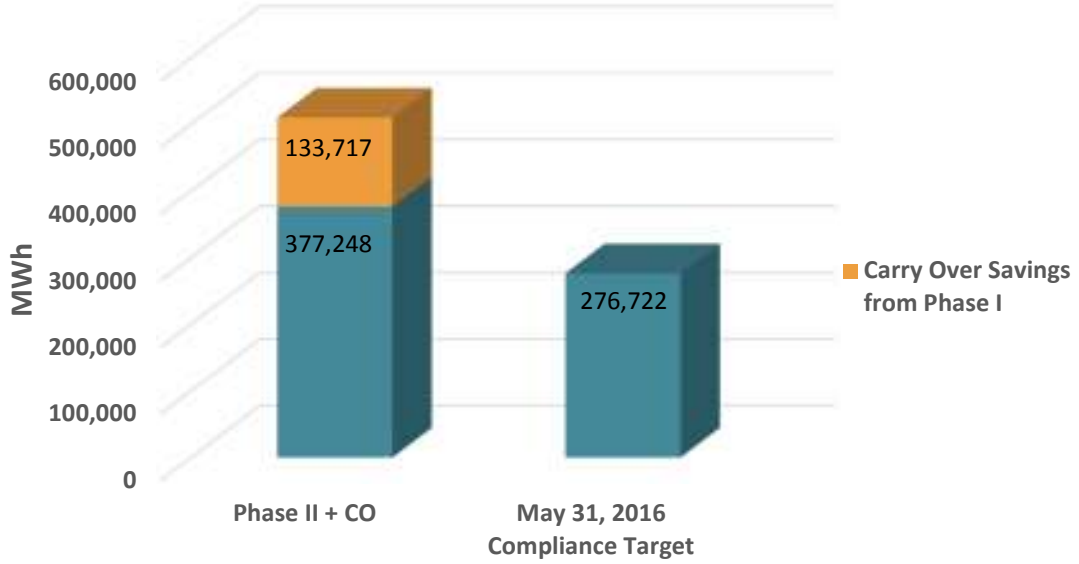
Implementation of Phase II Act 129 programs began June 1, 2013. This report documents the progress and effectiveness of the Phase II EE&C accomplishments for Duquesne Light Company (Duquesne Light) in Program Year 7 (PY7), defined as June 1, 2015 through May 31, 2016, as well as the cumulative accomplishments of the programs since inception of Phase II. This report 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 Consulting, Inc. (Navigant) evaluated the programs, which included measurement and verification of the savings.

1.1 SUMMARY OF PROGRESS TOWARD COMPLIANCE TARGETS

Duquesne Light has achieved 185 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 I (Cumulative Annual MWh/Yr)	Phase II+CO Verified Gross Savings (Cumulative MWh/Yr)
Residential (Non Low Income)	62,571	150,550	72,602	223,152
Residential (Low Income)	6,070	23,173	16,576	39,749
Total Residential (Non Low Income Plus Low Income)	68,641	173,723	89,178	262,901
Commercial and Industrial	64,368	181,390	36,817	218,207
GNI	9,178	22,135	7,722	29,857
Total	142,187	377,248	133,717	510,965

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 I (Lifetime MWh)	Phase II+CO Verified Gross Savings (Lifetime MWh)
Residential (Non Low Income)	440,626	1,069,935	429,775	1,499,710
Residential (Low Income)	34,903	138,723	99,456	238,179
Total Residential (Non Low Income Plus Low Income)	475,528	1,208,657	529,231	1,737,888
Commercial and Industrial	953,432	2,167,057	515,530	2,682,587
GNI	133,176	345,912	114,012	459,924
Total	1,562,136	3,721,626	1,158,773	4,880,399

Table 1-3: Phase I and Phase II Cumulative Annual Savings

Sector	Phase I Cumulative Annual Savings (MWh)	Phase II Cumulative Annual Savings (MWh)	Act 129 Cumulative Annual Savings (MWh) Through Phase II
Residential (Non Low Income)	173,310	150,550	323,860
Residential (Low Income)	39,589	23,173	62,762
Total Residential (Non Low Income Plus Low Income)	212,899	173,723	386,622
Commercial and Industrial	308,984	181,390	490,373
GNI	49,997	22,135	72,132
Total	571,880	377,248	949,127

Table 1-4: 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 Savings (Lifetime MWh)	Phase II Verified Net Savings (Lifetime MWh)
Residential (Non Low Income)	50,551	103,398	319,225	769,210
Residential (Low Income)	4,732	13,427	27,133	105,141
Total Residential (Non Low Income Plus Low Income)	55,283	116,825	346,358	874,351
Commercial and Industrial	42,341	115,439	959,978	1,753,667
GNI	7,375	16,055	98,502	218,420
Total	104,999	248,319	1,404,839	2,846,439

In addition, Duquesne Light has achieved 45.6 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 1-11 and Table 1-12 of this section.

[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.

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

There are 14 measures available at no cost to low income customers. These measures offered to the low income sector comprise 14 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 1-5 and Table 1-6.

Table 1-5: Phase II Low income Sector Compliance (Number of Measures)

	Low income Sector	All Sectors	% Low income	Goal
# of Measures Offered	14	97	14%	8.4%

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

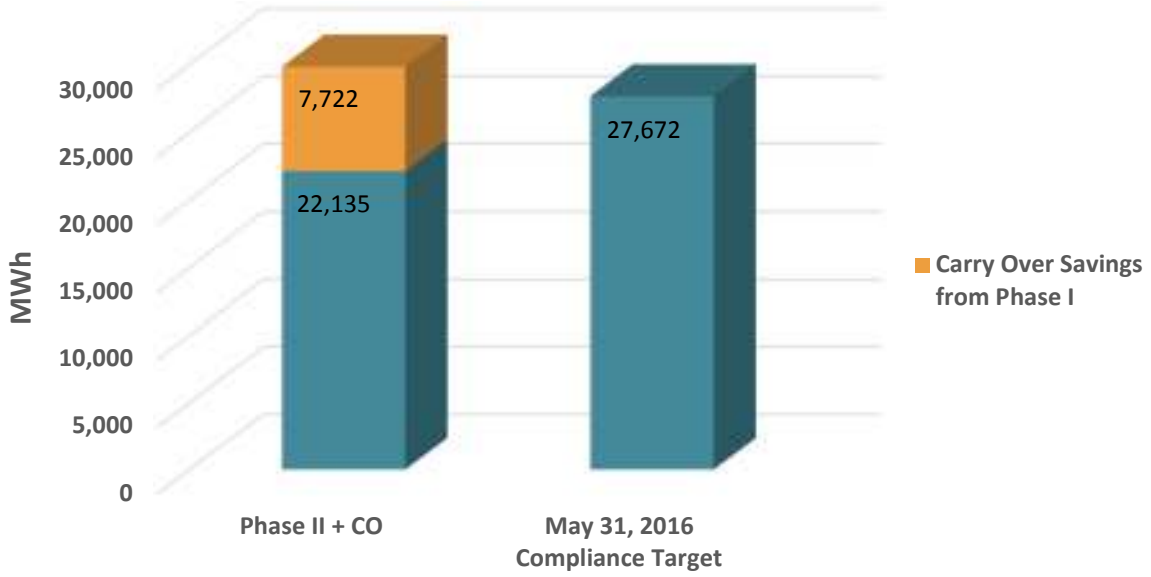
	Phase II Gross Verified
Low Income Verified Gross Savings from Low Income Programs (Cumulative Annual MWh/Yr)	5,495
Low Income Verified Gross Savings from Other Residential Programs (Cumulative Annual MWh/Yr)	17,678
Low Income Carryover Savings from Phase I (Incremental Annual MWh/Yr)	16,576
All Low Income Verified Gross Savings [Sum of First Two Rows]	39,749
Progress Towards Low Income Goal [Previous Row divided by Phase II MWh Target]	319.2%
Goal (MWh/Yr)	12,452

The Phase II verified gross energy savings achieved through programs specifically designed for income-eligible customers are 5,495 MWh/yr and 17,886 MWh/year through other programs; this is 319 percent against the 4.5 percent Phase II total portfolio verified gross energy savings target for the low income sector.

[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).

Duquesne Light achieved 108 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 PY7 and including carry-over savings from Phase I as shown in Figure 1-3.

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 1-7.

Table 1-7: 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 Paid ($1,000)
Residential	247,543	150,550	10.793	$6,773
Low income	34,519	23,173	1.509	$489
Small Commercial and Industrial	660	66,439	13.886	$3,060
Large Commercial and Industrial	260	114,951	15.194	$5,906
Government, Nonprofit, and Institutional	247	22,135	4.238	$2,891
Phase II Total	**283,229**	**377,248**	**45.620**	**$19,119**

A summary of the energy savings from Phase I programs that remain in Phase II is shown in Table 1-8 below for both the beginning and the end of Phase II.[4]

Table 1-8: Summary of Phase I Verified Gross Savings Remaining Through Phase II

Sector	Phase I Carryover (MWh)	Phase II Cumulative Annual Savings (MWh)	Phase I Carryover Savings + Phase II Cumulative Annual Savings (MWh)	Phase II Compliance Targets (MWh)	Phase II Carryover Savings (MWh)[1]
Residential	72,602	150,550	223,152	N/A	N/A
Low income	16,576	23,173	39,749	12,452	3,431[5]
Small Commercial and Industrial	36,817	66,439	218,207	N/A	N/A
Large Commercial and Industrial		114,951			
Government, Nonprofit, and Institutional	7,722	22,135	29,857	27,672	0
Total	**133,717**	377,248	510,965	**276,722**	**100,526**[2]

[1] To be eligible for Phase II carryover, all of the Phase II target must have been met and exceeded by Phase II program spending.
[2] Not a summation but rather for the entire portfolio for Phase II, of which the low-income amount is a subset.

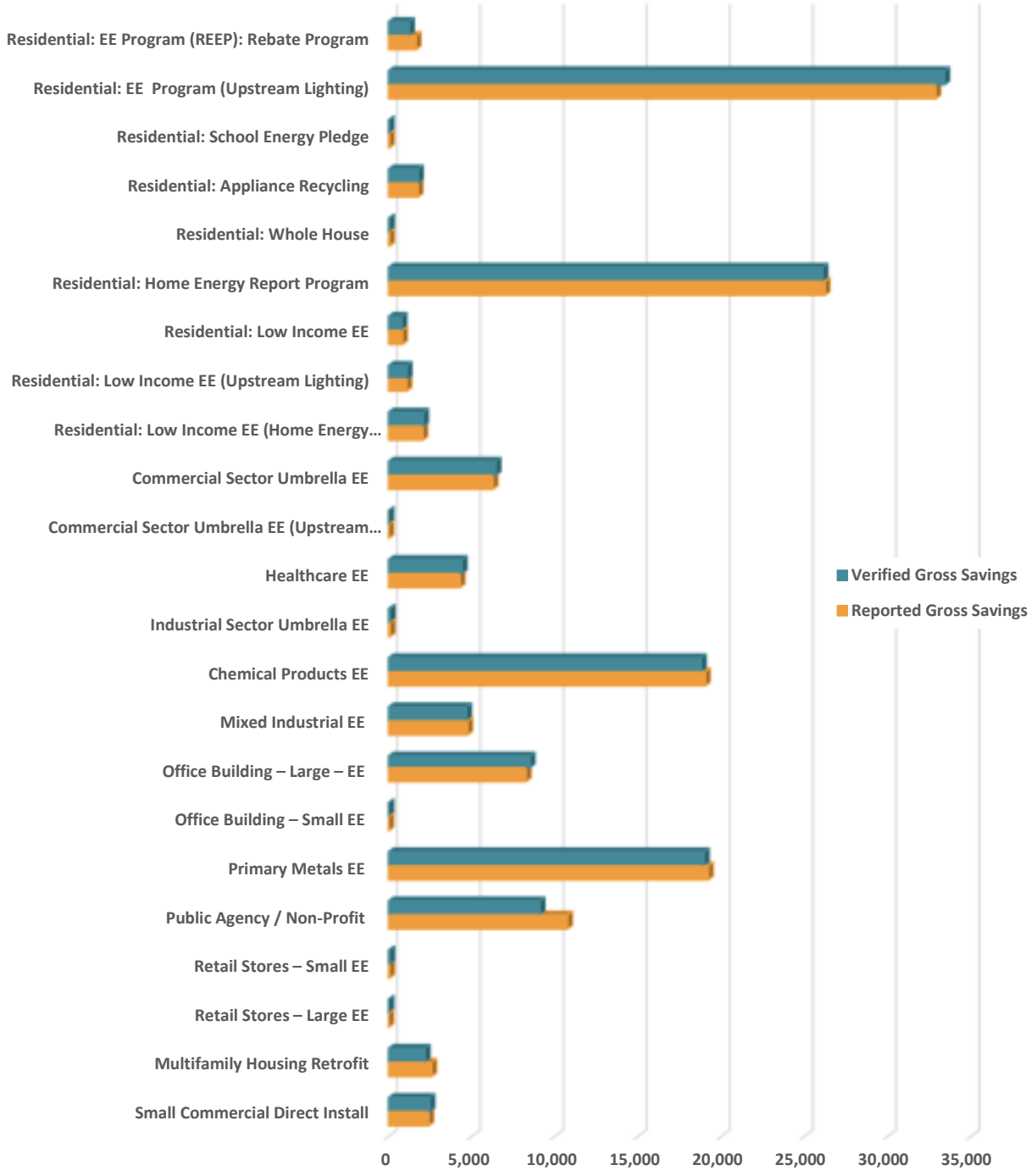
[4] To be eligible for Phase II carryover, all of the Phase II target must have been met and exceeded by Phase II program spending. For example, if the Phase II target was 1,000 MWh and 500 MWh was carried over from Phase I, the EDC would have had to show verified savings of at least 1,501 MWh to realize a Phase II carryover of 1 MWh. Low income carryover savings are calculated differently from other carryover savings. Only savings resulting from programs specifically targeting low income customers will count toward the Phase III savings target for low income. Some savings achieved during Phase II met that criterion and some did not. To calculate low income carryover savings, the ratio of low income specific low income savings to all low income savings (including both low income specific and non-low income specific savings) is multiplied by the total amount of low income savings in excess of the Phase II target that were paid for with Phase II funds.

[5] ([23,173 (Phase II Cumulative Annual Savings (MWh))] – [12, 452 (Phase II Target (MWh))]) * 32%. The 32% represents the proportion of the total low income verified Phase II savings associated with programs that were targeted specifically to low income customers. This includes 997 MWh from LIEEP (but excludes LIEEP measures: Apogee Kits, Upstream Lighting, RARP, Rebates), 2,085 MWh from low income HER, and 4,105 MWh from Multi-Family (only the portion, 96%, that was verified to go directly to low income customers).

1.2 SUMMARY OF ENERGY IMPACTS

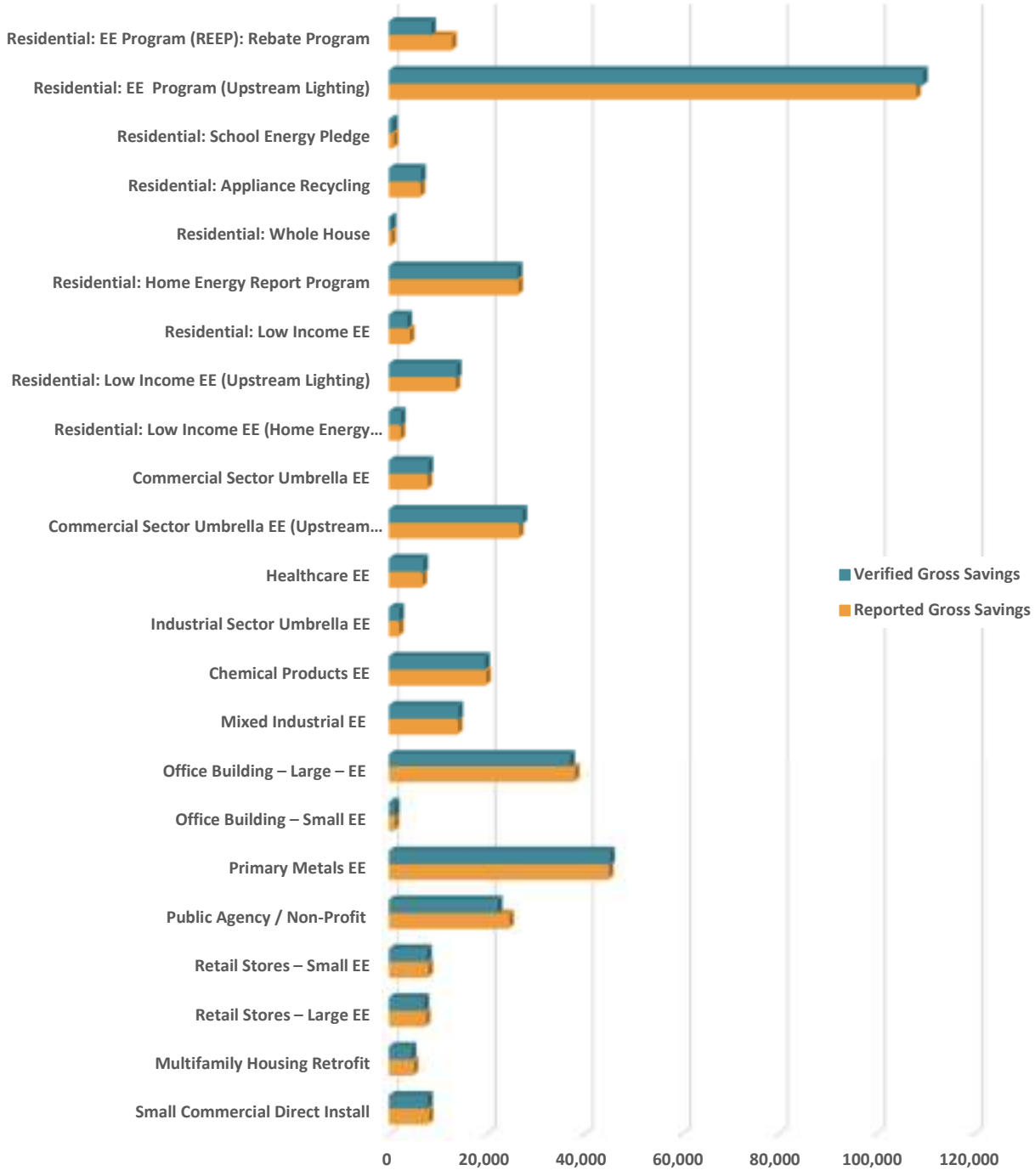
A summary of the reported and verified energy savings by program for PY7 is presented in Figure 1-4.

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 PY7 are presented in Table 1-9 and Table 1-10.

Table 1-9: Reported Participation and Gross Energy Savings by Program

	Participants		Reported Gross Impact (MWh/Yr)	
Program	PYTD	Phase II	PYTD	Phase II
Residential: EE Program (REEP): Rebate Program	6,193	38,733	1,636	12,619
Residential: EE Program (Upstream Lighting)	N/A	N/A	32,875	107,975
Residential: School Energy Pledge	125	1,698	36	618
Residential: Appliance Recycling	1,715	6,675	1,759	6,139
Residential: Whole House	64	186	43	128
Residential: Home Energy Report Program	200,251	200,251	26,230	26,230
Residential: Low Income EE	1,774	9,366	825	3,936
Residential: Low Income EE (Upstream Lighting)	N/A	N/A	1,087	13,371
Residential: Low Income EE (Home Energy Report)	25,153	25,153	2,049	2,049
Commercial Sector Umbrella EE	25	61	6,270	7,597
Commercial Sector Umbrella EE (Upstream Lighting)	N/A	N/A	0	26,400
Healthcare EE	2	12	4,288	6,506
Industrial Sector Umbrella EE	3	6	75	1,716
Chemical Products EE	6	20	19,033	19,640
Mixed Industrial EE	25	77	4,740	13,833
Office Building – Large – EE	11	120	8,264	37,858
Office Building – Small EE	0	35	0	827
Primary Metals EE	13	38	19,213	44,840
Public Agency / Non-Profit	59	163	10,745	24,355
Retail Stores – Small EE	22	371	49	7,761
Retail Stores – Large EE	0	70	0	7,247
Multifamily Housing Retrofit	45	84	2,579	4,750
Small Commercial Direct Install	22	110	2,406	7,835
TOTAL PORTFOLIO	**235,508**	**283,229**	**144,200**	**384,229**

Table 1-10: 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	1,636	76%	1,236	12%	8,301	2.9%
Residential: EE Program (Upstream Lighting)	32,875	102%	33,404	0%	109,372	0.4%
Residential: School Energy Pledge	36	66%	24	16%	435	6.0%
Residential: Appliance Recycling	1,759	101%	1,775	1%	6,229	1.6%
Residential: Whole House	43	89%	38	6%	120	4.0%
Residential: Home Energy Report Program	26,230	99%	26,094	0%	26,094	0.0%
Residential: Low Income EE	825	96%	791	2%	3,410	1.1%
Residential: Low Income EE (Upstream Lighting)	1,087	101%	1,100	0%	13,573	0.7%
Residential: Low Income EE (Home Energy Report)	2,049	102%	2,085	0%	2,085	0.0%
Commercial Sector Umbrella EE	6,270	103%	6,442	4%	7,747	3.6%
Commercial Sector Umbrella EE (Upstream Lighting)	0	103%	0	4%	27,079	1.8%
Healthcare EE	4,288	103%	4,406	4%	6,679	2.9%
Industrial Sector Umbrella EE	75	99%	74	2%	1,751	2.0%
Chemical Products EE	19,033	99%	18,788	2%	19,407	2.1%
Mixed Industrial EE	4,740	99%	4,679	2%	13,888	8.6%
Office Building – Large – EE	8,264	103%	8,490	4%	36,879	5.4%
Office Building – Small EE	0	103%	0	4%	838	2.0%
Primary Metals EE	19,213	99%	18,966	2%	45,091	3.0%
Public Agency / Non-Profit	10,745	85%	9,091	10%	21,964	19.1%
Retail Stores – Small EE	49	103%	50	4%	7,468	6.6%
Retail Stores – Large EE	0	103%	0	4%	6,896	7.7%

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]
Multifamily Housing Retrofit	2,579	85%	2,181	10%	4,276	5.8%
Small Commercial Direct Install	2,406	103%	2,472	4%	7,667	2.1%
TOTAL PORTFOLIO	**144,200**	**99%**	**142,187**	**0.8%**	**377,248**	**1.4%**
Phase I Carryover	**N/A**	**N/A**	**N/A**	**N/A**	**133,717**	**N/A**
Total Phase II+CO	**N/A**	**N/A**	**N/A**	**N/A**	**510,965**	**N/A**

