Final Annual Report
to the
Pennsylvania Public Utility Commission

For the Period
June 2013 through May 2014
Program Year 5

For Pennsylvania Act 129 of 2008
Energy Efficiency and Conservation Plan

Prepared by Navigant Consulting, Inc.

For

Duquesne Light

November 15, 2014

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Acronyms

C&I	Commercial and Industrial
CFL	Compact Fluorescent Lamp
Phase II Verified	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
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).

TOTAL RESOURCE COST COMPONENTS[1]

Administration, Management, and Technical Assistance Costs

Includes rebate processing, tracking system, general administration, EDC and CSP program management, general management and legal, and technical assistance.

EDC Costs

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

Participant Costs

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

Total TRC Costs

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

Total TRC Benefits

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

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

1 Overview of Portfolio

Pennsylvania Act 129 of 2008, which was signed on October 15, 2008, mandated energy savings and demand reduction goals for the largest electric distribution companies (EDCs) in Pennsylvania for Phase I (2008 through 2013). In 2009, each EDC submitted energy efficiency and conservation (EE&C) plans pursuant to these goals, which were approved by the Pennsylvania Public Utility Commission (PUC) . Each EDC filed new EE&C plans with the PUC in 2012 for Phase II (June 2013 through May 2016) of the Act 129 programs. These plans were approved by the PUC in 2013.

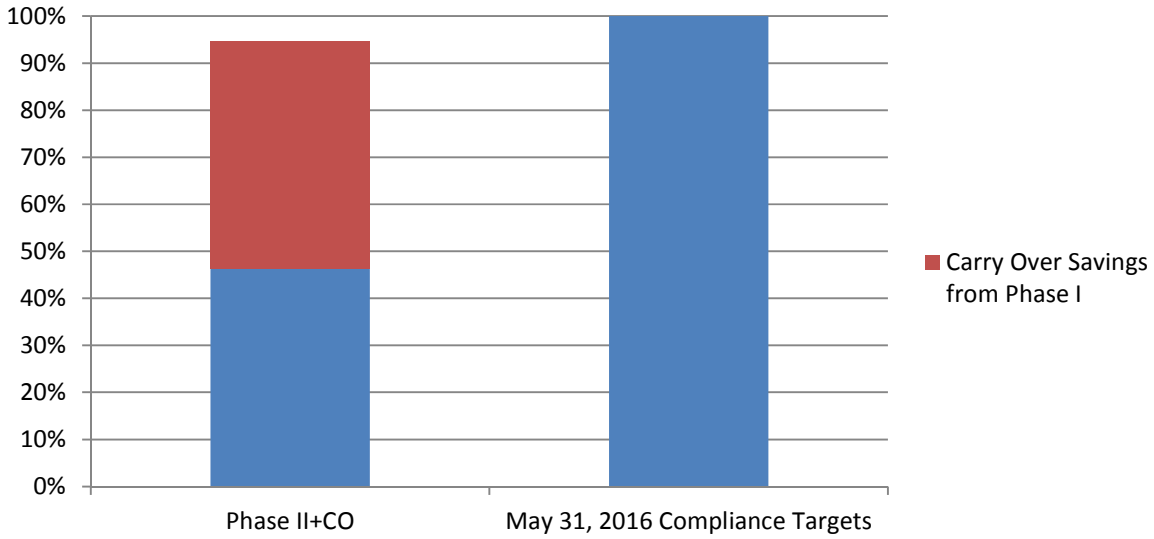
Implementation of Phase II Act 129 programs began June 1, 2013. This report documents the progress and effectiveness of the Phase II EE&C accomplishments for Duquesne Light in Program Year 5 (PY5), defined as June 1, 2013 through May 31, 2014, as well as the cumulative accomplishments of the programs 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. evaluated the programs, which included measurement and verification of the savings.

1.1 Summary of Progress Toward Compliance Targets

Duquesne Light has achieved 95% 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



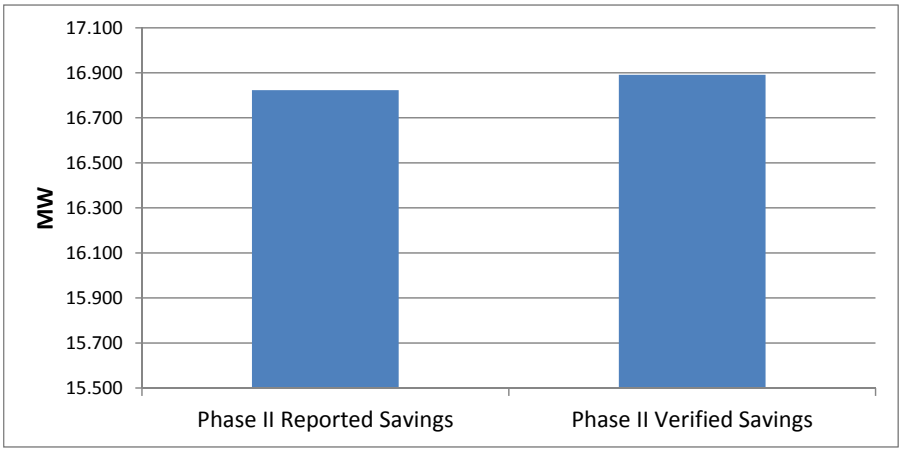
According to the Phase II Implementation Order , Duquesne Light is allowed by the PUC to "carry over" into Phase II the Phase I verified energy savings that exceeded the Phase I compliance target. Table 1-1 shows how many MWh/yr of savings from Phase I Duquesne Light is carrying over into Phase II.