[1] At the 85% confidence level
[2] At the 90% confidence level

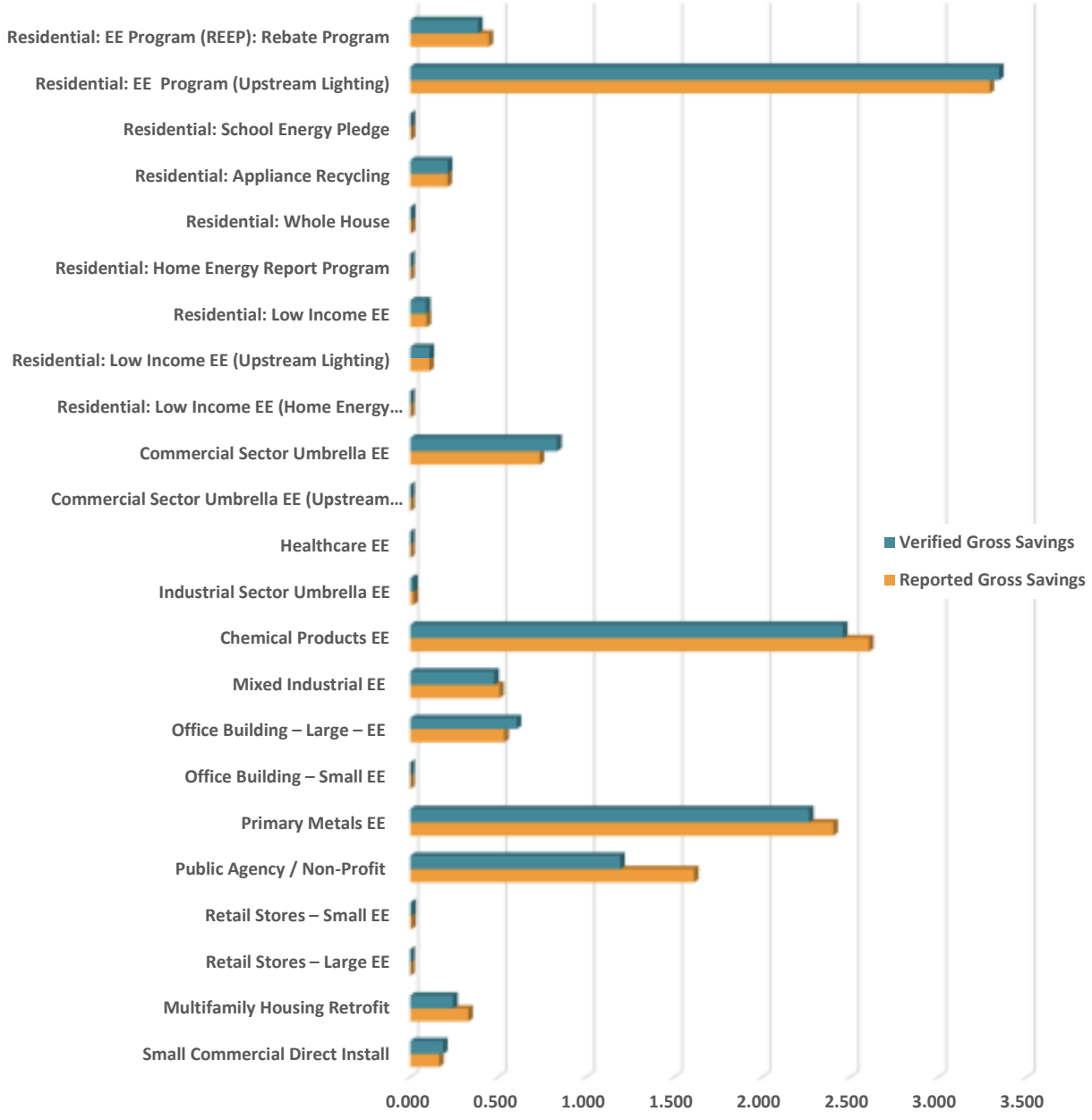
1.3 SUMMARY OF FUEL SWITCHING IMPACTS

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

1.4 SUMMARY OF DEMAND IMPACTS

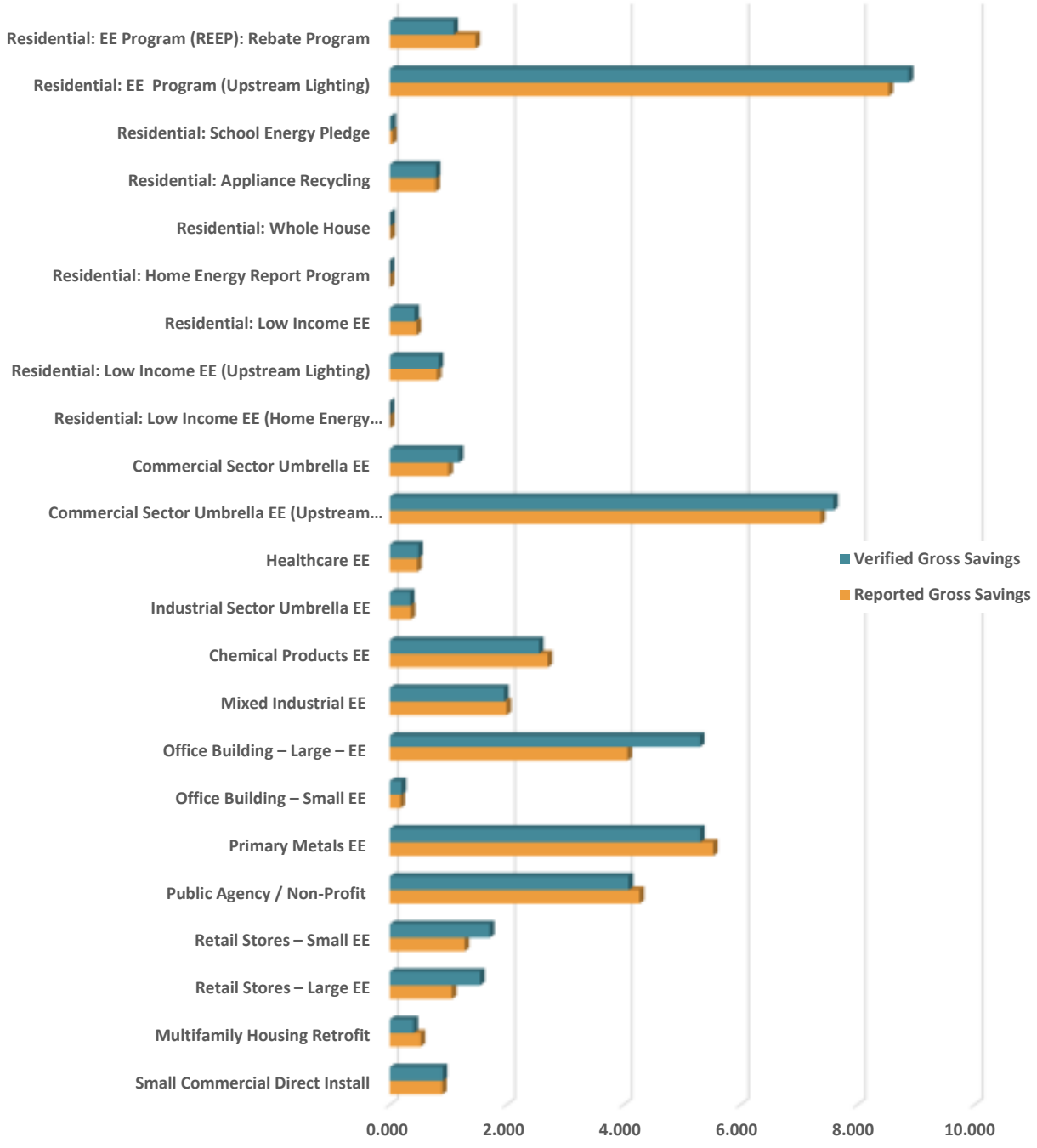
A summary of the reported and verified demand reduction by program for PY7 is presented in Figure 1-6. The impacts below reflect the line loss factors shown in Table 1-15.

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 PY7 is presented in Table 1-11 and Table 1-12.

Table 1-11: 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	6,193	38,733	0.45	1.466
Residential: EE Program (Upstream Lighting)	N/A	N/A	3.29	8.535
Residential: School Energy Pledge	125	1,698	0.00	0.038
Residential: Appliance Recycling	1,715	6,675	0.21	0.782
Residential: Whole House	64	186	0.00	0.013
Residential: Home Energy Report Program	200,251	200,251	0.00	0.000
Residential: Low Income EE	1,774	9,366	0.09	0.457
Residential: Low Income EE (Upstream Lighting)	N/A	N/A	0.11	0.807
Residential: Low Income EE (Home Energy Report)	25,153	25,153	0.00	0.000
Commercial Sector Umbrella EE	25	61	0.74	1.002
Commercial Sector Umbrella EE (Upstream Lighting)	N/A	N/A	0.00	7.373
Healthcare EE	2	12	0.00	0.469
Industrial Sector Umbrella EE	3	6	0.02	0.357
Chemical Products EE	6	20	2.61	2.702
Mixed Industrial EE	25	77	0.51	1.997
Office Building – Large – EE	11	120	0.53	4.066
Office Building – Small EE	0	35	0.00	0.181
Primary Metals EE	13	38	2.40	5.533
Public Agency / Non-Profit	59	163	1.61	4.273
Retail Stores – Small EE	22	371	0.01	1.279
Retail Stores – Large EE	0	70	0.00	1.063
Multifamily Housing Retrofit	45	84	0.33	0.526
Small Commercial Direct Install	22	110	0.16	0.895
TOTAL PORTFOLIO	**235,508**	**283,229**	**13.07**	**43.813**

Table 1-12: 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	0.445	87%	0.386	8.0%	1.089	5.1%
Residential: EE Program (Upstream Lighting)	3.290	102%	3.343	0.0%	8.876	0.3%
Residential: School Energy Pledge	0.003	71%	0.002	18.2%	0.028	6.0%
Residential: Appliance Recycling	0.211	101%	0.213	1.3%	0.788	1.6%
Residential: Whole House	0.004	87%	0.004	6.1%	0.012	4.0%
Residential: Home Energy Report Program	0.000	100%	0.000	0.0%	0.000	0.0%
Residential: Low Income EE	0.093	97%	0.090	2.4%	0.424	1.4%
Residential: Low Income EE (Upstream Lighting)	0.109	101%	0.110	0.0%	0.833	0.7%
Residential: Low Income EE (Home Energy Report)	0.000	100%	0.000	0.0%	0.000	0.0%
Commercial Sector Umbrella EE	0.735	113%	0.834	20.8%	1.179	17.4%
Commercial Sector Umbrella EE (Upstream Lighting)	0.000	113%	0.000	20.8%	7.591	2.5%
Healthcare EE	0.000	113%	0.000	20.8%	0.486	2.5%
Industrial Sector Umbrella EE	0.019	94%	0.017	6.4%	0.344	2.3%
Chemical Products EE	2.606	94%	2.457	6.4%	2.550	7.0%
Mixed Industrial EE	0.506	94%	0.478	6.4%	1.956	9.6%
Office Building – Large – EE	0.534	113%	0.605	20.8%	5.305	15.4%
Office Building – Small EE	0.000	113%	0.000	20.8%	0.203	6.4%
Primary Metals EE	2.402	94%	2.265	6.4%	5.307	4.2%
Public Agency / Non-Profit	1.612	74%	1.192	28.8%	4.085	10.6%
Retail Stores – Small EE	0.007	113%	0.008	20.8%	1.709	17.3%

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]
Retail Stores – Large EE	0.000	113%	0.000	20.8%	1.546	22.0%
Multifamily Housing Retrofit	0.330	74%	0.244	28.8%	0.404	19.9%
Small Commercial Direct Install	0.165	113%	0.187	20.8%	0.904	6.3%
TOTAL PORTFOLIO	**13.071**	**95%**	**12.438**	**3.7%**	**45.620**	**2.5%**
Phase I Carryover	**N/A**	**N/A**	**N/A**	**N/A**	**0**	**N/A**
Total Phase II+CO	**N/A**	**N/A**	**N/A**	**N/A**	**45.620**	**N/A**

[1] At the 85% confidence level
[2] At the 90% confidence level

1.5 SUMMARY OF PY7 NET-TO-GROSS RATIOS

Per the 2013 TRC Order, EDCs are required to conduct net-to-gross (NTG) research. NTG ratios are not used for compliance purposes, but are used for cost effectiveness reporting and future program planning and should be applied to gross savings in order to calculate net verified energy and demand savings. NTG should be estimated for all programs, including low income and programs that distribute free measures. The only exception is if an EDC (or its evaluation consultant) provides an explanation, acceptable to the SWE, that estimating NTG for a given program would be inappropriate or unfeasible. Table 1-13 presents a summary of NTG ratios by program.

Table 1-13: PY7 NTG Ratios by Program.

Program Name	Free Ridership (%)	Spillover (%)	NTG Ratio PY7	PY7 Verified Net Energy Savings (MWh/Yr)	PY7 Verified Net Demand Savings (MW/Yr)	NTG Categories Included[1]
Residential: EE Program (REEP): Rebate Program	50%	8%	58%	714	0.223	FR, Part. SO
Residential: EE Program (Upstream Lighting)	54%	24%	69%	23,124	2.314	FR, Part. SO
Residential: School Energy Pledge	31%	19%	87%	21	0.002	FR, Part. SO
Residential: Appliance Recycling	72%	4%	32%	570	0.069	FR, Part. SO
Residential: Whole House	33%	6%	73%	27	0.003	FR, Part. SO
Residential: Home Energy Report Program	0%	0%	100%	26,094	0.000	None
Residential: Low Income EE	56%	6%	50%	397	0.045	FR, Part. SO
Residential: Low Income EE (Upstream Lighting)	54%	24%	69%	761	0.076	FR, Part. SO
Residential: Low Income EE (Home Energy Report)	0%	0%	100%	2,085	0.000	None
Commercial Sector Umbrella EE	44%	0%	56%	3,588	0.464	FR, Part. SO
Commercial Sector Umbrella EE (Upstream Lighting)	N/A	N/A	N/A	0	0.000	FR, Part. SO
Healthcare EE	44%	0%	56%	2,454	0.000	FR, Part. SO
Industrial Sector Umbrella EE	32%	0%	68%	50	0.012	FR, Part. SO
Chemical Products EE	32%	0%	68%	12,857	1.681	FR, Part. SO
Mixed Industrial EE	32%	0%	68%	3,202	0.327	FR, Part. SO
Office Building – Large – EE	44%	0%	56%	4,729	0.337	FR, Part. SO
Office Building – Small EE	44%	0%	56%	0	0.000	FR, Part. SO
Primary Metals EE	32%	0%	68%	12,979	1.550	FR, Part. SO
Public Agency / Non-Profit	20%	0%	80%	7,313	0.959	FR, Part. SO

Program Name	Free Ridership (%)	Spillover (%)	NTG Ratio PY7	PY7 Verified Net Energy Savings (MWh/Yr)	PY7 Verified Net Demand Savings (MW/Yr)	NTG Categories Included[1]
Retail Stores – Small EE	44%	0%	56%	28	0.004	FR, Part. SO
Retail Stores – Large EE	44%	0%	56%	0	0.000	FR, Part. SO
Multifamily Housing Retrofit	29%	0%	71%	1,551	0.174	FR, Part. SO
Small Commercial Direct Install	7%	7%	99%	2,455	0.186	FR, Part. SO
(Weighted by program savings for programs reporting NTG Ratios)	32%	6%	74%	104,999	8.426	N/A

[1] 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 1-14.

Table 1-14: Summary of Portfolio Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 through 4)	$30,639	$67,616
2	EDC Incentives to Participants	$6,256	$19,118
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$24,384	$48,499
5	Program Overhead Costs (Sum of rows 6 through 10)	$9,825	$33,861
6	Design & Development	$0	$240
7	Administration, Management, and Technical Assistance[1]	$8,568	$28,148
8	Marketing[2]	$52	$1,209
9	EDC Evaluation Costs	$980	$2,361
10	SWE Audit Costs	$225	$1,903
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$40,464	$101,477
13	Total NPV Lifetime Energy Benefits	$76,290	$179,008
14	Total NPV Lifetime Capacity Benefits	$6,235	$15,678
15	Total NPV TRC Benefits[4]	$87,577	$206,693
16	TRC Benefit-Cost Ratio[5]	2.16	2.04

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 IN PY7

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. Table 1-15 shows the TRC ratios by program and other key factors used in the TRC ratio calculation for Phase II programs.

Table 1-15: PYTD TRC Ratios by Program[6]

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	26,279	9,183	2.91	6.90%	1.074	1.074
Residential: School Energy Pledge	9	141	0.07	6.90%	1.074	1.074
Residential: Appliance Recycling	733	490	1.50	6.90%	1.074	1.074
Residential: Whole House	11	370	0.03	6.90%	1.074	1.074
Residential: Home Energy Report Program	1,496	711	2.11	6.90%	1.074	1.074
Residential: Low Income EE	1,273	454	2.80	6.90%	1.074	1.074
Commercial Sector Umbrella EE	5,260	2,426	2.17	6.90%	1.074	1.074
Healthcare EE	3,106	1,581	1.96	6.90%	1.074	1.074
Industrial Sector Umbrella EE	57	102	0.56	6.90%	1.074	1.074
Chemical Products EE	14,691	6,243	2.35	6.90%	1.074	1.074
Mixed Industrial EE	3,524	930	3.79	6.90%	1.074	1.074
Office Buildings	6,613	5,372	1.23	6.90%	1.074	1.074
Primary Metals EE	14,708	2,967	4.96	6.90%	1.074	1.074
Public Agency / Non-Profit	6,991	6,219	1.12	6.90%	1.074	1.074
Retail Stores	42	216	0.19	6.90%	1.074	1.074
Multifamily Housing Retrofit	862	1,690	0.51	6.90%	1.074	1.074
Small Commercial Direct Install	1,520	1,371	1.11	6.90%	1.074	1.074
TOTAL	**87,577**	**40,464**	**2.16**	**6.90%**	**1.074**	**1.074**

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

1.8 COMPARISON OF PY7 PERFORMANCE TO APPROVED EE&C PLAN

Table 1-16 below shows PY7 expenditures compared to the budget estimates set forth in the EE&C plan.

Table 1-16: Comparison of PY7 Program Expenditures to PY7 EE&C Plan

Program	PY7 Budget from EE&C Plan	PY7 Actual Expenditures	% Difference from PY7 EE&C Plan [(Planned – Actual)/Planned]
Residential: EE Program (REEP): Rebate Program	$5,837	$4,991	14.5%
Residential: EE Program (Upstream Lighting)			
Residential: School Energy Pledge	$428	$138	67.8%
Residential: Appliance Recycling	$135	$342	-152.9%
Residential: Whole House	$250	$365	-46.0%
Residential: Home Energy Report Program[1]	$845	$368	56.5%
Residential: Low Income EE	$1,381	$351	74.6%
Residential: Low Income EE (Upstream Lighting)			
Commercial Sector Umbrella EE	$1,460	$1,136	22.2%
Commercial Sector Umbrella EE (Upstream Lighting)			
Healthcare EE	$567	$150	73.5%
Industrial Sector Umbrella EE	$330	$75	77.3%
Chemical Products EE	$816	$1,415	-73.4%
Mixed Industrial EE	$730	$624	14.5%
Office Building – Large – EE	$1,000	$1,022	-2.2%
Office Building – Small EE			
Primary Metals EE	$2,246	$1,990	11.4%
Public Agency / Non-Profit	$1,289	$994	22.9%
Retail Stores – Small EE	$460	$367	20.1%
Retail Stores – Large EE			
Multifamily Housing Retrofit	$585	$946	-61.7%
Small Commercial Direct Install	$1,139	$759	33.4%
TOTAL	**$19,498**	**$16,033**	**17.8%**

[1] Market HER includes low income

Table 1-17 shows PY7 program savings compared to the energy and demand savings estimates filed in the EE&C plan.

Table 1-17: Comparison of PY7 Actual Program Savings to EE&C Plan for PY7

Program	PY7 MWh Savings Projected in EE&C Plan	Actual Reported PY7 MWh Savings	% Difference [(Planned – PY7 Actual)/PY Planned]	PY7 MW Savings Projected in EE&C Plan	Actual Reported PY7 MW Savings	% Difference [(PY7 Planned – PY7 Actual)PY7 /Planned]
Residential: EE Program (REEP): Rebate Program	33,625	1,636	-3%	1.849	0.445	-102%
Residential: EE Program (Upstream Lighting)		32,875			3.290	
Residential: School Energy Pledge	1,423	36	97%	0.046	0.003	93%
Residential: Appliance Recycling	1,592	1,759	-10%	0.197	0.211	-7%
Residential: Whole House	333	43	87%	0.024	0.004	82%
Residential: Home Energy Report Program	9,346	26,230	-181%	0.000	0.000	N/A
Residential: Low Income EE	4,981	2,874	20%	0.250	0.093	19%
Residential: Low Income EE (Upstream Lighting)		1,087			0.109	
Commercial Sector Umbrella EE	5,193	6,270	-21%	0.870	0.735	15%
Commercial Sector Umbrella EE (Upstream Lighting)	3,350	0	100%	0.787	0.000	100%
Healthcare EE	4,108	4,288	-4%	0.688	0.000	100%
Industrial Sector Umbrella EE	1,844	75	96%	0.310	0.019	94%
Chemical Products EE	4,563	19,033	-317%	0.767	2.606	-240%
Mixed Industrial EE	4,079	4,740	-16%	0.685	0.506	26%
Office Building – Large – EE	7,250	8,264	-14%	1.215	0.534	56%
Office Building – Small EE		0			0.000	
Primary Metals EE	12,560	19,213	-53%	2.110	2.402	-14%
Public Agency / Non-Profit	9,344	10,745	-15%	1.565	1.612	-3%
Retail Stores – Small EE	3,331	49	99%	0.558	0.007	99%
Retail Stores – Large EE		0			0.000	
Multifamily Housing Retrofit	1,725	2,579	-50%	0.080	0.330	-312%
Small Commercial Direct Install	2,042	2,406	-18%	0.343	0.165	52%
TOTAL	110,689	144,200	-30%	12.344	13.071	-6%

The percentage differences in the PY7 tables above indicate over- and under-achievement relative to EE&C Plan projections for the year made prior to the beginning of Phase II. Programs that exceeded their targets for the year, whether it be savings or spending, show negative "% Difference" numbers, while those who did not reach their targets show positive "% Difference" numbers. At the portfolio level

Duquesne Light exceeded its PY7 savings goals but spent less than that projected amounts to achieve those goals.

Of the 12 programs that exceeded their savings targets, 8 did so while staying below their spending targets, including REEP, HER, Commercial Umbrella, Healthcare, Mixed Industrial, Primary Metals, PAPP/Non-profit, and SCDI. It is also important to keep in mind when looking at PY7 performance that the EE&C Plan projections for each year of the 3-year Phase II program were at the same level each year. Actual implementation for some programs, however, included a ramp up or, if funds were being depleted, a slowdown. For other programs, sometimes long lead times led to savings and/or costs being disproportionately allocated across the years rather than being constant year to year as the filed EE&C Plan shows.

Of particular note were the Primary Metals and HER programs, both of which significantly exceeded their projected savings goals for PY7. Primary Metals was able to bring some extremely large projects to fruition, causing the savings goal to be exceeded by 53%. Duquesne Light reported savings for the HER program for the first time in PY7 and achieved nearly two times its PY7 target (181% over target). This was done in order to align the program with the overall Phase goal, because the program did not report any savings in PY5 or PY6.

In addition to the 8 programs noted above, four others exceeded their savings goals but overspent relative to Phase II projections, including Appliance Recycling, Chemical Products, Multifamily and Offices. The major disruption to the Appliance Recycling program caused by the dissolution of JACO caused the utility to have to scramble to determine the status of participation in the program and find a vendor to pick up appliances already scheduled or for which the pick-up process had already begun. It also resulted in bounced incentive checks and considerable efforts to pay participants again. The utility also had to address the many customer relations issues that resulted from all of these problems. Based on the survey results with participating customers, which showed only a slight dip in customer satisfaction in PY7, the utility was successful in its efforts.

In PY7, Chemical Products achieved more than three times its savings target but overspent by less than twice its spending target. As is the case with a number of nonresidential programs, Chemical Products projects sometimes can take quite a long time to come to fruition, during which funds are expended but savings do not materialize because the project is not complete. Then, the project finally is installed and, if the project is large, there is a large bump in savings. Particularly large projects can sometimes be subject to incentive caps, which limits spending while savings may be very large. This was the case with the Chemical products program in PY7. The Multifamily overspent relative to projections and exceeded savings targets relative to projections by approximately the same amounts, due to aggressive implementation. The Offices program was only slightly overspent, relative to Phase II projections (2.2%) and savings exceeded projections by only 14%.

Four programs and did not achieve their savings goals and also underspent relative to their projected PY7 budgets, including SEP, LIEEP, Industrial Umbrella and Retail. Duquesne Light reports that the SEP has few schools at which to implement the program, having reached most schools during Phase I of the program and nearly the remainder of schools in PY5 and PY6. Only one school was visited during the third quarter of PY7. Duquesne Light indicated that it avoided implementing SEP at schools more than once during Phase II. The utility took this approach to avoid supplying schools with multiple incentives and families with multiple kits. Duquesne Light acknowledges that new students have cycled through since the beginning of Phase II, but that those families likely remain associated with the schools because of siblings who may still be in attendance. The program plans for Phase III include replacing SEP with a program for

middle and high schools. Duquesne Light plans to engage and recruit middle and high school students to assist with energy audits that will lead to energy savings at their schools.

LIEEP savings were low due to poor performance from the Whole House (WHEAP) program and a slow down for the upstream lighting program as overall savings goals had been exceeded significantly. However, LIEEP achieved 130 percent of its Phase II goals. The Industrial Umbrella program accounts for measures and projects that do not fit conveniently into one of Duquesne Light's other industrial offerings, and is therefore not extremely impactful. The Retail Store program had already exceeded its Phase II goal by PY6 and so was not promoted in PY7.

Two programs did not reach savings targets but overspent relative to the EE&C Plan projected budgets – Appliance Recycling and Whole House (WHEAP). The major disruption to the Appliance Recycling program caused by the dissolution of JACO caused the utility to have to scramble to determine the status of participation in the program and find a vendor to pick up appliances already scheduled or for which the pick-up process had already begun. It also resulted in bounced incentive checks and considerable efforts to pay participants again. The utility also had to address the many customer relations issues that resulted from all of these problems. Based on the survey results with participating customers, which showed only a slight dip in customer satisfaction in PY7, the utility was successful in its efforts.

The Whole House program also did not meet its PY7 goals and yet overspent relative to projections. However, WHEAP in PY7 positioned itself well to support Phase III energy efficiency activities. Duquesne Light will team up with gas utilities on efforts that target low income homes using both electric and gas energy. These activities will include audits, home weatherization, marketing, outreach presentations, advisory services, and other service offerings to benefit low income customers. The program manager commented that while the program savings are relatively low compared to the utility portfolio, the program continues to offer intensive audits for the participating customers. As a result of the unsatisfactory performance and costs associated with the PY7 Whole House program, it will be implemented differently (as noted above) and not by a CSP in Phase III.

Table 1-20 provides details on program progress toward Phase II goals.

1.9 SUMMARY OF COST-EFFECTIVENESS BY PROGRAM FOR PHASE II

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. Table 1-18 shows the TRC ratios by program and other key factors used in the TRC ratio calculation for Phase II programs.

Table 1-18: Phase II TRC Ratios by Program

Program	TRC NPV Benefits ($1000)	TRC NPV Costs ($1000)	TRC Benefit-Cost Ratio	Discount Rate	Energy Line Loss Factor	Demand Line Loss Factor
Residential: EE Program (REEP): Rebate Program	$65,301	$26,896	2.43	6.90%	1.074	1.074
Residential: School Energy Pledge	$138	$552	0.25	6.90%	1.074	1.074
Residential: Appliance Recycling	$2,600	$1,793	1.45	6.90%	1.074	1.074
Residential: Whole House	$40	$746	0.05	6.90%	1.074	1.074
Residential: Home Energy Report Program	$1,496	$2,338	0.64	6.90%	1.074	1.074
Residential: Low Income EE	$7,361	$2,546	2.89	6.90%	1.074	1.074
Commercial Sector Umbrella EE	$15,902	$3,771	4.22	6.90%	1.074	1.074
Healthcare EE	$3,322	$3,502	0.95	6.90%	1.074	1.074
Industrial Sector Umbrella EE	$1,295	$639	2.03	6.90%	1.074	1.074
Chemical Products EE	$15,136	$6,895	2.20	6.90%	1.074	1.074
Mixed Industrial EE	$10,655	$2,938	3.63	6.90%	1.074	1.074
Office Buildings	$25,589	$15,445	1.66	6.90%	1.074	1.074
Primary Metals EE	$24,940	$8,496	2.94	6.90%	1.074	1.074
Public Agency / Non-Profit	$17,207	$12,485	1.38	6.90%	1.074	1.074
Retail Stores	$9,167	$5,299	1.73	6.90%	1.074	1.074
Multifamily Housing Retrofit	$2,018	$2,999	0.67	6.90%	1.074	1.074
Small Commercial Direct Install	$4,524	$4,137	1.09	6.90%	1.074	1.074
TOTAL	**$206,692**	**$101,476**	**2.04**	**6.90%**	**1.074**	**1.074**

1.10 COMPARISON OF PHASE II PERFORMANCE TO APPROVED EE&C PLAN

Table 1-19 below shows Phase II expenditures compared to the budget estimates set forth in the EE&C plan.

Table 1-19: Comparison of Phase II Program Expenditures to Phase II EE&C Plan

Program	Phase II Budget from EE&C Plan ($1000)	Phase II Actual Expenditures	% Difference from Phase II EE&C Plan [(Planned – Actual)/Planned]
Residential: EE Program (REEP): Rebate Program Residential: EE Program (Upstream Lighting)	$17,511	$16,394	6.4%
Residential: School Energy Pledge	$1,285	$549	57.3%
Residential: Appliance Recycling	$406	$1,460	-259.8%
Residential: Whole House	$750	$732	2.4%
Residential: Home Energy Report Program[1]	$2,536	$1,995	21.3%
Residential: Low Income EE Residential: Low Income EE (Upstream Lighting)	$4,142	$1,988	52.0%
Commercial Sector Umbrella EE Commercial Sector Umbrella EE (Upstream Lighting)	$4,380	$2,855	34.8%
Healthcare EE	$1,700	$1,599	6.0%
Industrial Sector Umbrella EE	$989	$366	63.0%
Chemical Products EE	$2,448	$1,959	20.0%
Mixed Industrial EE	$2,189	$1,859	15.1%
Office Building – Large – EE Office Building – Small EE	$3,001	$4,597	-53.2%
Primary Metals EE	$6,739	$5,310	21.2%
Public Agency / Non-Profit	$3,867	$4,900	-26.7%
Retail Stores – Small EE Retail Stores – Large EE	$1,379	$2,071	-50.2%
Multifamily Housing Retrofit	$1,755	$1,602	8.7%
Small Commercial Direct Install	$3,417	$2,513	26.4%
TOTAL	**$58,493**	**$52,749**	**9.8%**

Table 1-20 shows Phase II program savings compare to the energy and demand savings estimates filed in the EE&C plan.

Table 1-20: Comparison of Phase II Actual Program Savings to EE&C Plan for Phase II

Program	Phase II MWh Savings Projected in EE&C Plan	Actual Reported Phase II MWh Savings	% Difference [(Planned – Phase II Actual)/Phase II Planned]	Phase II MW Savings Projected in EE&C Plan	Actual Reported Phase II MW Savings	% Difference [(Phase II Planned – Phase II Actual)Phase II /Planned]
Residential: EE Program (REEP): Rebate Program	100,875	12,619	-20%	5.547	1.466	-80%
Residential: EE Program (Upstream Lighting)		107,975			8.535	
Residential: School Energy Pledge	4,269	618	86%	0.138	0.038	72%
Residential: Appliance Recycling	4,775	6,139	-29%	0.591	0.782	-32%
Residential: Whole House	998	128	87%	0.072	0.013	82%
Residential: Home Energy Report Program	28,037	26,230	6%	0.000	0.000	N/A
Residential: Low Income EE	14,943	5,985	-30%	0.750	0.457	-68%
Residential: Low Income EE (Upstream Lighting)		13,371			0.807	
Commercial Sector Umbrella EE	15,578	7,597	51%	2.610	1.002	62%
Commercial Sector Umbrella EE (Upstream Lighting)	10,050	26,400	-163%	2.361	7.373	-212%
Healthcare EE	12,325	6,506	47%	2.064	0.469	77%
Industrial Sector Umbrella EE	5,531	1,716	69%	0.930	0.357	62%
Chemical Products EE	13,690	19,640	-43%	2.301	2.702	-17%
Mixed Industrial EE	12,238	13,833	-13%	2.055	1.997	3%
Office Building – Large – EE	21,751	37,858	-78%	3.645	4.066	-16%
Office Building – Small EE		827			0.181	
Primary Metals EE	37,681	44,840	-19%	6.330	5.533	13%
Public Agency / Non-Profit	28,033	24,355	13%	4.935	3.748	24%
Retail Stores – Small EE	9,993	7,761	-50%	1.674	1.279	-40%
Retail Stores – Large EE		7,247			1.063	
Multifamily Housing Retrofit	5,174	4,750	8%	0.240	0.526	-119%
Small Commercial Direct Install	6,126	7,835	-28%	1.029	0.895	13%
TOTAL	332,066	384,229	-16%	37.272	43.287	-16%

At the portfolio level Duquesne Light exceeded its Phase II savings goals but spent less than that projected amounts to achieve those goals.

Of the 10 programs that exceeded their savings targets, 7 did so while staying below their spending targets, including REEP, LIEEP, Commercial Umbrella, Chemical Products, Mixed Industrial, Primary Metals and Small Commercial Direct Install (SCDI). Of these programs the one that had the most significant increase relative to projected savings was Commercial Umbrella and this was due primarily to significant savings the program achieved through an allocation of Upstream Lighting program savings in PY5. A similar situation was the case for LIEEP, which received an allocation of Upstream Lighting program savings all three years of Phase II. Finally, the performance of the Chemical Products program was exemplary due to the large size of its projects. For the rest of these programs the overachievement and underspending was generally within about 20% of the Phase II projections, except for SCDI, which exceeded the savings goal by almost 30% and underspent relative to projections by around 25%. Like Chemical Products, this was a very successful program.

In addition to the 7 programs noted above, three others exceeded their savings goals but overspent relative to Phase II projections to get those savings, including Appliance Recycling, Retail and Offices. As noted above in the discussion regarding the PY7 results, the major disruption to the Appliance Recycling program caused by the dissolution of JACO, the utility's CSP for the program and consequent logistical, data and customer relations issues. Also, Duquesne Light reports that what appears to be "high" actual expenditures is actually a result of the Projected (budgeted) numbers being too low. The utility has indicated that its Phase II EE&C Plan understated certain RARP implementation costs. The utility reports that it has projected more accurately in its Phase III filing.

Retail exceeded its savings targets and spending targets by approximately the same amount, reflective of aggressive activity. The Offices program was only slightly overspent, relative to Phase II projections (2.2%) and savings exceeded projections by 14%.

Six programs did not achieve their savings goals and also underspent relative to their projected PY7 budgets, including SEP, WHEAP, HER, Healthcare, Industrial Umbrella and Multifamily. As noted above regarding PY7 activities, Duquesne Light reports that the SEP had few schools at which to implement the program, having reached most schools during Phase I of the program. This program is being discontinued in Phase III in favor of a program targeting middle and high schools. WHEAP was a problematic program which has had significant costs (thorough auditing of homes) but limited penetration of measures, in particular measures that address electrical end uses (due in part to the low penetration of electric heat and water heating in the territory. This program is being modified for Phase III, with the utility seeking to work with local gas utilities to keep costs down and changing program administration from a CSP to in-house. The HER program fell only 6% short of projected savings but underspent relative to projections by more than 20%.

The Healthcare program achieved savings that were significantly lower than projected (47% of projections) but expenditures were only 6% lower than projections. Due to growing saturation of high-efficiency equipment and tightening minimum efficiency standards, easier "low-hanging fruit" projects are evaporating. The program pursued more complex projects that proved difficult to implement and required longer measurement periods. This learning is being incorporated into Phase III plans and

implementation. Both Industrial Umbrella and Multifamily fell short of projected savings and spending projections by approximately equal amounts.

One program, PAPP/Non-profit, did not achieve its savings goal but overspent relative to its projected PY7 budget. PAPP projects, due to the need to work with public agencies, can have an extremely long lead time. Budgets are developed well in advance of the following year and there tends to be little flexibility in these budgets. That means that planning for new projects must be done well in advance of the actual year of implementation, and in the meantime program costs for meeting with the agencies and specific building managers, assessing potential projects, etc., are incurred. Also, as with the Healthcare program, the utility is learning to appreciate the magnitude of the extended measurement periods that are needed for complex projects. Again, addressing deeper savings is more costly and has a learning curve in itself.

The success of Upstream Lighting in the residential sector, the low income sector (LIEEP), and the commercial sector (only during PY5) contributed significantly to the savings in excess of the Phase II savings targets. Overall, Upstream Lighting contributed 40 percent of the verified gross savings for Phase II. LIEEP exceeded its Phase II targets and achieved over 19,000 MWh. This excess contributed to the Phase II low income carryover of 3,431 MWh shown in Table 1-8. As previously discussed, SEP and WHEAP did not achieve their PY7 targets nor their Phase II targets. SEP will be replaced by another program in Phase III, and WHEAP will be implemented in-house rather than through a CSP. WHEAP is also expected to ramp up Phase III activities and try to control costs by partnering with gas utilities.

Overall, the portfolio cost effectiveness was a bit higher than projected in the utility's Phase II filing – 2.04 versus 1.8. The programs with the lowest benefit/cost ratios – SEP and WHEAP – are being modified for Phase III to improve effectiveness and lower cost.

1.11 PORTFOLIO LEVEL/CROSS-CUTTING PROCESS AND IMPACT EVALUATION SUMMARY FOR PY7

A number of process evaluation activities were completed in PY7 for both residential and C&I programs. These activities are summarized below in Table 1-21.

Table 1-21: PY7 Process Evaluation Activities

Program	Activity	Number of Completed Surveys/Interviews
REEP	Participant Surveys	59 Rebate participants 15 Kit participants
RARP	Participant Surveys	109
SEP	Participant Surveys	27
WHEAP	Participant Surveys	22
LIEEP	Participant Surveys	25 Kit participants 40 RARP participants *Rebates, SEP, WHEAP combined with market rate participants shown above*
All Residential and LIEEP Programs	Duquesne Light Program Manager Interview	1
HER	Market Rate Participant Surveys Low Income Participant Surveys Opt-Out Participant Surveys	59 75 30
Commercial Programs	Commercial Participant Surveys GNI Participant Surveys Multifamily Participant Surveys	6 15 0
Industrial Programs	Participant Surveys	15

Table 1-22 provides overarching process and impact evaluation recommendations affecting multiple programs or the portfolio. Additional details and findings of the PY7 process evaluations can be found in the individual program discussions later in this report and also in Residential and C&I reports process evaluation reports prepared by Navigant.

Table 1-22: Phase II Process and Impact Evaluation Recommendations from PY7 Evaluations

Applicability	Recommendations
Portfolio Level	During PY7 the utility experienced difficulty with its program tracking system as changes occurred both with regard to IT systems and the personnel responsible for uploading participation data. As a result, Duquesne Light developed several revisions to the program data tracking system over time, and some savings were not posted in the system until primary evaluation research activities (i.e., verification and net-to-gross/process evaluation surveys) had been completed. Ultimately, savings were verified by Navigant, but the revision process created significant administrative burdens. The utility has already set up a more effective system allowing for more ongoing tracking of participation data and better access to these data, which should alleviate this problem. However, Navigant recommends that this process be monitored closely and that all official participation data be cross-checked to the extent possible in advance of reporting needs.

1.12 SITE INSPECTIONS SUMMARY

Table 1-23 below includes information on site inspections conducted during PY7, as requested by the SWE.

Table 1-23: Summary of PY7 Site Visits

Program	Measure	Inspection Firm	Number of Inspections Planned	Number of Inspections Conducted	Number of Sites with Discrepancies from Reports	Resolution of Discrepancies
Commercial	Lighting, whole building, custom	Navigant, Karpinski	9	9	0	N/A
GNI	Lighting, VFDs, whole building, custom	Navigant, Karpinski	11	12	1	None
Industrial	Lighting, VFDs, whole building, custom	Navigant, Karpinski	9	6	3	None
Multifamily	Lighting	Karpinski	3	2	1	Updated PMRS Data
TOTAL			**32**	**29**		

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 and financial incentives. Program educational materials include an online survey help to communicate and promote the availability of the REEP rebates. Duquesne Light also holds regular events within a number of retail stores to educate consumers on energy efficiency products, and to provide a platform for more broadly educating consumers on other programs falling under the Watt Choices brand.

REEP also provides energy efficiency measures—in the form of Energy Efficiency Kits—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—Upstream Lighting—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 since it does not require rebate forms. The elimination of rebate forms at the transaction level, in favor of bulk processing, significantly cuts processing costs.

2.1 PROGRAM UPDATES

No significant changes were made to REEP for PY7.

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 PY7. 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 PY7, Duquesne Light reported savings totaling 103 percent of its PY7 gross savings goal of 33,625 MWh. Table 2-1 shows REEP participation, savings and incentives for PY7.

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 Paid ($1,000)
Residential	38,733[1]	120,594	10.001	$6,543
Phase II Total	**38,733**[1]	**120,594**	**10.001**	**$6,543**
[1] Excludes Upstream Lighting participants				

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 PY7 Sampling Plan, the annual sample size target for REEP was 70—including 15 Kit participants and 55 Rebate participants—with a targeted precision of 15 percent at 85 percent confidence. However, once Navigant learned of limited program activities among LIEEP Rebate participants it instead combined the low income and market rate participants for the analysis. Table 2-2 presents the targeted and achieved (actual) sample sizes for the program. The achieved sample represents respondents for PY7 from both the market and low income sectors. Given the limited program activities and small sample sizes Navigant combined the market rate (REEP Rebates) and low income (LIEEP Rebates) participants into a single stratum in order to develop more robust verification results. REEP Rebates is implemented identically for these two groups.

Table 2-2: REEP Sampling Strategy for PY7

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Rebates	3,259	85%/15%	70	84[1]	Application Review & Phone Verification (Market rate and LI combined)
Kits	4,176	85%/15%	15	15	Phone Verification Only
Upstream Lighting	N/A	85%/15%	N/A	N/A	Database Verification
Program Total	**7,435**	**85%/15%**	**85**	**99**	
[1] Surveyed 59 people, 55 market rate, 4 low income. These respondents were surveyed about one to three appliances each.					

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 PY7 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.

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 2015 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 2015 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 supporting 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: PY7 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	477	105%	499	0.95	15.5%
Kits	1,159	64%	737	0.46	17.9%
Upstream Lighting	32,875	102%	33,404	N/A	0.0%
Program Total	**34,511**	**100%**	**34,640**	**N/A**	**0.6%**

[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: PY7 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	0.341	94%	0.320	0.53	8.7%
Kits	0.105	63%	0.066	0.57	22.2%
Upstream Lighting	3.290	102%	3.343	N/A	0.0%
Program Total	**3.735**	**100%**	**3.729**	**N/A**	**1.0%**

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

2.3 IMPACT EVALUATION NET SAVINGS

The target for the net savings analysis is 85/15 confidence/precision at the program level, and the Net-to-Gross (NTG) analysis for REEP used the same phone surveys as for the gross impact verification, and therefore maintained the 85/15 target.

The Upstream Lighting component of REEP draws on the findings from PY6 to inform the PY7 results. During PY6, that Upstream Lighting sampling strategy was developed separately from the other portions of REEP with the intent of achieving 90/10 for both the general population survey and the intercept survey conducted that year. Navigant notes that multiple data sources were combined in PY6 to determine the overall Upstream Lighting stratum NTG (intercept survey, general population survey, and Delphi panel). As a result a target sample is not specified in Table 2-5.

Table 2-5: REEP Sampling Strategy for PY7 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[1] to Achieve Sample
Rebates	All	3,259	0.75	85%/15%	70	59	100%
Kits	All	4,176	0.65	85%/15%	15	15	100%
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Program Total		**7,435**		**85%/15%**	**85**	**99**	

[1] 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 PY7 is similar to the approaches used throughout Phase II and provides a means for a useful comparison year-to-year.

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 in PY6 to estimate free ridership and spillover. These findings inform the PY7 results.

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 survey findings that inform the REEP program evaluation. Free ridership varies from 8 percent to 100 percent.

Table 2-6: REEP Rebate Free Ridership Results

Rebated Equipment	Respondent Installation Measure Count in PY7	Average FR
ENERGY STAR® Refrigerator	6	60%
ENERGY STAR® Freezer	1	25%
ENERGY STAR® Clothes Washer	3	83%
Clothes Dryer with Moisture Sensor	5	66%
ENERGY STAR® Dehumidifier	14	58%
ENERGY STAR® Dishwasher	1	100%
Programmable Thermostat	2	63%
Heat Pump	2	75%
Central Air Conditioner or Heat Pump	18	56%
ENERGY STAR® Room Air Conditioner	2	75%
High Efficiency Fan Heating	2	63%
ENERGY STAR® Television	2	8%
Smart Strip	1	25%

Navigant found that overall free ridership increased from 52 percent in PY5 to 73 percent in PY6. That ultimately fell to 59 percent in PY7. Additional details can be found in the PY7 Process Evaluation report. For example, Navigant examined annual ENERGY STAR® market penetration rates to understand how the availability of ENERGY STAR® as well as non-efficient equipment options might influence purchasing decisions particularly as that mix of efficiency options changes with ENERGY STAR® criteria updates.

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.

Overall kit free ridership between PY5 and PY6 rose from 37 to 44 percent, and then to 47 percent in PY7. CFL and smart strip free ridership contributed to the overall increase for the kits. CFLs increased from 42, to 44, and then finally to 53 percent in PY7. Smart strips decreased first from 35 to 33 percent but then increased to 41 percent. However, the PY7 sample size is quite small, so that comparing results across program years is not likely to be valid, statistically.

Table 2-7: REEP Kit Free Ridership Results

Kit Items	Gross Energy Savings (kWh)		
	Reported	Verified (for weighting final FR)	Average FR
CFLs (two 13W, one 20W, one 23W)	152	86.1	53%
Smart Strips (one)	74.5	54.6	41%
LED Nightlights (two)	51	35.7	39%
Total Kit	**277.5**	**176.5**	**47%**

Upstream Lighting Free Ridership

Navigant conducted three research activities to estimate free ridership for the Upstream Lighting component of REEP in PY6, and applied these findings to the PY7 evaluation analysis. These efforts included in-store intercept surveys, online surveys of 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. Details of the analysis activities including how the results of those analysis activities were developed can be found in the PY6 Compliance Report and supporting documents.

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 2-8 shows the overall REEP program free ridership. Navigant's analysis found a free ridership rate of 54 percent for the REEP program in PY7. This is the same as the free ridership rate in previous years given that Upstream Lighting has remained consistent and contributes significantly to the free ridership roll up. Additional detail regarding the free ridership estimation for all REEP components can be found in the PY7 Residential Process Evaluation Report.

Table 2-8: REEP Total Free Ridership Ratio

REEP Sub-program	Gross Verified Savings (MWh)	Percent of Savings	Individual FR
Rebates	499	1%	47%
Kits	737	2%	59%
Upstream Lighting	33,404	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.[9] 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 PY7 tracking data (PMRS) that references deemed savings values from the 2015 Pennsylvania TRM. Generally, savings for a given spillover action rely on either a specific 2015 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 PY7. 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 PY7 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.

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 PY7 participants for each 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 PY7 Residential Process Evaluation Report.

Table 2-9: REEP Spillover Factors

REEP Sub-program	Gross Verified Savings (MWh)	Percent of Savings	Spillover %
Rebates	499	1%	18%
Kits	737	2%	4%
Upstream Lighting	33,404	97%	24%
		Total REEP Spillover Factor:	**23%**

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

REEP Net-to-Gross Estimate

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

NTG = 1-FR+Spillover

Table 2-10 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 2-10: PY7 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	59%	18%	59%	0.45	8.5%
Kits	47%	4%	57%	0.30	11.8%
Upstream Lighting	54%	24%	69%	0.38	7.4%
Program Total[1]	**54%**	**23%**	**69%**	**N/A**	**7.1%**
[1] NTG ratio at program level should be developed using stratum weight and stratum NTG ratios.					

2.4 PROCESS EVALUATION

The process evaluation for the REEP program group in PY7 included the following activities:

- Review of the 2015 Pennsylvania TRM and program materials
- Surveys with 59 REEP Rebate and 15 REEP Kit participants sampled randomly from the entire PY7 population for each program segment (Rebates and Kits) between April 27 to May 7, 2016 and July 20 to August 1, 2016. These surveys included both verification questions and selected process evaluation questions. The REEP Rebate participants included 55 market rate and 4 low income participants who received rebates for 84 appliances and equipment.
- Review of participant application files for the sampled REEP Rebate participants surveyed.

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 2-11: REEP Sampling Strategy for PY7

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)
Rebates	All	3,259	0.75	85%/15%	70	59	100%	Impact, Process, NTG
Kits	All	4,176	0.65	85%/15%	15	15	100%	Impact, Process, NTG
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Impact, Process, NTG
Program Manager	1	1	N/A	N/A	N/A	1	100%	Process
Program Total		**7,436**		**85%/15%**	**85**	**75**	**0%**	**Impact, Process, NTG**

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

Navigant conducted supplemental research in PY6 to investigate the residential lighting market in greater detail. These activities are detailed in the PY6 Compliance Report and supporting documents.

The process evaluation findings and details can be found in the Residential Energy Efficiency Programs PY7 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. That fell to 59 percent in PY7. Also, over the three years of the Phase the NTG decreased from 81 percent to 46 percent and then increased to 59 percent. A fluctuating spillover over the Phase contributed to the changing NTG where spillover ranged from 18 percent up to 34 percent.
- ENERGY STAR® criteria regularly increases efficiency thresholds. Often, the majority of product options currently available to consumers are ENERGY STAR® rated. Navigant also found instances where ENERGY STAR® nearly represents the entire market. For example, even with criteria updates in January 2016, ENERGY STAR® dishwashers still represent 84 percent of 2015 shipments.
- Navigant was able to use Claim IDs to match reported savings in Duquesne Light's PMRS tracking system to rebate application detail files. This linkage allowed Navigant to confirm applications are tracked correctly. The Claim IDs also assisted with the verification of partially deemed measures where the main PMRS tracking data did not include all necessary detailed inputs to calculate savings. Instead, Duquesne Light relies on default assumptions for partially deemed measures in these situations (exact SEER or capacity), resulting in the possibility of a realization rate adjustment in addition to the one yielded by the results of verification survey calls. PY7 actions to improve this process were limited to a degree by changes and priorities in the utility's CIS and IT systems, where the focus for Act 129 programs was on setting up proper systems for Phase III (including those that would address this issue), and the utility reports that Phase III protocols will improve the process. In any case the impact of the potential realization rate adjustments on achieving savings targets is very small, given the savings contributed by the measures affected.

- Participant satisfaction is generally high among PY7 participants. On a scale of 1 to 5, where 1 means "very dissatisfied" and 5 means "very satisfied," participants rated the overall REEP Rebate program with a 4.3. Navigant observed several isolated instances of dissatisfaction among PY7 participants, however Duquesne Light was ultimately able to maintain high satisfaction through Phase II for REEP Rebates.

2.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The REEP program achieved an energy savings realization rate of 100 percent and the evaluation found a 0.69 NTG ratio. Table 2-12 shows the evaluation's recommendations and additional details can be found in the PY7 Process Evaluation report.

Table 2-12: REEP Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Recommendation 1 Monitor ENERGY STAR® for criteria changes and estimates on market penetration rates. For Phase III, additional rebate criteria or tiered incentives could help promote increased savings and reduce free ridership. For example, the Consortium for Energy Efficiency (CEE)[1] publishes criteria for efficiency tiers beyond ENERGY STAR® for several residential appliances and equipment. Also, one CEE initiative defines two efficiency tiers above ENERGY STAR® for residential clothes washers.[2] However, this was not part of the utility's Phase III and would likely require a refiling to implement. It also may or may not be worthwhile offering tiered incentives, given the low penetration of electric water heating in the utility's territory.	Under consideration
Recommendation 2 Consider leveraging the REEP, LIEEP, and SEP kits to introduce LEDs to participants in Phase III. LEDs could be provided in addition to one or more CFLs and may result in lower free ridership. However, the cost effectiveness of such an addition should be reviewed first.	Under consideration
Recommendation 3 Duquesne Light should consider updating Wattley or changing this well-known Watt Choices image, if Phase III activities shift away from primary promotion of CFLs to primary promotion of LEDs. Without such a shift, at some point in Phase III the utility may be heavily promoting LEDs while its primary marketing icon visually promotes alternatives to LEDs (i.e., CFLs). This is a timing issue and it is also a delicate market one. Wattley is widely known in the territory and is as very positive program image. Changing or removing such an image should only be done after considerable thought and possibly testing regarding the consequences.	Under consideration
[1] Consortium for Energy Efficiency. CEE. http://www.cee1.org/ [2] CEE Super Efficient Home Appliances Initiative. High efficiency specifications for Residential Clothes Washers. Effective March 7, 2015. http://library.cee1.org/sites/default/files/library/12282/CEE_ResidentialClothesWasherSpec_07Mar2015.pdf	

2.6 FINANCIAL REPORTING

REEP is performing above plan levels, achieving 103 percent of the PY7 energy savings goal and spending 86 percent 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 generally been overwhelming and accepted among retailers and Duquesne Light utility customers throughout Phase II. A breakdown of the program finances is presented in Table 2-13.

Table 2-13: Summary of Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 through 4)	$6,929	$17,045
2	EDC Incentives to Participants	$2,738	$6,543
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$4,191	$10,503
5	Program Overhead Costs (Sum of rows 6 through 10)	$2,253	$9,851
6	Design & Development	$0	$52
7	Administration, Management, and Technical Assistance[1]	$2,006	$7,943
8	Marketing[2]	$2	$967
9	EDC Evaluation Costs	$199	$490
10	SWE Audit Costs	$46	$399
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$9,183	$26,896
13	Total NPV Lifetime Energy Benefits	$20,216	$51,409
14	Total NPV Lifetime Capacity Benefits	$1,658	$3,138
15	Total NPV TRC Benefits[4]	$26,679	$65,301
16	TRC Benefit-Cost Ratio[5]	2.91	2.43

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. The program also used an implementation contractor (JACO) common to all program across Pennsylvania. That implementer ceased business operations during PY7 and disrupted RARP activities for the year.

3.1 PROGRAM UPDATES

The Residential Appliance Recycling Program (RARP) remained unchanged across Phase II with respect to Duquesne Light's program design and implementation. However, the implementer JACO ceased business operations during PY7. This resulted in the program ending early in PY7 and around the third quarter.

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 PY7. 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 110 percent of the energy savings target for PY7 but spent 253 percent of the targeted budget to achieve those savings. Table 3-1 shows RARP participation, savings and incentives for PY7.

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 Paid ($1,000)
Residential	6,675	6,139	0.782	$230
Phase II Total	**6,675**	**6,139**	**0.782**	**$230**

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. 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 PY7 Sampling Plan, the annual sample size target for RARP was 109 participants, with a targeted level of precision of 15 percent at 85 percent confidence. Table 3-2 below, presents the targeted and achieved sample sizes for the program.

Table 3-2: RARP Sampling Strategy for PY7

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
RARP	1,789	85%/15%	109	109	Telephone Verification & File Review
Program Total	**1,789**	**85%/15%**	**109**	**109**	

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 here, 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: PY7 RARP detailed data were requested from JACO and reviewed as a check on the accuracy of the participant database. This was completed for the first quarter of PY7 that represented about 40 percent of year's activities. In PY7 no exceptions were noted for the data on hand.
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 RARP have deemed savings specified in the 2015 TRM. The TRM provides a retirement value specific to the appliance type regardless of whether the unit is retired or replaced by the participant. 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
Freezer	Retirement	1,103	0.139

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. Verified gross savings are counted when recycling activities are confirmed. Further, gross savings, reported or verified, do not calculated different savings for cases where participants replace units. All gross savings reflect full retirement savings. 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 3-4 and Table 3-5.

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

These results are shown in Table 3-4 and Table 3-5.

Table 3-4: PY7 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	1,759	101%	1,775	0.10	1.3%
Program Total	**1,759**	**101%**	**1,775**	**N/A**	**1.3%**

Table 3-5: PY7 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 (Cv) or Proportion in Sample Design	Relative Precision at 85% C.L.
RARP	0.211	101%	0.213	0.10	1.3%
Program Total	**0.211**	**101%**	**0.213**	**N/A**	**1.3%**

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

3.3 IMPACT EVALUATION NET SAVINGS

The target for the net savings analysis is 85/15 confidence/precision at the program level, and the Net-to-Gross (NTG) analysis for RARP used the same phone surveys as for the gross impact verification, and therefore maintained the 85/15 target.

Table 3-6: RARP Sampling Strategy for PY7 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[1] to Achieve Sample
RARP	All	1,789	1.1	85%/15%	109	109	93%
Program Total	**All**	**1,789**	**1.1**	**85%/15%**	**109**	**109**	
[1] 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 aligned to the methodologies required by the SWE.[10] Navigant notes that while this methodology remained the same for PY6 and PY7, it was somewhat different from that used in PY5. As a result, the evaluation team has a limited view into 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 following PY5 activities 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:

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.

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

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

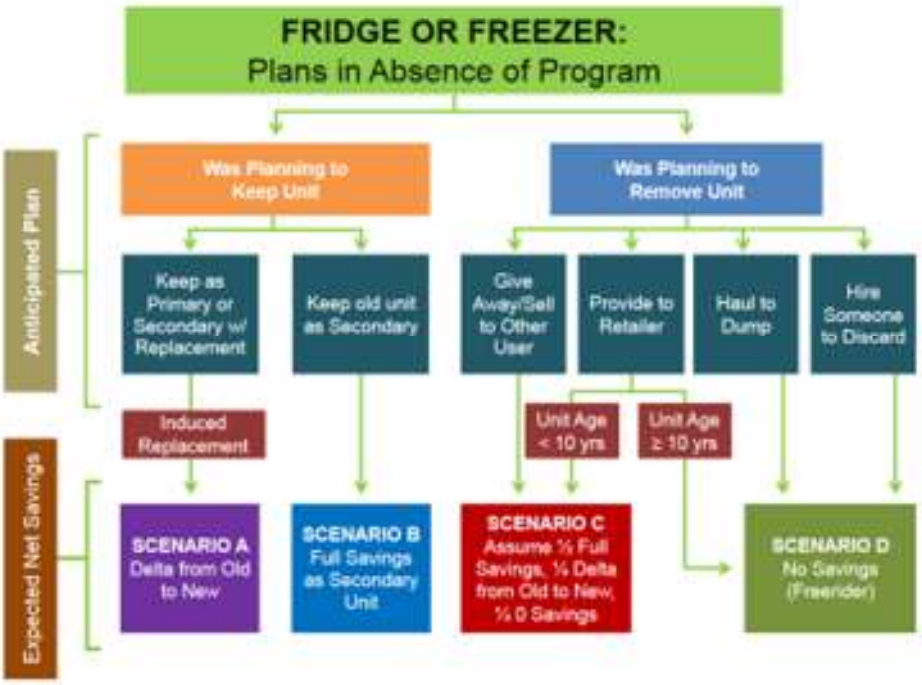


Table 3-7 shows the free ridership results for RARP. Navigant followed SWE guidance by first calculating the total net savings for each surveyed program participant's appliance, based on the appropriate path in Figure 3-1 for that participant's appliance. Most participants only recycled one appliance, but seven of the 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 PY7 was 72 percent for both refrigerators and freezers. This is higher than the PY6 estimate of 65 percent. Additional detail about the RARP free ridership estimation can be found in the PY7 Residential Process Evaluation Report.

Table 3-7: RARP Total FR Ratio

Metric	Value
Reported Gross Savings (MWh)	1,759
Realization Rate	101%
Verified Gross Savings (MWh)	1,775
Reported Units (refrigerators and freezers)	1,789
Unit Net Savings (kWh)	282
Verified Net Savings (MWh)	504
Preliminary Net-to-Gross Ratio (not including spillover)	28%
Free ridership rate	**72%**

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 about 39 kWh per respondent for PY7. That is down from the spillover savings for in PY5 and PY6 that were in excess of 100 kWh per participant. Additional detail about the spillover analysis can be found in the PY7 Residential Process Evaluation Report.

In order to determine a spillover factor for RARP, Navigant multiplied the savings per participant by the number of PY7 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 PY7 is 4 percent. That is a significant drop from the 12 percent and 15 percent seen previously in PY5 and PY6, respectively.

Navigant calculated the NTG ratio for the RARP program shown in Table 3-8 with the following equation:

Equation 3-1. Net to Gross Ratio

($NTG=1-FR+Spillover$)

Table 3-8: PY7 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	72%	4%	34%	1.22	16.9%
Program Total[1]	**72%**	**4%**	**34%**	**1.22**	**16.9%**
[1] NTG ratio at program level should be developed using stratum weight and stratum NTG ratios.					

3.4 PROCESS EVALUATION

The process evaluation for the RARP program group in PY7 included the following activities:

- Review of the 2015 Pennsylvania TRM and program materials
- Surveys with 109 RARP participants sampled randomly from the entire PY7 population between August 4, 2016 and August 24, 2016. These surveys included verification, net-to-gross and selected process evaluation questions.

Table 3-9: RARP Sampling Strategy for PY7

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	All	1,789	1.1	85%/15%	109	109	93%	Impact, Process, NTG
Program Manager	1	1	N/A	N/A	1	1	100%	Process
Program Total		**1,780**			**110**	**110**		

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 PY7 Residential Process Evaluation report. Highlights of the process evaluation are summarized below:

- RARP experienced a significant disruption when JACO's business operations ceased during PY7. This created substantial administrative issues for Duquesne Light. However, the utility's residential coordinator oversaw the difficult process of closing out program activities while maintaining a satisfactory experience for participants.
- Free ridership increased significantly in PY7 to 72 percent. Previously, Navigant estimated free ridership levels of 65 and 51 percent for PY5 and PY6, respectively. Navigant found that when applying the SWE methodology for net savings, the majority of units fell into Scenario D. Recycled units are classified as Scenario D if participants planned or indicated that units would be disposed. Also, Scenario D is applied if units are provided to a retailer (presumably a retailer who replaces a recycled appliance) and the unit is over 10 years old. The SWE methodology assumes that units

older than 10 years have no resale value and are therefore recycled. Navigant estimates that recycled units are 24 years old, on average.

- Navigant learned from the Residential Coordinator that approximately 90 participant rebate checks issued by JACO in PY7 bounced because that implementer's issuing account was no longer active. This count is relatively small, but highlights a potential customer satisfaction risk for Duquesne Light. Navigant also learned from the Residential Coordinator that she tracked all outstanding projects to minimize bounced check issues. For these checks that did bounce, she refunded all rebates and covered all fees incurred by participants.
- Navigant conducted the PY7 participant surveys after the program had closed and after the resolution of the issues and difficulties related to the previous CSP's abrupt cessation of business operations. The PY7 satisfaction questions reflect the sentiment of participants who experienced these issues. For example, market rate participants rated the time it took to receive their incentive with a score of 3.6 on a 5-point scale. That same aspect received scores of 4.3 and 4.4 during PY5 and PY6, respectively. While that PY7 aspect score fell, all other aspect scores only fell by 0.3 points on the same 1 to 5 point scale. Also, participants rated their experience with the overall program with a 4.6 in PY7 indicating they were satisfied to extremely satisfied. These high scores are a direct reflection of the utility's significant efforts to remedy participant issues present during PY7 and provide a positive customer experience.

3.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The RARP program achieved an energy savings realization rate of 101 percent and the evaluation found a 0.34 NTG ratio. Table 3-10 shows the evaluation's recommendations and additional details can be found in the PY7 Residential Process Evaluation report.

Table 3-10: RARP Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Recommendation 1: Consider boosting survey sample sizes in PY8 for this program, to determine whether free ridership and net-to-gross factors are indeed increasing. Modify the survey questionnaire to try to probe more deeply the reasons for any free ridership identified, and consider conducting focus groups if needed (i.e., if the reasons are not clear from the surveys).	Under consideration

3.6 FINANCIAL REPORTING

RARP is performing well above plan levels, achieving 110 percent of the PY7 energy savings goal and spending 253 percent of the targeted budget for the year. A breakdown of the program finances is presented in Table 3-11.

Table 3-11: Summary of Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 through 4)	$148	$333
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)	$148	$333
5	Program Overhead Costs (Sum of rows 6 through 10)	$342	$1,460
6	Design & Development	$0	$6
7	Administration, Management, and Technical Assistance[1]	$267	$1,119
8	Marketing[2]	$45	$230
9	EDC Evaluation Costs	$24	$58
10	SWE Audit Costs	$6	$47
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$490	$1,793
13	Total NPV Lifetime Energy Benefits	$666	$2,389
14	Total NPV Lifetime Capacity Benefits	$68	$212
15	Total NPV TRC Benefits[4]	$733	$2,600
16	TRC Benefit-Cost Ratio[5]	1.50	1.45

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.

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 PY7.

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 PY7. 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 3 percent of the energy savings target for PY7 but spent 32 percent of the targeted budget to achieve those savings. Table 4-1 shows SEP participation, savings and incentives for PY7.

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 Paid ($1,000)
Residential	1,698	618	0.038	$0
Phase II Total	**1,698**	**618**	**0.038**	**$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.

In Duquesne Light's PY7 Sampling Plan, Navigant initially estimated an annual sample size target for SEP of 70 participants, with a targeted level of precision of 15 percent at 85 percent confidence. However, once Navigant learned of limited program activities it instead attempted a census of the program population. Table 4-2 presents the targeted and achieved (actual) sample sizes for the program. The achieved sample represents the efforts to contact all program participants from PY7 from both the market and low income sectors. Given the limited program activities and small sample sizes Navigant combined the market rate (SEP) and low income (LIEEP SEP) participants into a single stratum in order to develop more robust verification results. SEP is implemented identically for these two groups.

Table 4-2: SEP Sampling Strategy for PY7

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
SEP Participants	125	85%/15%	Attempted Census	27	File Review & Phone Verification (Market rate and LI combined)
Program Total	**125**	**85%/15%**	**Attempted Census**	**27**	

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 2015 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 the 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: PY7 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 Participant	36	66%	24	0.41	11%
Program Total	**36**	**66%**	**24**	**0.41**	**11%**

Navigant's analysis found that surveyed participants were installing only 70 percent of the CFLs from the kit (roughly three of four lamps) and half of the Limelights (one of the two). Also, 30 percent of the participants were not using the smart strip.

Navigant notes that the realization rate in Table 4-4 shows 71 percent, but the analysis spreadsheet of the sample data shows 70 percent. The analysis spreadsheet value is illustrative. As noted before, Navigant combined the market rate and low income samples. The difference in results in the roll up of verified findings originates from the distribution of market rate versus low income participants. Those distributions differ between the sample and population. This is true for the energy calculation in Table 4-3 as well. However, it does not impact the realization rate's two significant digits.

Table 4-4: PY7 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 Participants	0.003	71%	0.002	0.47	12%
Program Total	**0.003**	**71%**	**0.002**	**0.47**	**12%**

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

4.3 IMPACT EVALUATION NET SAVINGS

The target for the net savings analysis is 85/15 confidence/precision at the program level, and the Net-to-Gross (NTG) analysis for SEP used the same phone surveys as for the gross impact verification, and therefore maintained the 85/15 target.[11] However for SEP in PY7, the phone surveys ultimately targeted a census of all market rate and low income participants given the small program population. Findings for PY7 were developed from an examination of both groups given that SEP is implemented identically for them.

Table 4-5: SEP Sampling Strategy for PY7 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[1] to Achieve Sample
SEP Participants	All	125	0.5	85%/15%	Attempted Census	27	100%
Program Total	**All**	**125**	**0.5**	**85%/15%**	**Attempted Census**	**27**	**100%**

[1] 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 followed the methodologies required by the SWE. Further, this methodology used for PY7 is similar to the approaches used for PY5 and PY6 and provides a means for a useful comparison across Phase II.

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

[11] During planning, the SEP sample planned to target about 70 surveys to inform gross, net, and process evaluation activities. This estimation was based on historical activities. However, program activities were limited in PY7 and Duquesne Light achieved only 3 percent of planned goals for SEP. The program population was smaller than anticipated and therefore Navigant attempted a census. The team achieved a total of 27 surveys of market rate and low income participants.

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 PY6 and PY7, the reported savings, used to weight the overall free ridership, remained unchanged at 288 kWh.

Free ridership increased from 36 percent in PY5 to 42 percent in PY6 and then fell to 31 percent in PY7. The individual component free riderships only shift slightly from PY5 to PY6. These shifts are driven by the individual kit component free ridership changes, and CFLs saw the largest changes over the Phase. CFL free ridership was 49 percent in PY5, decreased to 47 percent in PY6, and fell again to 34 percent in PY7.

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	34%
Smart Strips (one)	74.5	25%
LED Limelight Nightlights (two)	59.0	30%
Total Kit	**287.7**	**31%**

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 48 instances of CFLs and LEDs being installed by SEP respondents (across by market rate and low income participants). However, these are excluded from spillover savings and Navigant conservatively assumes that those CFLs and LEDs are purchased and captured within the Upstream Lighting component. Additional detail about the spillover analysis can be found in the PY7 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 PY7 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. Navigant estimates 36 kWh of spillover savings per surveyed SEP participant from PY7. There were 125 participants in PY7 and so the total spillover savings for the program year are 4.54 MWh.

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	36.3	125	4,542	23,899	19%

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

Equation 4-1. Net to Gross Ratio

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

Table 4-8: PY7 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 Participants	31%	19%	87%	0.21	6.1%
Program Total[1]	**31%**	**19%**	**87%**	**0.21**	**6.1%**
[1] NTG ratio at program level should be developed using stratum weight and stratum NTG ratios.					

4.4 PROCESS EVALUATION

The process evaluation for the SEP program group in PY7 included the following activities:

- Review of the 2015 Pennsylvania TRM and program materials
- Surveys with 27 SEP participants (both market rate and low income) through a census attempt of the entire PY7 population between July 20 and August 14, 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 Sampling Strategy for PY7

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 Participants	All	125	0.5	85%/15%	Attempted Census	27	100%	Impact, Process, NTG
Program Manager	1	1	N/A	N/A	N/A	1	100%	Process
Program Total		**126**			**N/A**	**28**		

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

The SEP process evaluation findings and details can be found in the Residential Energy Efficiency Programs PY7 Process Evaluation report. Highlights of the process evaluation are summarized below:

- SEP achieved only 3 percent of its PY7 goals and spent only 32 percent of its PY7 budget.
- The SEP program saw a decrease in the amount of spillover in PY7 as compared to PY6. However, spillover was still significant and at 19 percent. Interestingly, spillover was higher among low income participants (23 percent after removing one outlier) than market rate participants (14 percent). Overall, 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. Over half (16 of the 27 respondents) did not know of a recommendation or thought the program was fine as designed and implemented.
- Duquesne Light indicated that it avoided implementing SEP at schools more than once during Phase II. The utility took this approach to avoid supplying schools with multiple incentives and families with multiple kits. Duquesne Light acknowledges that new students have cycled through since the beginning of the Phase, but that those families likely remain associated with the schools because of siblings who may still be in attendance.

Navigant also notes that the SEP program, that targets elementary school children and their families, will be transitioned in Phase III to a program that targets middle and high school students.

4.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The SEP program achieved an energy savings realization rate of 66 percent and the evaluation found a 0.87 NTG ratio. Table 4-10 shows the evaluation's recommendations and additional details can be found in the PY7 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)
Recommendation 1 Duquesne Light plans for a different program to replace SEP during Phase III. Therefore, no recommendations are offered at this time.	N/A

4.6 FINANCIAL REPORTING

SEP performed below targets, having achieved just 3 percent of the energy savings target for PY7 and having spent about 32 percent of the targeted program year budget. A breakdown of the SEP program finances is presented in Table 4-11.

Table 4-11: Summary of Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 through 4)	$3	$3
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)	$3	$3
5	Program Overhead Costs (Sum of rows 6 through 10)	$138	$549
6	Design & Development	$0	$6
7	Administration, Management, and Technical Assistance[1]	$107	$433
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$25	$62
10	SWE Audit Costs	$6	$48
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$141	$552
13	Total NPV Lifetime Energy Benefits	$9	$129
14	Total NPV Lifetime Capacity Benefits	$1	$6
15	Total NPV TRC Benefits[4]	$9	$138
16	TRC Benefit-Cost Ratio[5]	0.07	0.25

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.

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 receive 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

No changes occurred for WHEAP in PY7.

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 PY7. Participants can only participate in the program once in PY7 and the evaluation found no repeating participation.

5.2 IMPACT EVALUATION GROSS SAVINGS

WHEAP did not meet its savings goals for PY7. By the end of program year, program verified savings totaled 13 percent of the PY7 unverified gross savings goal of 333 MWh. The program saw limited activities

given that Duquesne Light had already exceeded its Phase II portfolio levels. Additionally, Navigant identified a portion of participants who were initially identified as market rate customers were determined to be low 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 PY7.

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 Paid ($1,000)
Residential	186	128	0.013	$0
Phase II Total	**186**	**128**	**0.013**	**$0**

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. 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.

Navigant developed two strata in PY6 for WHEAP. A Small and Large strata that differentiated projects by reported savings total. Navigant did not stratify the sample in PY7 given the smaller program activities and resulting smaller samples. Also, Navigant did not see the variation in installation rates among different project sizes in the PY6 data as it had assumed during PY6 planning. Therefore, stratification was not necessary to developing verified results.

Navigant attempted a census of the program population. Table 5-2 presents the targeted and achieved (actual) sample sizes for the program. The achieved sample represents the efforts to contact all program participants from PY7 from both the market and low income sectors. Given the limited program activities and small sample sizes Navigant combined the market rate (WHEAP) and low income (LIEEP WHEAP) participants into a single stratum in order to develop more robust verification results. WHEAP is implemented very similar for these two groups. Specifically, both groups are offered the same types of energy efficiency measures that are direct installed by onsite field staff who receive the same program training.

Table 5-2: WHEAP Sampling Strategy for PY7

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
WHEAP Participants	64	85%/15%	Attempted Census	22	File Review & Phone Verification (Market rate and LI combined)
Program Total	**64**			**22**	

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 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 2015 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 2015 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 sample realization rate was then calculated using the verified energy and demand savings from telephone interviews for each measure item installed through the audit, similar to the component level approach used for REEP or SEP Kits.

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 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.

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.

Navigant notes that the energy and demand realization rates shown here differ from the values in the analysis spreadsheet for the telephone survey effort. The telephone survey developed a realization rate by comparing PMRS data to participant responses. Navigant also reviewed the CSP's data against PMRS. In most cases, CSP and PMRS data are identical. However, Navigant found one discrepancy and confirmed the CSP's value was accurate. Specifically for one audit (one respondent), PMRS credited the project with 16 13W CFLs. The CSP data only showed six. The analysis spreadsheet notes this finding, but does not incorporate it into the sample level analysis there. Instead, Navigant incorporated this difference into its program level analysis and the realization rates shown here.

Table 5-3: PY7 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.
WHEAP Participants	83	89%	74	0.16	6%
Program Total	**83**	**89%**	**74**	**0.16**	**6%**

Table 5-4: PY7 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.
WHEAP Participants	0.008	87%	0.007	0.17	8%
Program Total	**0.008**	**87%**	**0.007**	**0.17**	**8%**

Realization rates at or close to 100 percent are typical for direct install programs because installations are completed and confirmed by trained installers instead of by the participants. The evaluation found energy realization rates at 89 percent. One low income participant reported that only 1 of the 10 CFLs reported as installed remained installed. They indicated that some lamps were broken while others burned out

earlier than expected. Another low income participant said that only three CFLs had been installed while the tracking data indicated eight. A market rate participant was not happy with some CFLs and removed 4 of 13 installed. Finally, another market rate participant removed a smart strip installed by an auditor. These findings contributed to the program's realization rate.

5.3 IMPACT EVALUATION NET SAVINGS

The target for the net savings analysis is 85/15 confidence/precision at the program level, and the Net-to-Gross (NTG) analysis for WHEAP used the same phone surveys as for the gross impact verification, and therefore maintained the 85/15 target.[12] 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. However for WHEAP in PY7, the phone surveys ultimately targeted a census of all market rate and low income participants given the small program population. Findings for PY7 were developed from an examination of both groups given that WHEAP is implemented similarly for them.

Table 5-5: WHEAP Sampling Strategy for PY7 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[1] to Achieve Sample
WHEAP Participants	All	64	0.5	85%/15%	Attempted Census	22	100%
Program Total		**64**	**0.5**	**85%/15%**		**22**	

[1] 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 ratio for WHEAP was 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 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?

[12] During initial planning, Navigant did not specify a WHEAP sample to inform gross, net, and process evaluation activities given that program activities were uncertain. Program activities were limited in PY7 and Duquesne Light achieved only 13 percent of planned goals for WHEAP. The program population was smaller than anticipated and therefore Navigant attempted a census. The team achieved a total of 22 surveys of market rate and low income participants.

- 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

Measure	Sample, n (participants with given measure and implementation verified)	Average FR
CFLs	21	33%
Night Lights	0	N/A
Aerators	2	0%
Showerheads	3	33%
Smart Strips	0	N/A
Pipe Wrap	3	8%
Total Audits	**22**	**33%**

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 PY7 Process Evaluation report.

The NTG ratio for the program is determined as follows:

$$NTG = 1\text{-}FR+Spillover$$

Table 5-7 summarizes the NTG ratio for the WHEAP program. The free ridership for the Whole House program was generally higher than previously found in PY6 among both market rate and low income participants. This relates to increased market adoption of CFLs. Navigant also found lower spillover for the

overall PY7 program. The PY7 spillover reflects the combination of the market rate and low income participants. The spillover among market rate participants was high (18 percent for the sample) and low among low income participants (0 percent for the sample). For this deeper view, these market-specific spillover rates are similar to those found from the PY6 activities.

Table 5-7: PY7 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
WHEAP Participants	33%	6%	73%	0.36	12%
Program Total[13]	**33%**	**6%**	**73%**	**0.36**	**12%**

5.4 PROCESS EVALUATION

Navigant conducted in-depth process evaluation activities for WHEAP's first year of implementation in PY6. Those PY6 findings are still applicable to WHEAP in PY7, and Navigant took a more limited approach in PY7 to supplement those findings. PY7 activities included the following:

- Review of the 2015 Pennsylvania TRM and program materials
- Interviews with Duquesne Light program staff
- Surveys with 22 participants sampled through a census attempt of the entire PY7 population between May 16, 2016 and July 25, 2016. 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 PY7

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)
WHEAP Participants	All	64	0.5	85%/15%	Attempted Census	22	100%	Impact, Process, NTG
Program Manager	1	1	N/A	N/A	N/A	1	100%	Process
Program Total		**65**				**23**		

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 PY7 Process Evaluation report. Highlights of the process evaluation are summarized below:

- WHEAP achieved only 13 percent of its PY7 energy savings compliance target. This was due, in large part, to the fact that Duquesne Light had already exceeded its Phase II compliance targets before the end of the phase. The program manager commented on this result. She indicated that WHEAP in PY7

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

positioned itself well to support Phase III energy efficiency activities. For example, the program, and Duquesne Light, will team up with gas utilities on efforts that target low income homes using both electric and gas energy. These activities will relate to audits, home weatherization, marketing, outreach presentations, advisory services, and other service offerings to benefit low income customers.

- CFLs compose roughly 97 percent of WHEAP savings. The program excluded LEDs in PY7.
- WHEAP continues to provide 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.
- 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 formal tracking to understand what recommended REEP rebates are implemented by participants. Further, Navigant reviewed program tracking for the PY7 population of participants. It found that only 10 of 138 participants participated in any other type of Duquesne Light program (i.e., REEP rebates or other) following their audits.
- Satisfaction remains high for the program. The 22 participants surveyed indicated an average satisfaction score of 4.6 on a 1 to 5 scale where 5 means "extremely satisfied."

5.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The WHEAP program achieved an energy savings realization rate of 89 percent and the evaluation found a 0.73 NTG ratio. Table 5-9 shows the evaluation's recommendations and additional details can be found in the PY7 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)
Recommendation 1 As the utility initiates its Phase III WHEAP, it should carefully monitor costs relative to savings and ensure that all savings opportunities are being taken advantage of once a utility representative is in the customer home. Visit costs are incurred once the program auditor is on site; any incremental savings that can be obtained as a result of the visit are likely to only improve cost effectiveness.	Under consideration
Recommendation 2 Track the implementation rate for REEP Rebates that are recommended through the new and differently implemented WHEAP in PY8, to determine whether specific actions are needed to ensure that the link between the two programs is being made effectively to participants. Track the awareness of REEP rebates through participant surveys in PY8 for the same reason.	Under consideration
Recommendation 3 Consider sending follow-up email notices to participants after they have participated in the program (e.g., at least one quarter or more later), reminding them of recommendations made and rebate opportunities available through REEP if they have not participated as recommended. Also, consider conducting regular reviews of program tracking data to understand REEP Rebate adoption rates among WHEAP participants after they have participated in WHEAP.	Under consideration

5.6 FINANCIAL REPORTING

WHEAP is performing below plan projections. The program achieved only 13 percent of its energy savings goals in PY7. The program also exceeded its PY7 budget and spent 146 percent of plan. A breakdown of the program finances is presented in Table 5-10.

Table 5-10: Summary of Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 through 4)	$5	$14
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)	$5	$14
5	Program Overhead Costs (Sum of rows 6 through 10)	$365	$732
6	Design & Development	$0	$0
7	Administration, Management, and Technical Assistance[1]	$350	$700
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$12	$22
10	SWE Audit Costs	$3	$10
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$370	$746
13	Total NPV Lifetime Energy Benefits	$10	$38
14	Total NPV Lifetime Capacity Benefits	$1	$3
15	Total NPV TRC Benefits[4]	$11	$40
16	TRC Benefit-Cost Ratio[5]	0.03	0.05

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 HOME ENERGY REPORTS (HER)

The Residential Home Energy Reports (HER) program influences behavior change in customers through the power of information, provided in the form of an energy report mailed to participants on a regular basis. The primary goal of the HER program is to achieve cost-effective energy savings by helping residential customers understand their energy use and adopt energy-efficient behavior changes. The reports provide participants with information about their recent energy use and compare the usage to that of similar homes. The reports also provide participants with energy-saving tips, some of which are tailored to the participant's circumstances. This set of information has been shown in other studies to stimulate participants to reduce their energy use, creating average energy savings in the 1 percent to 2 percent range.

The program is an opt-out program in which the CSP, Opower, enrolls participants in the program based on a randomized control trial (RCT) program design. Enrolled customers can opt out of the program by calling or emailing the program implementer.

This program was launched in PY4 and targets high-use residential customers. The program included a total of over 225,400 participant enrollees, including over 25,000 low income customers. Energy savings are the primary metric for gauging program success and are determined via a regression analysis performed on the billing records of participant households. Savings from behavioral programs, such as the HER program, are typically considered to have a one-year lifetime for as long as the reports are being delivered. Section A.2.c.2 of the Commission's Phase II Final Implementation Order[14] indicates that savings are only counted for those measures for which the useful life is not expired at the end of the phase. Therefore, only savings from the HER program in PY7 will count toward Duquesne Light's compliance goals for Phase II.

6.1 PROGRAM UPDATES

There were no major program design updates for PY7. In preparation for PY7, the CSP began sending HERs in March of PY6 to households that were enrolled in the program during the PY4 program year and still had active accounts with Duquesne Light. In addition, two new waves of market rate and low income customers began receiving reports at the same time. These new waves of participants originally totaled 152,000 and 21,000 households respectively. Furthermore, the program did provide a more tailored experience for Low income participants, including focusing on low income measures and low income specific program information.

6.1.1 Definition of Participant

A key feature of the HER program is the use of an RCT design, in which eligible customers are randomly assigned to treatment and control groups. Due to random assignment, any difference in usage between treatment participants and control customers is a result of participation in the program. Duquesne Light defines participation based on the number of customer households assigned to the treatment group. One treatment group home equals one participant.

Prior to the launch of a participant wave, the program implementer selected a representative sample of target customers and randomly assigned them into either a treatment or control group; treatment group customers receive the HERs and control group customers do not. Customers assigned to the participant

[14] The Pennsylvania Public Utility Commission, "Act 129 EE&C Phase II Implementation Order," August 3, 2012.

group may opt out if they no longer want to receive the HERs. The evaluation, measurement, and verification industry considers this RCT strategy to be the best way to enable accurate evaluation of the impacts of behavioral programs.[15] The RCT strategy also aids the CSP and Duquesne Light in monitoring progress toward program goals.

6.2 IMPACT EVALUATION GROSS SAVINGS

As mentioned earlier, because this behavior program is assumed to have a one-year measure life, savings that accrue to this program are reported and verified each year but decay to zero at the completion of the program year. Therefore, only savings from the HER program in PY7 count toward Duquesne Light's compliance goals for Phase II. During PY7 and Phase II, the HER program reported total savings of 26,230 MWh with no reported demand savings. The savings results and participant counts for the market-rate portion of the program for the entirety of Phase II are summarized in Table 6-1.

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

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives Paid ($1,000)
Residential	200,251	26,230	0.000	$0
Phase II Total	**200,251**	**26,230**	**0.000**	**$0**

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

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

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

[15] State and Local Energy Efficiency Action Network. *Evaluation, Measurement and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*. May 2012.

This is referred to as a one-way fixed-effects model because it includes a household-specific fixed-effects term. Equation 6-1 formally presents the equation for this model.[16]

Equation 6-1. One-Way Fixed-Effects Regression Model

$$ADC_{kt} = \alpha_{0k} + \alpha_1 Post_t + \alpha_2 Participant_k \cdot Post_t + \varepsilon_{kt}$$

where

ADC_{kt} =	The average daily use in kWh for participant or non-participant *k* during billing cycle *t*. This is the dependent variable in the model.
$Post_t$ =	A binary variable indicating whether bill cycle *t* is in the post-program period (taking a value of 1) or in the pre-program period (taking a value of 0).
$Participant_k$ =	A binary variable indicating whether household *k* is in the participant group (taking a value of 1) or in the non-participant group (taking a value of 0).
α_{0k} =	The household-specific fixed effect (constant term) for household *k*. The fixed-effect controls for all participant or non-participant-specific effects on energy consumption that do not change over time, such as the number of household members or the size of the dwelling.
α_1, α_2 =	Regression parameters corresponding to the independent variables.

The coefficient α_{0k} is the household-specific fixed-effect that implicitly captures all participant-specific and non-participant-specific effects on electricity use that do not change over time. The calculation of the fixed-effect term does not require knowledge of which characteristics at each household are unchanged; the regression model uses billing data to implicitly estimate the aggregate impact upon energy use of all characteristics that are unchanged over time. Second, α_1 captures the average effect among non-participants of being in the post-treatment period. In other words, it captures the effects of exogenous factors, such as economic conditions, that affect all non-participants in the program period but not in the pre-program period. Third, $\alpha_1 + \alpha_2$ captures the average effect among participants of being in the post-program period, and so the effect directly attributable to the HER program is captured by the coefficient α_2. In other words, this coefficient captures the difference-in-difference (DID) in average daily kWh use between the participants and non-participants across the pre-program and treatment periods. Consequently, the DID statistic is considered the best indicator of program effects in a program evaluation. The evaluation team generated average savings for PY7 by multiplying the estimate of household average daily savings (α_2) by the average number of post days per participant.

The one-way fixed-effects model is the preferred model used for reporting savings. As a check on the robustness of the savings estimates, Navigant also modeled HER program savings utilizing a post-only model. Due to the experimental design of the program, the two models should generate similar results. The second model uses post-enrollment program observations only and replaces the household fixed effect with the household's energy use in the same calendar month of the pre-program year to account for household-level variation in energy use. Navigant refers to this model as the post-program regression (PPR) model. Formally, defining $Preconsumption_{kt}$ as household *k*'s energy use in month *t* and letting γ_t denote the fixed effect for month *t*, the model takes the form shown in Equation 6-2.

Equation 6-2. PPR Model with Monthly Fixed Effects

$$ADC_{kt} = \alpha_{ot} + \alpha_1 Preconsumption_{tk} + \alpha_2 Participant_k + \gamma_t + \varepsilon_{kt}$$

[16] This equation corresponds to Formula 1.1 in Appendix C of *Evaluation, Measurement, and Verification (EM&V) of Residential Behavior-Based Energy Efficiency Programs: Issues and Recommendations*, published by the State and Local Energy Efficiency Action Network in May 2012.

Participants and non-participants that moved out of Duquesne Light territory during the course of the program were omitted from the regression analysis to estimate program effects but were included in the estimate of total program savings for the time prior to when they moved away. Navigant assumed that until a participant moves out, their program savings are equal to savings over the same period for participants that remain in the program for the balance of the program duration. Table 6-2 summarizes the sampling strategy for the PY7 evaluation.

Both regression models utilize billing data from all treatment and control households that are enrolled in the HER program. Thus, the sampling strategy is considered to be a census approach where data from all households is utilized in the analysis, as shown in Table 6-2.

Table 6-2: HER Sampling Strategy for PY7

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Residential: Home Energy Report Program	200,251	N/A	Census	Census	Billing Analysis
Program Total	**200,251**	**N/A**	**Census**	**Census**	

No onsite inspections were conducted for the PY7 HER program evaluation.

The verified ex-post energy savings for HER in PY7 and Phase II were 26,094 MWh, after accounting for double-counted savings with other Duquesne Light energy efficiency programs. A summary of verified ex-post HER program savings is shown in Table 6-3 and Table 6-4.

Table 6-3: PY7 HER 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.
Residential: Home Energy Report Program	26,230	99%	26,094	N/A	0.0%
Program Total	**26,230**	**99%**	**26,094**	**N/A**	**0.0%**

Due to the nature of the delivered home energy reports, the HER program does not report participant demand savings, nor are they verified as part of the program's evaluation.

Table 6-4: PY7 HER 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.
Residential: Home Energy Report Program	0.000	100%	0.000	N/A	N/A
Program Total	**0.000**	**100%**	**0.000**	**N/A**	**N/A**

6.3 IMPACT EVALUATION NET SAVINGS

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

> *RCTs eliminate this free-rider concern during the study period because the treatment and control groups each contain the same number of free riders through the process of random assignment to the treatment or control groups. When the two groups are compared, the energy savings from the free riders in the control group cancel out the energy savings from the free riders in the treatment group, and the resulting estimate of program energy savings is an unbiased estimate of the savings caused by the program (the true program savings).*
>
> …
>
> [Participant spillover], *in which participants engage in additional energy efficiency actions outside of the program as a result of the program, is also automatically captured by an RCT design for energy use that is measured within a household.*

However, the RCT design does not account for non-participant spillover. Section 2.2.2 of the SEE Action protocol continues:

> [Non-participant spillover] *issues in which a program influences the energy use of non-program participants are not addressed by RCTs. In these cases in which non-participant spillover exists, an evaluation that relies on RCT design could underestimate the total program-influenced savings.*

Free ridership and spillover and incorporated into the results of the HER regression analysis based on customer billing records. Non-participant spillover is not included in the regression analysis, but the industry standard approach is to assume that non-participant spillover is small for this type of program. It would be primarily driven by conversations that participants may have with non-participant Duquesne Light customers, which are expected to have a relatively small impact on non-participant energy savings. The conservative approach used by Navigant is to assume that non-participant spillover is 0.00 and that the NTG ratio for the HER program is conservatively assumed to be 1.0. As a result, the net and gross savings estimates are the same for the HER program. As such, there is no NTG sample for the HER program.

Table 6-5: HER Sampling Strategy for PY7 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[1] to Achieve Sample
Residential: Home Energy Report Program	All	200,251	N/A	N/A	N/A	N/A	N/A
Program Total		**200,251**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

[1] 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: PY7 HER 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
Residential: Home Energy Report Program	N/A	N/A	N/A	N/A	N/A
Program Total[1]	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**

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

6.4 PROCESS EVALUATION

The HER process research focused on participant experience with the Home Energy Report, participant satisfaction, energy awareness, and opt-out participants. Telephone surveys were completed with a total of 134 HER participants (including 75 low income participants and 59 market rate participants) and 30 participants who opted out of receiving the reports.

The evaluation achieved the targeted number of completes for low-income participants but not for market rate participants. The evaluation team experienced very low levels of sample contact. This may have been partially due to the timing of the survey, which occurred in the months before a presidential election. Duquesne Light territory is located in what is commonly referred to as a "swing state", in which the two major political parties have similar levels of support among voters, and is viewed as important in determining the overall result of a presidential election. It is highly likely that many of the Duquesne HER participants were refraining from answering their telephones, because along with the HER survey calls, it is likely that there were receiving many politically centered calls, either from political polling companies or political campaigns.

The following findings were the key results of the HER process evaluation:

Participant Engagement. The vast majority (72 percent of all participants) recalled thoroughly reading at least one report, with the number being slightly higher for low income participants (76 percent) than market rate participants (68 percent). Additionally, slightly less than half of the participants (44 percent) reported that they thoroughly read all, or nearly all, of the reports that they remembered receiving.

Satisfaction. The majority, 70 percent, of the HER participants are satisfied with their reports, giving a rating of 4 or more on a 1 to 5 scale.

Table 6-7: HER Sampling Strategy for PY7

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)
HER Market Rate Participants	All Market Rate Participants	200,251	0.5	85%/15%	75	59	100%	Process
HER Opt-Out Participants	All Opt-Out Participants	391	0.5	85%/15%	75	30	100%	Process
Program Total		**200,642**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**Process**

6.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The HER program achieved an energy savings realization rate of 99 percent and the evaluation assumed an NTG ratio of 1.00. Table 6-8 shows the evaluation's recommendations and additional details can be found in the PY7 Process Evaluation report.

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

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Recommendation 1 No recommendations for the HER program are offered at this time.	N/A

6.6 FINANCIAL REPORTING

HER achieved above plan projections for PY7 and reached 249 percent of the PY7 energy goals. HER also only spent 44 percent of its PY7 budget. Navigant notes that for the Phase HER achieved 94 of its energy savings goal. A breakdown of the program finances is presented in Table 6-9.

Table 6-9: Summary of Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 through 4)	$343	$343
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)	$343	$343
5	Program Overhead Costs (Sum of rows 6 through 10)	$368	$1,995
6	Design & Development	$0	$0
7	Administration, Management, and Technical Assistance[1]	$368	$1,995
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$0	$0
10	SWE Audit Costs	$0	$0
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$711	$2,338
13	Total NPV Lifetime Energy Benefits	$1,496	$1,496
14	Total NPV Lifetime Capacity Benefits	$0	$0
15	Total NPV TRC Benefits[4]	$1,496	$1,496
16	TRC Benefit-Cost Ratio[5]	2.11	0.64

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.

7 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 PY7, 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) provided income qualifying customers in-depth home audits and direct install measures at no charge. This also delivered savings to LIEEP.

The Home Energy Report (HER) also contributed savings to LIEEP by targeting energy reports to income qualifying customers in PY7.

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 that are applied to PY7 program verification activities. The PY6 survey determined that 4.9 percent of CFL and 2.3 percent of LED lamps purchased were installed in low income households.

7.1 PROGRAM UPDATES

Similar to HER for market rate customers, the low income HER component became active during PY7. HER contributed savings to LIEEP in PY7 by targeting income qualifying households with energy reports.

7.1.1 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 7-1 represent a summation of the unique customer participant account numbers in the tracking system for the program in each of the four quarters of PY7. 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).

7.2 IMPACT EVALUATION GROSS SAVINGS

The Low Income Energy Efficiency Program (LIEEP) is not exceeding its goals for PY7. By the end of PY7, Duquesne Light reported savings totaling 80 percent of its PY7 unverified gross savings goal of 4,981 MWh. However, Duquesne Light is currently tracking above Phase II goals at 130 percent. Table 7-1 shows LIEEP participation, savings and incentives for PY7.

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

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives Paid ($1,000)
Low income	34,519	19,356	1.264	$489
Phase II Total	**34,519**	**19,356**	**1.264**	**$489**

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. 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 six strata were defined: REEP Rebates (non-kits), REEP Kits, RARP, SEP, WHEAP, and HER. This approach was used under the assumption that the implementation/installation rate for each of these strata could be quite different. PY7 activities excluded strata for Refrigerator Replacement and Smart Strips. These were analyzed in PY6, but activities were limited in PY7 and therefore excluded from primary research. Verification findings from LIEEP RARP and LIEEP Rebates are applied to Refrigerator Replacements and Smart Strips, respectively. Also, market rate and low income sampled participants were combined for REEP Rebates, SEP, and WHEAP in order to develop more robust verification findings. Participation levels were low for these LIEEP components in PY7 and the resulting samples were also small. These program components are implemented identically or very similar to their market rate counterparts.

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 percent for CFLs and 2.3 percent for LEDs through a general population telephone survey, and the associated levels of savings and incentive costs were allocated to LIEEP.

In Duquesne's PY7 Sampling Plan, the annual sample size target for LIEEP included a mix of targeted sample counts and attempted censuses. Table 7-2 shows the sample targets and where census attempts occurred for the LIEEP components that also targeted precision levels of 15 percent at 85 percent confidence. Navigant relied on census attempts for LIEEP components that experienced limited activities during PY7.

Table 7-2: LIEEP Sampling Strategy for PY7

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
LI Rebates	152	85%/15%	70	84[1]	File Review & Telephone Verification (Market rate and LI combined)
LI Kits	1,377	85%/15%	25	25	Application Review & Telephone Verification
LI SEP	97	85%/15%	Attempted Census	27[1]	File Review & Phone Verification (Market rate and LI combined)
LI RARP	390	85%/15%	40	39	Telephone Verification & File Review
LI WHEAP	247	85%/15%	Attempted Census	23[1]	File Review & Phone Verification (Market rate and LI combined)
LI Upstream Lighting	N/A	85%/15%	N/A	N/A	Database Review
LI HER	25,153	N/A	Census	Census	Billing Analysis
Program Total	**27,416**	**85%/15%**	**95**	**198**	
[1] Low income and market rate combined sample informs low income analysis					

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 listed in Duquesne Light's residential rebate catalog containing approved measures, provided by Duquesne Light in a community outreach energy efficiency kit, or offered from an authorized list through other approved means such as by auditors and assessors trained for WHEAP in-home audits.
3. Measure fulfillment 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, 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, HER) 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. 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 2015 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 2015 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).[17] 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 percent CFL and 2.3 percent LED low income sector lamp allocations determined from the PY6 analysis activities are then applied to the PY7 Upstream Lighting results to arrive at the LIEEP Upstream 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*[18] 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.

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

[18] 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.

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 7-3 and Table 7-4.

Table 7-3: PY7 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 (Cv) or Proportion in Sample Design	Relative Precision at 85% C.L.
LI Rebates	30	105%	32	0.36	21.3%
LI Kits	341	71%	241	0.37	11.0%
LI SEP	28	66%	19	0.43	16.3%
LI RARP	386	105%	406	0.21	4.8%
LI WHEAP	41	89%	36	0.49	11.3%
LI Upstream Lighting	1,087	101%	1,100	N/A	0.0%
LI HER	2,049	102%	2,085	N/A	0.0%
Program Total	**3,960**	**98%**	**3,917**	**N/A**	**1.8%**

Table 7-4: PY7 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 (Cv) or Proportion in Sample Design	Relative Precision at 85% C.L.
LI Rebates	0.009	94%	0.008	0.72	39.9%
LI Kits	0.031	72%	0.022	0.42	12.3%
LI SEP	0.002	71%	0.002	0.45	16.2%
LI RARP	0.046	105%	0.049	0.21	4.8%
LI WHEAP	0.004	87%	0.004	0.62	14.2%
LI Upstream Lighting	0.109	101%	0.110	N/A	0.0%
LI HER	0.000	100%	0.000	N/A	0.0%
Program Total	**0.202**	**97%**	**0.195**	**N/A**	**2.4%**

The lowest energy realization rate reported for the LIEEP program originates from the SEP component. Navigant's analysis (that combined market rate and low income participants into a single sample) found that surveyed SEP participants were installing only 70 percent of the CFLs from the kit (roughly three of

four lamps) and half of the Limelights (one of the two). Also, 30 percent of the participants were not using the smart strip.

Conversely, the RARP component showed the highest energy realization rate. The survey effort for the LIEEP RARP component generally confirmed that appliances were recycled as reported. There were two instances where participants reported that two, and not one, appliance had been recycled.

7.3 IMPACT EVALUATION NET SAVINGS

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

Table 7-5: LIEEP Sampling Strategy for PY7 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[1] to Achieve Sample
LI Rebates	All	152	0.5	85%/15%	70	59	100%
LI Kits	All	1,377	0.5	85%/15%	25	15	100%
LI SEP	All	97	0.5	85%/15%	Attempted Census	27	100%
LI RARP	All	390	0.5	85%/15%	40	22	93%
LI WHEAP	All	247	0.5	85%/15%	Attempted Census	39	100%
LI Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A
LI HER	All	25,153	0.5	85%/15%	75	75	
Program Total		**27,416**		**85%/15%**	**135**	**162**	

[1] 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 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"). Similar to the approach taken for the verification analysis, free ridership for the REEP Rebate, SEP, and WHEAP components of LIEEP are informed by the analysis that combines market rate and low income respondents. Also, free ridership for the LIEEP Upstream Lighting program component relied on the PY6 analysis that combined market rate and low income respondents.

Spillover

Similar to free ridership, the LIEEP spillover estimation duplicated the spillover approach deployed for each of the previously mention programs or combined findings from market rate and low income survey respondents for certain components as previously described. 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 PY7 Process Evaluation report.

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

$$NTG = 1\text{-}FR+Spillover$$

Table 7-6 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 7-6: PY7 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
LI Rebates	59%	18%	59%	0.45	9%
LI Kits	47%	4%	57%	0.30	12%
LI SEP	31%	19%	87%	0.21	6%
LI RARP	67%	5%	32%	1.18	29%
LI WHEAP	33%	6%	73%	0.36	12%
LI Upstream Lighting	54%	24%	69%	0.38	7%
LI HER	N/A	N/A	100%	N/A	N/A
Program Total[1]	**26%**	**8%**	**81%**	**N/A**	**4%**

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

7.4 PROCESS EVALUATION

The process evaluation for the LIEEP program group in PY7 included the following activities:

- Review of the 2015 Pennsylvania TRM and program materials
- Surveys with 4 REEP Rebate participants (respondents combined with market rate respondents), 25 REEP Kit participants, 40 RARP participants, 14 SEP participants (respondents combined with market rate respondents), 13 WHEAP participants (respondents combined with market rate respondents), and 75 HER participants sampled randomly or gathered through census attempts from the entire PY7 population for each program segment between April and September of 2015. Surveys for this group 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.

Table 7-7: LIEEP Sampling Strategy for PY7

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)
LI Rebates	All	152	0.75	85%/15%	70	84	100%	Impact, Process, NTG
LI Kits	All	1,377	0.65	85%/15%	25	25	100%	Impact, Process, NTG
LI SEP	All	97	0.50	85%/15%	Attempted Census	27	100%	Impact, Process, NTG
LI RARP	All	390	1.00	85%/15%	40	39	93%	Impact, Process, NTG
LI WHEAP	All	247	0.50	85%/15%	Attempted Census	23	100%	Impact, Process, NTG
LI Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Impact, Process, NTG
LI HER	All	25,153	N/A	N/A	N/A	N/A	N/A	Impact, Process, NTG
Program Manager	**1**	1	N/A	N/A	N/A	1	100%	Process
Program Total		**27,416**		**85%/15%**	**135**	**162**	**0%**	**Impact, Process, NTG**

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, WHEAP, and HER components.

The process evaluation findings and details can be found in the Residential Energy Efficiency Programs PY7 Process Evaluation report, and the findings highlighted in the REEP, RARP, SEP, WHEAP, and HER sections are applicable to the low income components of those programs. Highlights of the process evaluation are summarized below:

- The LIEEP program components generally performed consistently through Phase II. The established components and their implementation methodologies will provide Duquesne Light with suitable resources to pursue the low income energy efficiency goals established for Phase III.
- During PY6, Duquesne Light had difficulty delivering replacement refrigerators to low income customers who received audits through WHEAP. A significant backlog and lead times developed. However, these were ultimately resolved in PY6, and Navigant confirmed that Duquesne Light was able to maintain this resolution in PY7. Specifically, lead times were down to 5 weeks or less.

7.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

The LIEEP program achieved an energy savings realization rate of 99 percent and the evaluation found a 0.81 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 often the same as those for the other residential programs in which LIEEP customers participated. Additional recommendations are presented below.

Table 7-8: LIEEP Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Recommendation 1 For fulfillments through WHEAP, Duquesne Light was able to maintain refrigerator replacement lead times, but Navigant notes that the program activities were limited, thereby reducing the potential for backlog issues. During Phase III, Duquesne Light should monitor replacement lead times, particularly as activities ramp up. If issues are detected, then the program manager work to address the situation, making sure to communicate with participants, so that any negative impacts on satisfaction from the delays are minimized. Navigant found in PY6 that these backlogs and lack of communication were a significant source of dissatisfaction.	Under consideration

7.6 FINANCIAL REPORTING

LIEEP is performing well above plan levels with respect to Phase II. The program achieved 80 percent of its energy savings goals in PY7, and LIEEP achieved 130 percent for the Phase. The program is also under budget for PY7 and spent only 25 percent of plan. This Phase II result is mostly due to the success of the Upstream Lighting component of the program. A breakdown of the program finances is presented in Table 7-9.

Table 7-9: Summary of Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 through 4)	$120	$1,047
2	EDC Incentives to Participants	$17	$489
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$103	$558
5	Program Overhead Costs (Sum of rows 6 through 10)	$334	$1,499
6	Design & Development	$0	$15
7	Administration, Management, and Technical Assistance[1]	$254	$1,212
8	Marketing[2]	$5	$5
9	EDC Evaluation Costs	$61	$148
10	SWE Audit Costs	$14	$119
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$454	$2,546
13	Total NPV Lifetime Energy Benefits	$955	$6,154
14	Total NPV Lifetime Capacity Benefits	$70	$271
15	Total NPV TRC Benefits[4]	$1,273	$7,361
16	TRC Benefit-Cost Ratio[5]	2.80	2.89

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.

8 COMMERCIAL PROGRAM GROUP PROGRAMS

Duquesne Light's PY7 Act 129 Commercial Program Group included an overall umbrella program and programmatic efforts that targeted several market segments whether they be standard commercial businesses or government/non-profit/institutional (GNI) customers, including office, retail, healthcare, government, non-profit, education and multifamily. The commercial umbrella program provides energy efficiency services to smaller customer segments not directly served by specific market segment programs. The market segment initiatives are implemented by specialized contractors or Duquesne Light staff and are tailored to overcome known segment-specific barriers to program participation. When governmental/non-profit/institutional (GNI) program savings exceed 20 percent of total sector savings for the previous program year, they are to be treated as a separate program group for sampling purposes. That was the case in PY6, so that for PY7 the GNI programs of the Commercial Program Group were sampled separately.

The standard 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. All provide the same measures and incentive levels to ensure fair and transparent treatment of customers across all segments. 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 one exception to this approach for commercial programs is the Small Commercial Direct Install (SCDI) program. This program targets Duquesne Light nonresidential customers with monthly demand less than 300 kW, addressing small and medium C&I customer sector specific barriers. Customers in these segments are often subject to "split-incentives," where electric bill paying customers are tenants but not the owners of the properties at which they conduct their businesses. Owners do not pay the electric bills, so they are not motivated to upgrade energy using equipment in order to save on electric bills; electric bill-paying tenants are not motivated to upgrade properties they do not own. The program addresses these barriers by providing no-cost efficiency upgrades, whereby landlords received no-cost building upgrades and small business tenants benefit from lower electric bills.

The GNI programs target the government, non-profit, education and multifamily market segments, primarily through two mechanisms – the Multifamily Housing Retrofit program and the Public Agency Partnership 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 generally assists these customers in improving the efficiency of common area spaces in master metered multifamily buildings serving low income households. However, the program also will serve the dwelling units of a qualified building if they are also served by a master meter.

The Public Agency Partnership Program (PAPP) serves public agency customers such as federal, state and local governments, municipalities and school districts and may serve some healthcare systems, institutions of higher education and other non-profit entities. It engages these customers in a partnership to implement an Energy Efficiency Action Plan. Each Public Agency Partnership is established through the execution of a Memorandum of Understanding (MOU) by and between Duquesne Light and the selected local governmental agency. The MOU establishes working groups comprising Duquesne Light and agency representatives who identify project areas within agency departments (and jurisdictional agencies). Working groups define project scopes of service and establish project agreements to co-fund agreed-to projects. The project agreements contain the terms to leverage local agency staff to reach, pre-screen and enroll program participants. 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 following organizations were responsible for implementing the commercial sector programs in PY7:

- Commercial Umbrella: Duquesne Light staff
- Office Buildings: Enerlogics Networks, Inc.
- Retail: Encentiv Energy
- Healthcare: Duquesne Light staff
- Governmental and Non-Profit programs: Duquesne Light, serving governmental partners (public agencies, city, county, state and federal government, and jurisdictional agencies) non-profit multifamily housing organizations, educational institutions and other not-for-profit entities.
- Multifamily Housing Retrofit: Smart Watt, Inc.
- Small Commercial Direct Install: CLEAResult

In PY6, the Multi-family Housing Retrofit (MFHR) and Small Commercial Direct Install (SCDI) programs were new and were sampled separately to ensure that their verification results (i.e., realization rates) were not substantially different from those of the rest of the programs in the Commercial Program Group. This was indeed the case and for PY7, these programs were included in the Commercial program group and GNI program group sampling (as appropriate), as discussed below.

8.1 PROGRAM UPDATES

No significant changes were made to the Commercial Program Group in PY7.

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 PY7. 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 PY7, Duquesne Light reported cumulative Phase II Commercial Program gross savings totaling 120 percent of the 109,030 MWh cumulative estimate projected for Phase II in the utility's EE&C Plan (Table 8-1).

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

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives Paid ($1,000)
Small Commercial	577	50,420	10.730	$2,252
Large Commercial	202	51,611	5.598	$3,440
Government, Nonprofit, and Institutional	247	29,105	4.799	$2,891
Phase II Total	**1.026**	**131,137**	**21.127**	**$8,583**

The sample design for the Commercial Program Group used the stratified ratio estimator approach (Lohr 1999)[19]. 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 some known variable, in this case ranges of ex-ante savings. In other words, a disaggregation 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.

As noted above, per the utility's EM&V Plan and PY7 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. The GNI programs (Public Agency Partnership/Non-profit and Multifamily Housing Retrofit) were treated as a separate evaluation group with its own confidence and precision requirements, per the SWE directive to do so if savings exceeded 20 percent of the non-residential sector savings in the previous year. In PY7 Quarters 1 and 2, it appeared that there had been no Small Commercial Direct Install (SCDI) program participation. The PY7

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

updated Sampling Plan indicated that if any such participation occurred in Quarters 3 or 4, the records would be included in the overall Commercial Program Group sample frame.[20]

After all verification work had been completed in fall of 2016, Duquesne Light's ongoing QA/QC efforts identified additional Multifamily Retrofit projects and SCDI projects existed that had been completed during PY7 but not uploaded to the utility's tracking system, due to a staffing change in the department responsible for uploading program participation data.[21] These projects, of course, were too late to be included in the verification sampling. As a result, the additional Multifamily Retrofit projects were folded into the total GNI Program Group project population and given the same realization rates as other projects in that group. Likewise, the SCDI projects were folded into the total Commercial Program Group project population and given the same realization rates as other projects in that group. The additional Multifamily Retrofit projects accounted for approximately 1.8 million kWh, or about 13 percent, of reported GNI savings, while the additional SCDI projects accounted for approximately 1.6 million kWh, or about 7 percent, of Commercial Program Group savings.

In PY7, impact evaluation verification work was completed in three phases: in spring of 2016 for projects reported in the first two quarters of PY7, in summer of 2016 for projects completed in the third quarter of PY7, and in fall of 2016 for projects completed in the fourth quarter of PY7. Commercial Evaluation Group projects completed between 6/1/2015 and 11/30/2015 (Q1 and Q2), between 12/1/2015 and 2/28/2016 (Q3) and between 3/1/2016 and 5/31/2016 (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 8-2.

[20] "Sample Design for Program Year 7 Evaluation Work," revised sample design memorandum submitted February 12, 2016 to Statewide Evaluation team.

[21] The Multifamily Retrofit and Small Commercial Direct Install (SCDI) programs were both implemented by CSPs, and participation data for these programs were forwarded to Duquesne Light for inclusion in the utility's PMRS tracking database. However, due to the transition to a new customer information system and personnel changes in the department responsible for uploading participation data, certain batches of participation files were inadvertently not uploaded. While procedures have since been put into place to ensure that this problem does not recur, it did result in the late discovery of these Multifamily Retrofit and SCDI participation records.

Table 8-2: Commercial Program Sampling Strategy for PY7

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Commercial - Large	1	85%/15%	1	1	On-Site/Phone Verification
Commercial - Medium	17	85%/15%	6	6	On-Site/Phone Verification
Commercial - Small	40	85%/15%	6	3	On-Site/Phone Verification
GNI - Large	7	85%/15%	5	7	On-Site/Phone Verification
GNI - Small	55	85%/15%	8	7	On-Site/Phone Verification
Multifamily	45	85%/15%	3	3	On-Site/Phone Verification
Program Total	**165**	**85%/15%**	**29**	**27**	**N/A**

Per the utility's EM&V Plan[22], 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 Light 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.

[22] *Evaluation Measurement and Verification Plan: Duquesne Light Act 129—Phase II Energy Efficiency and Conservation Portfolio Programs 5 to 7 (Revised)*, March 3, 2016 (EM&V Plan), Section 2.1, Page 6.

Table 8-3: PY7 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 (Cv) or Proportion in Sample Design	Relative Precision at 85% C.L.
Commercial - Large	3,842	108%	4,162	0.00	**0%**
Commercial - Medium	10,441	101%	10,573	0.11	**6%**
Commercial - Small	2,065	100%	2,061	0.00	**0%**
GNI - Large	12,022	86%	10,339	0.17	**0%**
GNI - Small	3,653	75%	2,744	1.01	**59%**
Multifamily	2,579	92%	2,359	0.06	**8%**
All Commercial	16,347	103%	16,796	N/A	**4%**
All GNI	18,253	85%	15,442	N/A	**9%**
Program (Commercial & GNI) Total	**34,601**	**93%**	**32,239**	**N/A**	**5%**

Table 8-4: PY7 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 (Cv) or Proportion in Sample Design	Relative Precision at 85% C.L.
Commercial - Large	0.00	N/A	0.00	N/A	**0%**
Commercial - Medium	1.17	117%	1.36	0.48	**27%**
Commercial - Small	0.27	100%	0.27	0.00	**0%**
GNI - Large	0.82	100%	0.82	0.91	**57%**
GNI - Small	0.80	42%	0.33	1.00	**58%**
MF	0.33	87%	0.29	0.09	**11%**
All Commercial	1.44	113%	1.63	N/A	**21%**
All GNI	1.94	74%	1.44	N/A	**29%**
Program Total	**3.38**	**91%**	**3.07**	**N/A**	**17%**

Navigant completed a total of 20 site visits for the 22 projects in the commercial program that were selected in PY7 for verification, 11 of which were government/non-profit projects. The Navigant field staff included: Chris Yoder and Dan Golden. Navigant also utilized a subcontractor, Karpinski Engineering, to perform on site visits and evaluations of select lighting projects. Field staff for Karpinski included Chris Spalla and Erin Kennedy. 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 two commercial and government/non-profit projects sampled in PY7 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 reasons savings differing from the reported values were metered hours of use differing from the reported values, and projects utilizing the incorrect version of Appendix C. The updates in 2015 to the TRM require that demand savings be granted for lighting controls, which increased demand savings for those projects that used the 2014 TRM after the 2015 TRM went into effect.

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 Light 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.[23] However, sometimes CSPs split out fixtures into usage groups instead of using one whole building value from the TRM. This was particularly the case in the Multifamily projects.

The PY7 Commercial Program participation included several large retro-comissioning projects in the Healthcare sector. Navigant utilized customer-provided trend data, and consumption data provided by Duquesne Light, to analyze the savings from these sites. Each site differed slightly from the ex-ante savings estimates, but a common issue was the ex-ante modeled data not conforming to what actually took place during the retro-commissioning. For example, several equipment operating schedules had been changed back to their original settings, and one chiller plant sequence of operations was markedly different from what was modeled.

Finally, Navigant used Typical Meteorological Year (TMY) analysis for several of the large chiller projects that took place in PY7. This analysis compares baseline and efficient cases in an average measure year for the Pittsburgh area, rather than comparing the baseline case directly to the efficient case. This led to a slightly different estimate of average savings than the ex-ante estimate for two projects.

Navigant did not find any sites where the number of installed measures differed by more than 5 percent from the reported number of measures. The only site where the number differed is a site where 6 of 7 VFDs had been installed for several months, but were not yet controlling the motors for anything beyond a soft start and stop.

8.3 IMPACT EVALUATION NET SAVINGS

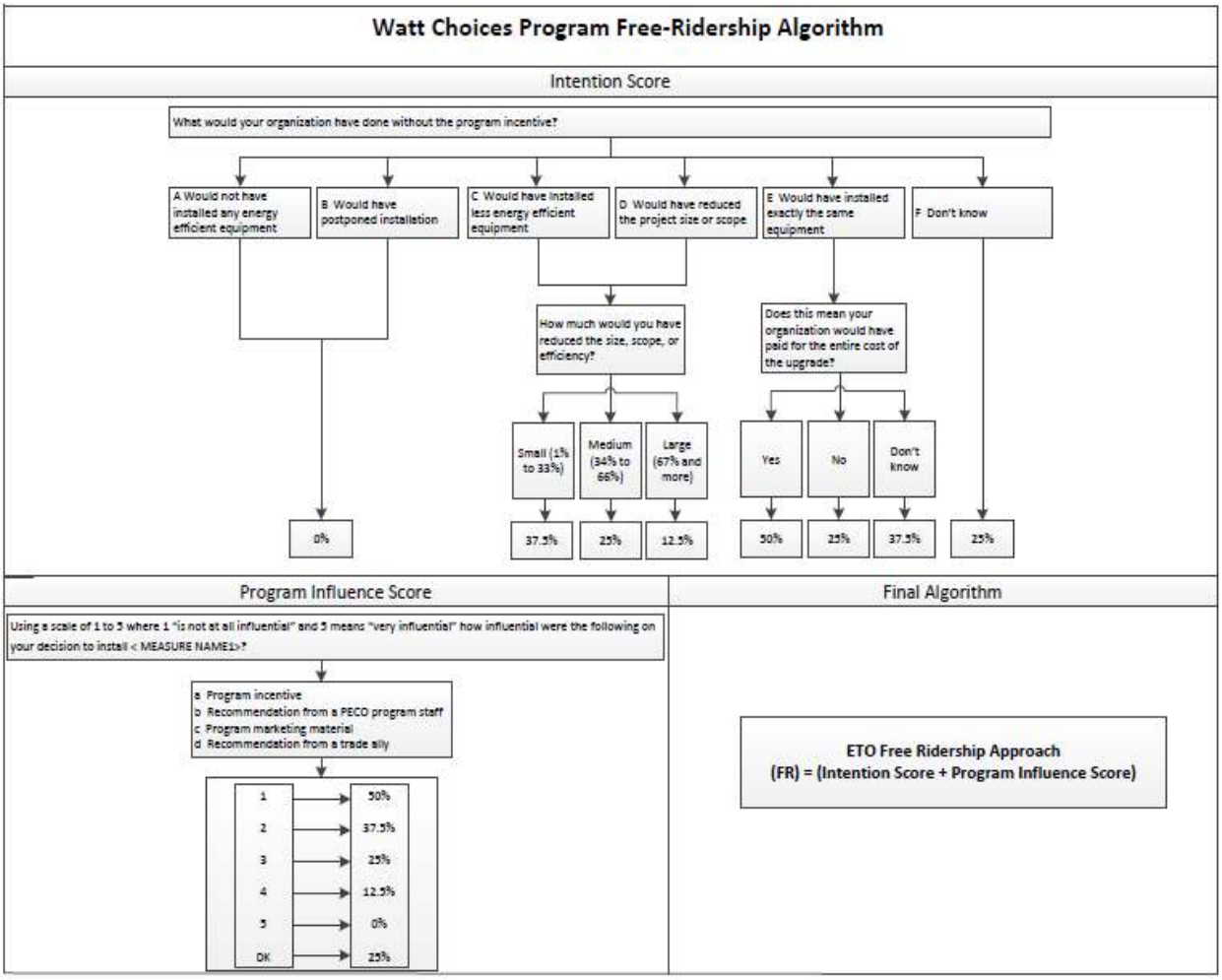
The primary objective of the net to gross analysis was to determine the program's net effect on customer energy consumption. After the Navigant team calculated verified gross program impacts, the team derived net program impacts by estimating an NTG ratio that quantifies the percentage of the gross program impacts that can reliably be attributed to the program.

[23] Exceptions to this rule were in the case of exit signs and exterior lighting.

The evaluation team assessed free ridership using a customer self-report approach following the SWE framework.[24] 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.

Figure 8-1 summarizes both the intention score and program influence score calculations for the Watt Choices program. The figure shows the possible response combinations to the questions described in the intention score section and the value assigned to each unique combination. In addition, it shows the program influence score and possible answers to the five-point scale along with the "don't know" answers.

Figure 8-1: Commercial Program Free Ridership Algorithm



Source: Navigant

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 at both the facility where the project occurred and also at any other facilities they operated in the service territory.

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

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 evaluation team assigned the influence rating a value which determined what proportion of the measure's energy savings were attributed to the program:

- A rating of 4 or 5 = 1.0 (full savings attributed to the program).
- A rating of 2 or 3 = 0.5 (half of the savings attributed to the program).
- A rating of 0 or 1 = 0 (no savings attributed to the program).

Where applicable, the Navigant team calculated the savings for each additional measure installed per the TRM. The team calculated all spillover estimates using customer self-reported data and did not conduct follow-up interviews or site visits.

More detail on the methods used for both free ridership and spillover assessment is provided in Duquesne Light's *Commercial and Industrial Energy Efficiency Programs – PY7 Process Evaluation*, submitted separately.

In total, 38 program participants responded the battery of NTG questions, including 12 commercial program participants, 5 multifamily participants, and 21 GNI program participants. These survey respondents represented 47%, 11% and 59% of the PY7 energy savings achieved by each program, respectively. NTG ratios were estimated separately for each group: The NTG kWh-weighted ratio for each program component was 0.56 for commercial, 0.71 for multifamily and 0.80 for GNI.

Table 8-6 presents the free ridership and spillover results for the Commercial program.

The NTG ratio is comprised of two terms:

1. A free ridership (FR) score, which accounts for the proportion of customers who would have installed "an energy efficiency measure without the program financial incentives"[25] and without information and non-financial support that can be integral parts of the DSM program including audits, technical assistance, product selection, and the like.

2. A spillover (SO) score, which accounts for "reductions in energy consumption and/or demand caused by the presence of the energy efficiency program, beyond the program-related gross savings of the participants. There can be participant and/or non-participant spillover."[26]

The generic formulation of this ratio is illustrated in Equation 8-1:

Equation 8-1. Total Net to Gross Ratio

$$Net\ to\ Gross\ Ratio = 1 - Free\ Ridership + Spillover$$

[25] Heins, S. (2006). *Energy Efficiency and the Spectre of Free-Ridership*. ACEEE Summer Study on Energy Efficiency in Buildings. http://aceee.org/files/proceedings/2006/data/papers/SS06_Panel12_Paper08.pdf.

[26] Shiller, S., Peters, J., and Drew, T. (2010). *Gross and Net Savings*. EPA State Climate Change Program, http://www.emvwebinar.org/Meeting%20Materials/2010/2010-04-06/2010-04-06-Schiller.pdf.

Net-to-gross (NTG) factors for the program were estimated based on results from a combination online and telephone survey of program participants, supplemented by interviews with customers representing some of the projects having the largest energy savings during PY7.

The evaluation team assessed free ridership using a customer self-report approach following the SWE framework.[27] 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.

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, in accordance with the SWE's guidance memorandum on this activity.[28]

Table 8-5: Commercial Program Sampling Strategy for PY7 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[1] to Achieve Sample
Commercial	All	30	N/A	N/A	Attempted Census	12	100%
GNI	All	47	N/A	N/A	Attempted Census	21	100%
Multifamily	All	12	N/A	N/A	Attempted Census	5	100%
Program Total	All	89			Attempted Census	38	100%

[1] 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 8-6: PY7 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
Commercial	44%	0%	56%	0.29	12.9%
GNI	20%	0%	80%	0.33	10.7%
Multifamily	29%	0%	71%	0.19	14.8%
Program Total	**32%**	**0%**	**68%**	**N/A**	**7.9%**

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

[28] SWE Guidance memorandum GM-025: Common Approach for Measuring Spillover for Downstream Programs, February 28, 2014.

8.4 PROCESS EVALUATION

The PY7 process evaluation effort focused exclusively on estimating net-to-gross factors for the nonresidential programs. However, the evaluation also assessed the program tracking data, and obtained responses from some surveyed participants to an open-ended question about how they thought the programs could be improved. Thirty-six of the survey respondents (including all participants from all nonresidential programs) responded to this question. Results are presented here for the entire nonresidential program population, because the number of respondents representing each sub-program was so small (the survey was an attempted census of all PY7 nonresidential project decision-makers). The majority of the responses were positive in nature, including some statements such as "[it's a] very good program" or "it's great".

About half of these participants offered specific positive statements about the program. Multiple participants praised the availability of the rebate, and stated that the impact of the rebate on their company's return on investment calculations made the difference between implementing the rebated project and not implementing the rebated project. This was especial true for the non-profit organizations, who were especially appreciative of the opportunity to receive a rebate for the energy efficiency projects. One of the participants stated that after participating in the program, their company would now consider energy efficiency when making any future upgrade to their facility. Another participant expressed surprise at the amount of money that they had saved on their electric bills since installing the rebated high efficiency lighting measures, in addition to the Duquesne Light program rebate reducing the cost of the upgrade.

Most of the participants interviewed reported positive experience with the administration of the program, including the application process. One participant reported that their Duquesne Light program representative was "very helpful", and that working with him was a positive experience. Another participant stated that the program was "explained very well" and that they were "given very clear instructions" during the application process. However, several participants reported that the application process, including the application review, took more time than they were expecting. Multiple participants also reported that they felt that it took a long time for them to receive their rebate checks, and that they were left wondering when they could expect to receive their rebate checks.

The process evaluation findings and details can be found in the *Commercial and Industrial Energy Efficiency Programs, PY7 Process Evaluation* report, which addressed the Commercial, Industrial and GNI program groups, including the Multifamily program. Conclusions of the process evaluation are summarized below:

- As a whole, in PY7, the nonresidential programs exceeded their energy savings goals and spent less than budgeted for PY7. The GNI and Industrial Program Groups, in particular, far exceeded their savings goals, while coming in approximately on budget.
- Duquesne Light experienced a problem with ensuring that 100% of program participation data for two programs were uploaded into the primary participation tracking system. However, it identified this problem via its own QA/QC procedures and indicates that the problem has been rectified and should not recur in PY8.
- In general, nonresidential program group net-to-gross ratios were about the same or somewhat lower than they were in PY5, the last time NTG was assessed for the Commercial and Industrial

participant groups, or PY6, the last time NTG was assessed for the Multifamily program. Both Multifamily samples (PY6 and PY7) were quite small and so it is difficult to know whether the change in NTG ratio from 0.95 to 0.71 is meaningful. The Commercial Program Group NTG ratio (56%) was about the same as it was when evaluated in PY5 (53%).

- Program participants were generally very satisfied with the GNI, Commercial, and Industrial programs. Participants reported that in many instances, the availability of the program rebate changed the expected return on investment to allow them to implement the rebated energy efficiency project. However, several participants did express dissatisfaction at the length of time between when they submitted their completed application and when they received their rebate check.

The table below presents the Commercial Program sampling strategy for the process evaluation, which in PY7, except for the extensive net-to-gross question battery, comprised an open-ended question about how the program might be improved.

Table 8-7: Commercial Program Sampling Strategy for PY7

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)
Commercial	All	58	N/A	N/A	Attempted Census	6	100%	Impact, Process, NTGR
GNI	All	62	N/A	N/A	Attempted Census	15	100%	Impact, Process, NTGR
Multifamily	All	45	N/A	N/A	Attempted Census	0	100%	Impact, Process, NTGR
Program Total		**165**			**Attempted Census**	**21**	**100%**	**Impact, Process, NTGR**

8.5 STATUS OF RECOMMENDATIONS FOR PROGRAM

As noted above, the Commercial Program Group achieved an energy savings realization rate of 99 percent and the evaluation found NTG ratios of 0.56 for commercial, 0.71 for multifamily and 0.80 for GNI. Recommendations for the Commercial Program Group are the same as those offered for the Industrial Program Group (see next section) and are presented below in Table 8-8.

Table 8-8: 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)
Recommendation 1 Monitor participant satisfaction with the time frame required for them to receive their rebate checks, and determine whether participants have unrealistic expectations regarding the probable timing of receiving	Under consideration

these payments. If a substantial number of participants identify this as an issue in PY8 and cause for dissatisfaction, consider conducting more extensive analysis of time frames for receiving rebate checks, as well as the feasibility of instituting a procedure whereby program management is automatically notified when a participant has waited longer than a pre-specified period before they receive their rebate check, so that management can then contact the customer to provide an update as to when the check will be issued. It may also be important to more effectively communicate the likely time frame for receiving rebate checks to the customers.	
Recommendation 2 Monitor closely program participation as identified in PMRS, the Act 129 program tracking system, to ensure that the issue of program participants being discovered after evaluation research has already been conducted does not recur in PY8 or later years.	Under consideration

8.6 FINANCIAL REPORTING

A breakdown of the program finances (by program) is presented in Table 8-9 through Table 8-15.

Table 8-9: Summary of Commercial 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 through 4)	$1,748	$2,130
2	EDC Incentives to Participants	$458	$1,214
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$1,290	$916
5	Program Overhead Costs (Sum of rows 6 through 10)	$678	$1,641
6	Design & Development	$0	$10
7	Administration, Management, and Technical Assistance[1]	$640	$1,475
8	Marketing[2]	$0	$7
9	EDC Evaluation Costs	$31	$81
10	SWE Audit Costs	$7	$68
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$2,426	$3,771
13	Total NPV Lifetime Energy Benefits	$4,805	$13,680
14	Total NPV Lifetime Capacity Benefits	$455	$1,909
15	Total NPV TRC Benefits[4]	$5,260	$15,902
16	TRC Benefit-Cost Ratio[5]	2.17	4.22

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 8-10: 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 through 4)	$1,442	$3,068
2	EDC Incentives to Participants	$11	$1,165
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$1,431	$1,903
5	Program Overhead Costs (Sum of rows 6 through 10)	$139	$434
6	Design & Development	$0	$13
7	Administration, Management, and Technical Assistance[1]	$72	$182
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$54	$132
10	SWE Audit Costs	$13	$107
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$1,581	$3,502
13	Total NPV Lifetime Energy Benefits	$3,106	$3,291
14	Total NPV Lifetime Capacity Benefits	$0	$32
15	Total NPV TRC Benefits[4]	$3,106	$3,322
16	TRC Benefit-Cost Ratio[5]	1.96	0.95

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 8-11: 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 through 4)	$4,724	$13,123
2	EDC Incentives to Participants	$375	$2,275
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$4,349	$10,848
5	Program Overhead Costs (Sum of rows 6 through 10)	$647	$2,322
6	Design & Development	$0	$36
7	Administration, Management, and Technical Assistance[1]	$525	$1,767
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$99	$276
10	SWE Audit Costs	$23	$243
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$5,372	$15,445
13	Total NPV Lifetime Energy Benefits	$6,288	$23,348
14	Total NPV Lifetime Capacity Benefits	$325	$2,241
15	Total NPV TRC Benefits[4]	$6,613	$25,589
16	TRC Benefit-Cost Ratio[5]	1.23	1.66

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 8-12: 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 through 4)	$21	$4,266
2	EDC Incentives to Participants	$172	$1,038
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	($151)	$3,228
5	Program Overhead Costs (Sum of rows 6 through 10)	$195	$1,033
6	Design & Development	$0	$14
7	Administration, Management, and Technical Assistance[1]	$123	$763
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$58	$141
10	SWE Audit Costs	$14	$115
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$216	$5,299
13	Total NPV Lifetime Energy Benefits	$38	$7,992
14	Total NPV Lifetime Capacity Benefits	$4	$1,176
15	Total NPV TRC Benefits[4]	$42	$9,167
16	TRC Benefit-Cost Ratio[5]	0.19	1.73

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 8-13: Summary of PAPP Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 through 4)	$5,828	$10,476
2	EDC Incentives to Participants	$603	$2,891
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$5,225	$7,585
5	Program Overhead Costs (Sum of rows 6 through 10)	$391	$2,009
6	Design & Development	$0	$42
7	Administration, Management, and Technical Assistance[1]	$215	$1,293
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$143	$367
10	SWE Audit Costs	$33	$307
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$6,219	$12,485
13	Total NPV Lifetime Energy Benefits	$6,354	$15,324
14	Total NPV Lifetime Capacity Benefits	$638	$1,883
15	Total NPV TRC Benefits[4]	$6,992	$17,207
16	TRC Benefit-Cost Ratio[5]	1.12	1.38

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 8-14: 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 through 4)	$612	$1,624
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)	$612	$1,624
5	Program Overhead Costs (Sum of rows 6 through 10)	$759	$2,513
6	Design & Development	$0	$0
7	Administration, Management, and Technical Assistance[1]	$689	$2,367
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$57	$94
10	SWE Audit Costs	$13	$52
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$1,371	$4,137
13	Total NPV Lifetime Energy Benefits	$1,445	$4,211
14	Total NPV Lifetime Capacity Benefits	$75	$313
15	Total NPV TRC Benefits[4]	$1,520	$4,524
16	TRC Benefit-Cost Ratio[5]	1.11	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.

Table 8-15: 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 through 4)	$744	$1,397
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)	$744	$1,397
5	Program Overhead Costs (Sum of rows 6 through 10)	$946	$1,602
6	Design & Development	$0	$0
7	Administration, Management, and Technical Assistance[1]	$909	$1,525
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$30	$49
10	SWE Audit Costs	$7	$28
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$1,690	$2,999
13	Total NPV Lifetime Energy Benefits	$809	$1,920
14	Total NPV Lifetime Capacity Benefits	$53	$98
15	Total NPV TRC Benefits[4]	$862	$2,018
16	TRC Benefit-Cost Ratio[5]	0.51	0.67

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.

[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 INDUSTRIAL PROGRAM GROUP PROGRAMS

Included in Duquesne Light's overall Watt Choices program portfolio is the Industrial Program Group, comprising 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 is implementing the industrial sector programs both with internal staff and Conservation Service Providers (CSPs), as follows:

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

9.1 PROGRAM UPDATES

No changes occurred for the Industrial Program Group in PY7.

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 PY7. 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 PY7, Duquesne Light reported cumulative Phase II gross savings totaling 116 percent of the 69,140 MWh cumulative estimate projected for Phase II in the utility's EE&C Plan.

Table 9-1: Phase II Industrial Program Reported Results by Customer Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives Paid ($1,000)
Small Industrial	83	15,549	2.354	$808
Large Industrial	58	64,479	8.235	$2,466
Phase II Total	**141**	**80,028**	**10.589**	**$3,274**

As with the Commercial Program Group, the sample design for the Industrial Program Group used the stratified ratio estimator approach (Lohr 1999)[29]. 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[30], 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 PY7, impact evaluation verification work was completed in three phases: in spring of 2015 for installed measures reported in the first two quarters of PY7, in summer of 2016 for measures completed in the third quarter of PY7, and in fall of 2016 for measures completed in the fourth quarter of PY7. Industrial Evaluation Group measures completed between 6/1/2015 and 11/30/2015 (Q1 and Q2), between 12/1/2015 and 2/28/2016 (Q3) and between 3/1/2016 and 5/31/2016 (Q4), were extracted from Duquesne Light's program tracking system and placed into strata based on each measure's reported kWh savings.

Table 9-2: Industrial Program Sampling Strategy for PY7

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size*	Evaluation Activity
Industrial - Large	6	85%/15%	5	4	On-Site/Phone Verification
Industrial - Medium	16	85%/15%	6	7	On-Site/Phone Verification
Industrial - Small	94	85%/15%	4	5	On-Site/Phone Verification
Program Total	**116**	**85%/15%**	**15**	**16**	

*Sample is based on measures rather than projects. Sampling was performed at the measure level.

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

[30] 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[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. 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 9-3: PY7 Industrial 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 - Large	36,238	98%	35,390	0.05	2.7%
Industrial - Medium	5,320	106%	5,647	0.13	6.0%
Industrial - Small	1,503	98%	1,470	0.01	0.8%
Program Total	**43,061**	**99%**	**42,507**	**N/A**	**1.9%**

Table 9-4: PY7 Industrial 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 - Large	4.73	92%	4.37	0.16	8.9%
Industrial - Medium	0.58	107%	0.63	0.47	22.0%
Industrial - Small	0.22	101%	0.22	0.00	0.2%
Program Total	**5.53**	**94%**	**5.22**	**N/A**	**6.4%**

Navigant conducted verifications of 11 industrial projects representing a total of 16 separate measure types. A total of five site visits were conducted for projects selected in PY7 for verification. The Navigant field staff included: Chris Yoder and Dan Golden. Navigant also utilized a subcontractor, Karpinski Engineering, to perform on site visits and evaluations of select lighting projects. Field staff for Karpinski included Chris Spalla and Erin Kennedy. 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 two industrial projects sampled in PY7 that had an incentive less than $2,000 and received telephone verification with no on-site

[31] Evaluation Measurement and Verification Plan: Duquesne Light Act 129—Phase II Energy Efficiency and Conservation Portfolio Programs 5 to 7 (Revised), March 3, 2016 (EM&V Plan), Sections 2.5 and 2.5.1, pages 21 and 22.

visit. In the case of one industrial customer, which had three projects sampled this year, Navigant did not conduct an onsite verification. This large customer had been sensitive regarding site visits in the past, and the Navigant reviewer decided that the additional data gained from the visit would not add enough value to merit the visit. Navigant did, however, request and receive additional, longer term trend data through the implementer which supported the analysis.

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 number of efficient lighting fixtures installed to match what was found during on-site evaluations. On one site, Karpinski found that the customer had not installed 10 lamp T5 fixtures, but had installed 6 lamp T5 fixtures instead. On a second, Karpinski found that the customer had only installed 118 fixtures out of an anticipated 130. These were the only two Industrial projects where Navigant found a discrepancy in fixture count of greater than 5 percent between the project files and the on site evaluation.

Additionally, Navigant found one site where metered HOU showed that occupancy sensors installed on site had a significantly greater impact on HOU than expected, increasing both energy and demand savings. Other discrepancies came from fewer lights being on occupancy sensors than expected (one site) and a small change in baseline equipment (one site).

Finally, there was one site where Navigant discovered during scheduling that the plant with efficient equipment installed had subsequently been shut down. As has been the case previously, since Navigant was able to confirm the site had completed the project prior to the plant being shut down, Navigant awarded this site full savings.

9.3 IMPACT EVALUATION NET SAVINGS

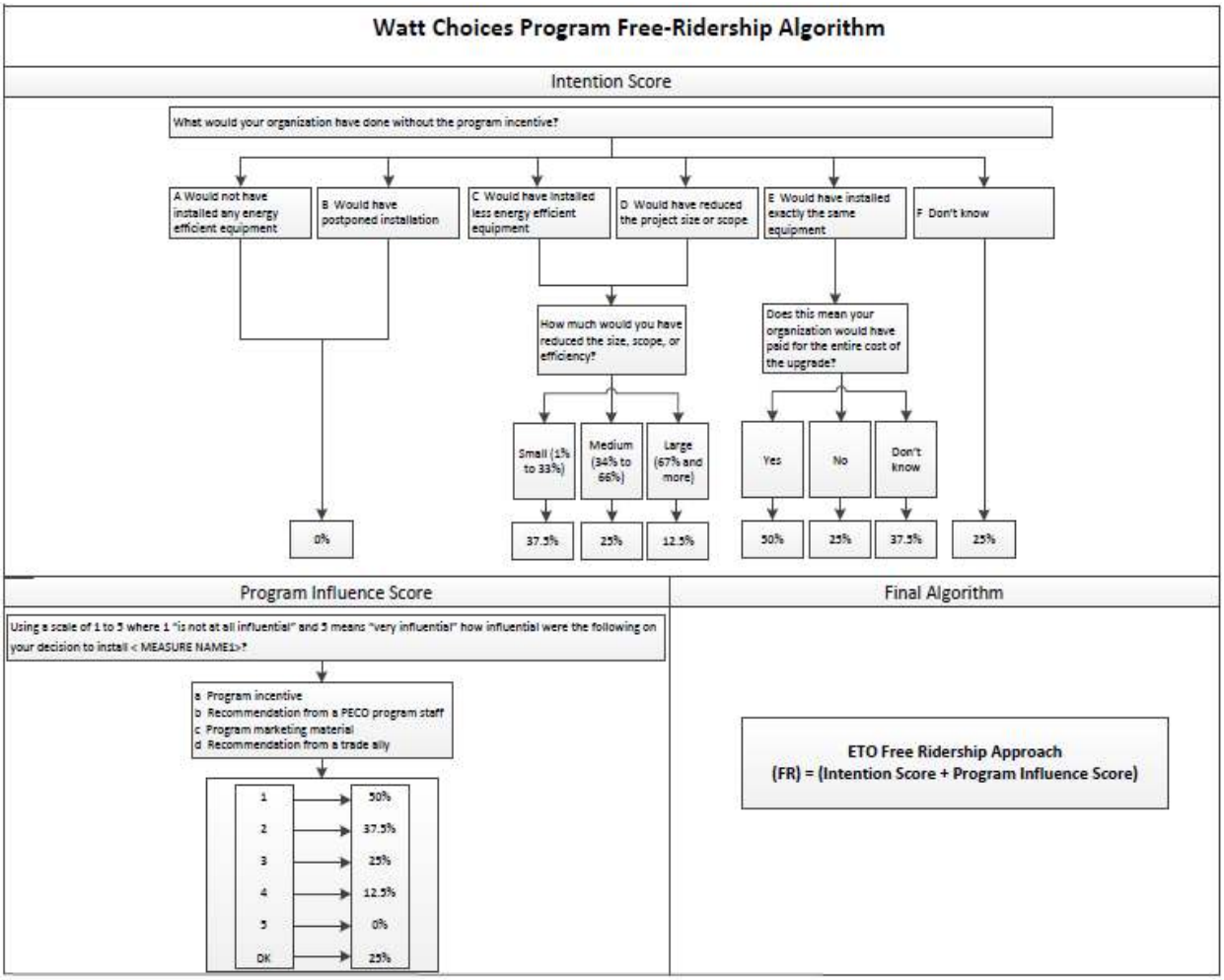
The primary objective of the net to gross analysis was to determine the program's net effect on customer energy consumption. After the Navigant team calculated verified gross program impacts, the team derived net program impacts by estimating an NTG ratio that quantifies the percentage of the gross program impacts that can reliably be attributed to the program.

The evaluation team assessed free ridership using a customer self-report approach following the SWE framework.[32] 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.

Figure 9-1 summarizes both the intention score and program influence score calculations for the Watt Choices program. The figure shows the possible response combinations to the questions described in the intention score section and the value assigned to each unique combination. In addition, it shows the program influence score and possible answers to the five-point scale along with the “don’t know” answers.

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

Figure 9-1: Industrial Program Free Ridership Algorithm



Source: Navigant

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 at both the facility where the project occurred and also at any other facilities they operated in the service territory.

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 evaluation team assigned the influence rating a value which determined what proportion of the measure's energy savings were attributed to the program:

- A rating of 4 or 5 = 1.0 (full savings attributed to the program).
- A rating of 2 or 3 = 0.5 (half of the savings attributed to the program).
- A rating of 0 or 1 = 0 (no savings attributed to the program).

Where applicable, the Navigant team calculated the savings for each additional measure installed per the TRM. The team calculated all spillover estimates using customer self-reported data and did not conduct follow-up interviews or site visits.

More detail on the methods used for both free ridership and spillover assessment is provided in Duquesne Light's *Commercial and Industrial Energy Efficiency Programs – PY7 Process Evaluation*, submitted separately.

In total, 18 industrial program participants responded to the battery of NTG questions. This group included four respondents whose PY7 projects were among the top 12 in terms of energy savings achieved and who therefore received a special in-depth interview (rather than a standard survey) to maximize both the number of completes with this group and also the quality of the responses received. In total, the 18 participants participating in the NTG survey had implemented projects representing 73 percent of all industrial sector PY7 savings. The evaluation team found an industrial NTG kWh-weighted ratio at the program level of 0.68.

Table 9-6 presents the free ridership and spillover results for the Industrial program. The NTG ratio is comprised of two terms:

3. A free ridership (FR) score, which accounts for the proportion of customers who would have installed "an energy efficiency measure without the program financial incentives"[33] and without information and non-financial support that can be integral parts of the DSM program including audits, technical assistance, product selection, and the like.

4. A spillover (SO) score, which accounts for "reductions in energy consumption and/or demand caused by the presence of the energy efficiency program, beyond the program-related gross savings of the participants. There can be participant and/or non-participant spillover."[34]

The generic formulation of this ratio is illustrated in Equation 9-1:

Equation 9-1. Total Net to Gross Ratio

$$Net\ to\ Gross\ Ratio = 1 - Free\ Ridership + Spillover$$

Net-to-gross (NTG) factors for the program were estimated based on results from a combination online and telephone survey of program participants, supplemented by interviews with customers representing some of the projects having the largest energy savings during PY7.

The evaluation team assessed free ridership using a customer self-report approach following the SWE framework.[35] 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.

[33] Heins, S. (2006). *Energy Efficiency and the Spectre of Free-Ridership*. ACEEE Summer Study on Energy Efficiency in Buildings. http://aceee.org/files/proceedings/2006/data/papers/SS06_Panel12_Paper08.pdf.
[34] Shiller, S., Peters, J., and Drew, T. (2010). *Gross and Net Savings*. EPA State Climate Change Program, http://www.emvwebinar.org/Meeting%20Materials/2010/2010-04-06/2010-04-06-Schiller.pdf.
[35] SWE Guidance memorandum GM-024: Common Approach for Measuring Free riders for Downstream Programs, October 4, 2013.

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, in accordance with the SWE's guidance memorandum on this activity.[36]

Table 9-5: Industrial Sampling Strategy for PY7 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[1] to Achieve Sample
Industrial	All	22	N/A	N/A	Attempted Census	18	100%
Program Total	**All**	**22**	**N/A**	**N/A**	**Attempted Census**	**18**	**100%**

[1] 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 9-6: PY7 Industrial 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
Industrial	32%	0%	68%	0.36	12.8%
Program Total	**32%**	**0%**	**68%**	**0.36**	**12.8%**

9.4

9.5 PROCESS EVALUATION

The PY7 process evaluation effort focused exclusively on estimating net-to-gross factors for the nonresidential programs. However, the evaluation also assessed the program tracking data, and obtained responses from some surveyed participants to an open-ended question about how they thought the programs could be improved. Thirty-six of the survey respondents (including all participants from all nonresidential programs) completed this question. Results are presented here for the entire nonresidential program population, because the number of respondents representing each sub-program were so small (the survey was an attempted census of all PY7 nonresidential project decision-makers). The majority of the responses were positive in nature, including some statements such as "[it's a] very good program" or "it's great".

About half of these participants offered specific positive statements about the program. Multiple participants praised the availability of the rebate, and stated that the impact of the rebate on their company's return on investment calculations made the difference between implementing the rebated project and not implementing the rebated project. This was especial true for the non-profit organizations, who were especially appreciative of the opportunity to receive a rebate for the energy

[36] SWE Guidance memorandum GM-025: Common Approach for Measuring Spillover for Downstream Programs, February 28, 2014.

efficiency projects. One of the participants stated that after participating in the program, their company would now consider energy efficiency when making any future upgrade to their facility. Another participant expressed surprise at the amount of money that they had saved on their electric bills since installing the rebated high efficiency lighting measures, in addition to the Duquesne Light program rebate reducing the cost of the upgrade.

Most of the participants interviewed reported positive experience with the administration of the program, including the application process. One participant reported that their Duquesne Light program representative was "very helpful", and that working with him was a positive experience. Another participant stated that the program was "explained very well" and that they were "given very clear instructions" during the application process. However, several participants reported that the application process, including the application review, took more time than they were expecting. Multiple participants also reported that they felt that it took a long time for them to receive their rebate checks, and that they were left wondering when they could expect to receive their rebate checks.

The process evaluation findings and details can be found in the *Commercial and Industrial Energy Efficiency Programs, PY7 Process Evaluation* report, which addressed the Commercial, Industrial and GNI program groups, including the Multifamily program. Conclusions of the process evaluation are summarized below:

- As a whole, in PY7, the nonresidential programs exceeded their energy savings goals and spent less than budgeted for PY7. The GNI and Industrial Program Groups, in particular, far exceeded their savings goals, while coming in approximately on budget.
- Duquesne Light experienced a problem with ensuring that 100% of program participation data for two programs were uploaded into the primary participation tracking system. However, it identified this problem via its own QA/QC procedures and indicates that the problem has been rectified and should not recur in PY8.
- In general, nonresidential program group net-to-gross ratios were about the same or somewhat lower than they were in PY5, the last time NTG was assessed for the Commercial and Industrial participant groups. The Industrial Program Group NTG ratio (68%) was about 12 points lower than in PY5 (80%). Again, however, the sample sizes in both years were quite small, due to the very limited number of individual participants in each program, so this drop may not indicate a real change in cost effectiveness of the program. It is also worth noting that the NTG ratio for the Industrial program participant having the largest savings was about 5 percentage points lower in PY7 than in PY5.
- Program participants were generally very satisfied with the GNI, Commercial, and Industrial programs. Participants reported that in many instances, the availability of the program rebate changed the expected return on investment to allow them to implement the rebated energy efficiency project. However, several participants did express dissatisfaction at the length of time between when they submitted their completed application and when they received their rebate check.

The table below presents the Commercial Program sampling strategy for the process evaluation, which in PY7, except for the extensive net-to-gross question battery, comprised an open-ended question about how the program might be improved.

Table 9-7: Industrial Sampling Strategy for PY7

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)
Rebates	All	22	N/A	N/A	Attempted Census	15	100%	Impact, Process, NTG
Program Total	**All**	**22**	**N/A**	**N/A**	**Attempted Census**	**15**	**100%**	**Impact, Process, NTG**

9.6 STATUS OF RECOMMENDATIONS FOR PROGRAM

As noted above, the Industrial Program Group achieved an energy savings realization rate of 99 percent and the evaluation found a NTG ratio of 0.68. Recommendations for the Industrial Program Group are the same as those offered for the Commercial Program Group (see previous section) and are presented below in Table 9-8.

Table 9-8: Industrial Status Report on Process and Impact Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Recommendation 1 Monitor participant satisfaction with the time frame required for them to receive their rebate checks, and determine whether participants have unrealistic expectations regarding the probable timing of receiving these payments. If a substantial number of participants identify this as an issue in PY8 and cause for dissatisfaction, consider conducting more extensive analysis of time frames for receiving rebate checks, as well as the feasibility of instituting a procedure whereby program management is automatically notified when a participant has waited longer than a pre-specified period before they receive their rebate check, so that management can then contact the customer to provide an update as to when the check will be issued. It may also be important to more effectively communicate the likely time frame for receiving rebate checks to the customers.	Under consideration
Recommendation 2 Monitor closely program participation as identified in PMRS, the Act 129 program tracking system, to ensure that the issue of program participants being discovered after evaluation research has already been conducted does not recur in PY8 or later years.	Under consideration

9.7 FINANCIAL REPORTING

A breakdown of the program finances (by program) is presented in Table 9-9 through Table 9-12.

Table 9-9: 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 through 4)	$2,036	$5,112
2	EDC Incentives to Participants	$1,060	$1,926
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$976	$3,186
5	Program Overhead Costs (Sum of rows 6 through 10)	$930	$3,384
6	Design & Development	$0	$24
7	Administration, Management, and Technical Assistance[1]	$808	$2,929
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$99	$238
10	SWE Audit Costs	$23	$193
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$2,967	$8,496
13	Total NPV Lifetime Energy Benefits	$13,448	$22,983
14	Total NPV Lifetime Capacity Benefits	$1,260	$1,957
15	Total NPV TRC Benefits[4]	$14,708	$24,940
16	TRC Benefit-Cost Ratio[5]	4.96	2.94

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 9-10: 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 through 4)	$38	$429
2	EDC Incentives to Participants	$11	$156
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$27	$273
5	Program Overhead Costs (Sum of rows 6 through 10)	$64	$210
6	Design & Development	$0	$4
7	Administration, Management, and Technical Assistance[1]	$45	$138
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$15	$37
10	SWE Audit Costs	$4	$31
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$102	$639
13	Total NPV Lifetime Energy Benefits	$48	$1,152
14	Total NPV Lifetime Capacity Benefits	$9	$143
15	Total NPV TRC Benefits[4]	$57	$1,295
16	TRC Benefit-Cost Ratio[5]	0.56	2.03

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 9-11: Summary of 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 through 4)	$572	$1,730
2	EDC Incentives to Participants	$266	$652
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$306	$1,078
5	Program Overhead Costs (Sum of rows 6 through 10)	$358	$1,208
6	Design & Development	$0	$9
7	Administration, Management, and Technical Assistance[1]	$318	$1,056
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$33	$79
10	SWE Audit Costs	$7	$64
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$930	$2,938
13	Total NPV Lifetime Energy Benefits	$3,272	$9,763
14	Total NPV Lifetime Capacity Benefits	$252	$892
15	Total NPV TRC Benefits[4]	$3,524	$10,655
16	TRC Benefit-Cost Ratio[5]	3.79	3.63

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.

[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 9-12: Summary of Chemical Products Program Finances

Row #	Cost Category	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
1	Incremental Measure Costs (Sum of rows 2 through 4)	$5,327	$5,476
2	EDC Incentives to Participants	$499	$540
3	EDC Incentives to Trade Allies	$0	$0
4	Participant Costs (net of incentives/rebates paid by utilities)	$4,828	$4,936
5	Program Overhead Costs (Sum of rows 6 through 10)	$916	$1,419
6	Design & Development	$0	$9
7	Administration, Management, and Technical Assistance[1]	$871	$1,251
8	Marketing[2]	$0	$0
9	EDC Evaluation Costs	$36	$87
10	SWE Audit Costs	$9	$72
11	Increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
12	Total TRC Costs[3] (Sum of rows 1, 5 and 11)	$6,243	$6,895
13	Total NPV Lifetime Energy Benefits	$13,324	$13,730
14	Total NPV Lifetime Capacity Benefits	$1,366	$1,405
15	Total NPV TRC Benefits[4]	$14,691	$15,136
16	TRC Benefit-Cost Ratio[5]	2.35	2.20

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-1: PY7 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
Government/Non-profit	Unique project number per quarter	Yes	Project
Industrial	Unique project number per quarter	Yes	Measure
REEP	Unique project number per quarter	Yes	Project
SEP	Unique project number per quarter	Yes	Project
RARP	Unique project number per quarter	Yes	Project
WHEAP	Unique customer account number per quarter	Yes	Project
HER	Member of Treatment Group	N/A	
LIEEP	Unique customer account number per quarter	Yes	Project

PY7 Evaluation Activities

Table A-2: PY7 Actual Evaluation Activities

Programs (Sub Programs if necessary)	Sectors	Records Review	Participant Surveys	Phone Verifications	Site Visits	Metering[1]
Commercial	C/I	10	0	1	9	4
Government/ Non-profit	C/I	14	0	2	12	8
Industrial	C/I	11	0	5	6	7
Multifamily	C/I	3	9	1	2	0
REEP	Res	59	99	99	0	0
SEP	Res	0	27	27	0	0

Programs (Sub Programs if necessary)	Sectors	Records Review	Participant Surveys	Phone Verifications	Site Visits	Metering[1]
RARP	Res	0	149	149	0	0
WHEAP	Res	0	22	22	0	0
HER	Res	0	164	0	0	0
LIEEP	Res	0	[2]	0	0	0

[1] Does not include statistical billing analysis but does include use of either trending data or metering data
[2] Includes low income portions of surveyed populations already counted above, including REEP, SEP, RARP, WHEAP, and HER

APPENDIX B | TRC INCREMENTAL COSTS

Table B-1: Measure Incremental Costs Not Taken from SWE Database or Filed Plan

Program	Measure	Incremental Cost	Incremental Cost Source
REEP & LIEEP - Upstream Lighting	Upstream Residential CFL	$2.10	Ecova PY7 Average
REEP & LIEEP - Upstream Lighting	Upstream Residential LED	$10.50	Ecova PY7 Average
LIEEP, REEP, & SEP	EE Kit: 2-13W, 1-20W, 1-23W, 2-LED NL, 1-Smart Strip	$25.83	Contract Price
LIEEP	Neighborhood Safety Program - 201210 - 13w bulb	$2.24	Ecova 13W PY7 Average
LIEEP	Neighborhood Safety Program - 201210 - 18w bulb	$2.47	Ecova 18-23W PY7 Average
LIEEP	DLC Refresher Training 20130313 - 23w bulb	$2.47	Ecova 18-23W PY7 Average
HER	Home Energy Reports	$0.0131	O-Power $/kWh
HER	Low Income Home Energy Reports	$0.0131	O-Power $/kWh
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
RARP	Refrigerator Recycling - LI Replace (DI - DLC Cost Share)	$82.50	Contract amount
RARP	Freezer Recycling - LI Replace (DI - DLC Cost Share)	$82.50	Contract amount
REEP	ENERGY STAR Television	$14.30	CA DEER - ITRON CPUC WO 017, pg 3-13
REEP	Central Air Conditioner SEER 15	$607.10	CA DEER - dxAC-Res-Split-SEER-15.0
REEP	Central Air Conditioner SEER 16	$699.23	CA DEER - dxAC-Res-Split-SEER-16.0
REEP	Central Air Conditioner SEER 17	$791.36	CA DEER - dxAC-Res-Split-SEER-17.0
REEP	Central Air Conditioner SEER 18	$883.48	CA DEER - dxAC-Res-Split-SEER-18.0

Program	Measure	Incremental Cost	Incremental Cost Source
REEP	Central Air Conditioner SEER 19	$1,008.72	CA DEER - Trended by SEER 15-18
REEP	Central Air Conditioner SEER 20	$1,151.71	CA DEER - Trended by SEER 15-18
REEP	Central Air Conditioner SEER 21	$1,314.97	CA DEER - Trended by SEER 15-18
REEP	Heat Pump - 14 SEER / 8.6 HSPF A/C Heat Pump	$1,143.16	CA DEER - dxHP-Res-Split-SEER-16.0
WHEAP	Whole Home 13 Watt CFL	$2.02	Ecova 13-14W PY7 Average
WHEAP	Whole Home 18 Watt CFL	$2.47	Ecova 18-23W PY7 Average
WHEAP	Whole Home 23 Watt CFL	$2.47	Ecova 18-23W PY7 Average
WHEAP	Whole Home 9W Candelabra CFL	$2.02	Ecova 13-14W PY7 Average
WHEAP	Whole Home 14W Candelabra CFL	$2.02	Ecova 13-14W PY7 Average
WHEAP	Whole Home 14W G25 CFL	$2.02	Ecova 13-14W PY7 Average
WHEAP	Whole Home 16W R30 CFL	$20.41	ECOVA Upstream LEDs
Commercial, GNI, and Industrial	Custom, C&I, Interior Lighting	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Custom, C&I, Exterior Lighting	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Custom, C&I, Cooling	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Custom, C&I, Refrigeration	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Custom, C&I, Ventilation	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Custom, C&I, Process	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Custom, C&I, Other	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	FB4 commercial ice machine, air cooled, 401-500 lb/24 hr	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	LA1 Screw-in Compact Fluorescent Lamp: 5-25 watts	$2.10	Y7 Upstream Lighting data
Commercial, GNI, and Industrial	T5 4 ft 4 Lamp HO Electronic ballast	$124.74	C&I Fluorescent Lighting Cost Study

Program	Measure	Incremental Cost	Incremental Cost Source
Commercial, GNI, and Industrial	T5 4 ft 6 lamp HO electronic ballast	$170.55	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T5 - 4' 8 Lamp - HO - Electronic Ballast	$222.21	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-17W 2 ft 1 lamp electronic ballast	$44.94	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-17W 2 ft 2 lamp electronic ballast	$51.35	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-17W 2 ft 3 lamp electronic ballast	$56.17	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-25W 3 ft 1 lamp electronic ballast	$47.59	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-25W 3 ft 2 lamp electronic ballast	$57.16	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-30W 4 ft 1 lamp (or 24" U tube) electronic ballast	$48.62	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-28W 4 ft 1 lamp (or 24" U tube) electronic ballast	$49.15	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-30W 4 ft 2 lamp electronic ballast	$58.45	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-28W 4 ft 2 lamp electronic ballast	$80.33	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	LE15 T8 4 ft 3 lamp electronic ballast	$51.95	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-30W 4 ft 3 lamp electronic ballast	$51.95	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-28W 4 ft 3 lamp electronic ballast	$59.29	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-30W 4 ft 4 lamp electronic ballast	$88.73	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-28W 4 ft 4 lamp electronic ballast	$53.17	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	T8-28W 4 ft 6 lamp electronic ballast	$76.66	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	Remove 4 ft linear fluorescent lamp	$27.27	C&I Fluorescent Lighting Cost Study
Commercial, GNI, and Industrial	Photocell	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Timeclock	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	LED PAR 20 7-9W	$25.33	ECOVA Upstream LEDs

Program	Measure	Incremental Cost	Incremental Cost Source
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
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
Commercial, GNI, and Industrial	ENERGY STAR Freezer Case w/Solid Door =30 ft3 - <50 ft3	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Evaporative Fan controller for Walk-in Cooler	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Beverage Vending Machine Controller, can capacity <500	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	Beverage Vending Machine Controller, can capacity ≥500	Actual	Project Cost Documentation
Commercial, GNI, and Industrial	VFD - Air Compressor Motor	$200.00	Michigan - N-CO-MP-000558-E-XX-XX-XX-XX-02

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

Low income participation in non-low income programs was 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 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 percent of CFL and 2.3 percent of LED bulbs purchased were installed in Low Income households.

APPENDIX D | RESIDENTIAL LIGHTING UPSTREAM PROGRAM CROSS-SECTOR SALES

Navigant completed in-store intercepts at the end of PY6 to re-evaluate cross sector sales, and these results were also used for PY7 reporting. 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 percent 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 percent 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.