Table 1-1: Savings from PY4 Carried Into Phase II

Sector	Phase II Verified Savings (MWh/Yr)	Verified Savings Carried Over from Phase 1 (MWh/Yr)	Phase II+CO Verified Savings (MWh/Yr)
Residential	63,875	89,178	153,053
Commercial and Industrial	63,807	36,817	100,624
GNI	740	7,722	8,462
Total	128,421	133,717	262,138

Duquesne Light has achieved 16.9 MW of gross verified demand reduction during Program Year 5[2].

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



There are Duquesne Light measures available at no cost to low-income customers. These measures offered to the low-income sector comprise 14% 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

[2] Unlike Phase I, there is no compliance target for demand reduction in Phase II.

divided by the total electricity consumption in the Duquesne Light territory by (8.4%).[3] These values are shown in Table 1-2 and Table 1-3.

Table 1-2: Low-Income Sector Compliance (Number of Measures)

	Low-Income Sector	All Sectors	% Low-Income	Goal
# of Measures Offered	7	50	14%	8.4%

Table 1-3: Low-Income Sector Compliance (Percentage of Savings)

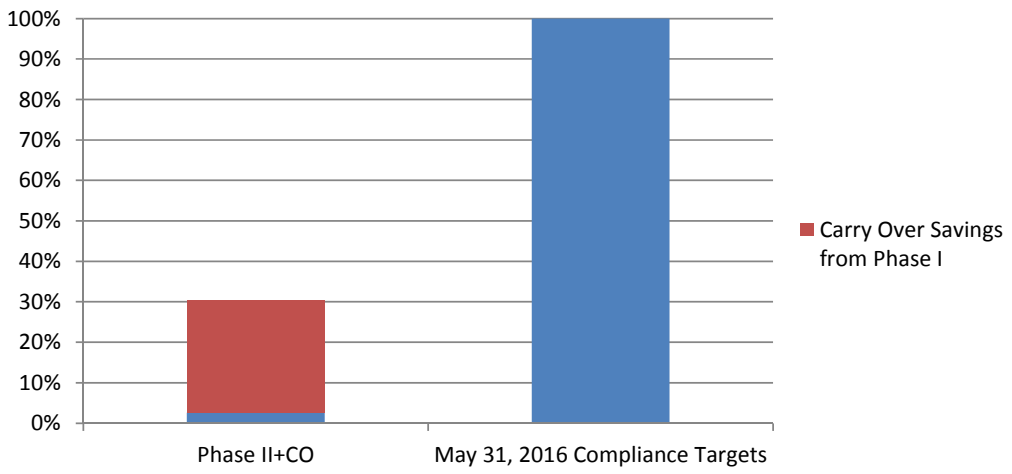
	Low Income Verified Savings from Low Income Programs (MWh/Yr)	Low Income Verified Savings from Other Residential Programs (MWh/Yr)	All Low Income Verified Savings [Sum of First Two Columns]	Progress Towards Low Income Goal [Previous Column divided by Phase II MWh Target]	Goal
Phase II Verified Gross Energy Savings	167	12,631	12,798	4.6%	4.5%

The Phase II verified gross energy savings achieved through programs specifically designed for income-eligible customers are 167 MWh/yr and 12,631 MWh/yr through other programs; this is 4.6% against the 4.5% Phase II total portfolio verified gross energy savings target for the low-income sector.

Duquesne Light achieved 30% of the May 31, 2016 energy reduction compliance target for the government, nonprofit, and institutional sector based on cumulative program/portfolio savings from Phase II+CO verified gross energy savings achieved from the inception of Phase II through Program Year 5 and including carry-over savings from Phase I as shown in Figure 1-3.

[3] Act 129 includes a provision requiring electric distribution companies to offer a number of energy efficiency measures to low-income households that are "proportionate to those households' share of the total energy usage in the service territory." 66 Pa.C.S. §2806.1(b)(i)(G).

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



A summary of 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 1-4.

Table 1-4: Summary of Phase II Performance by Sector

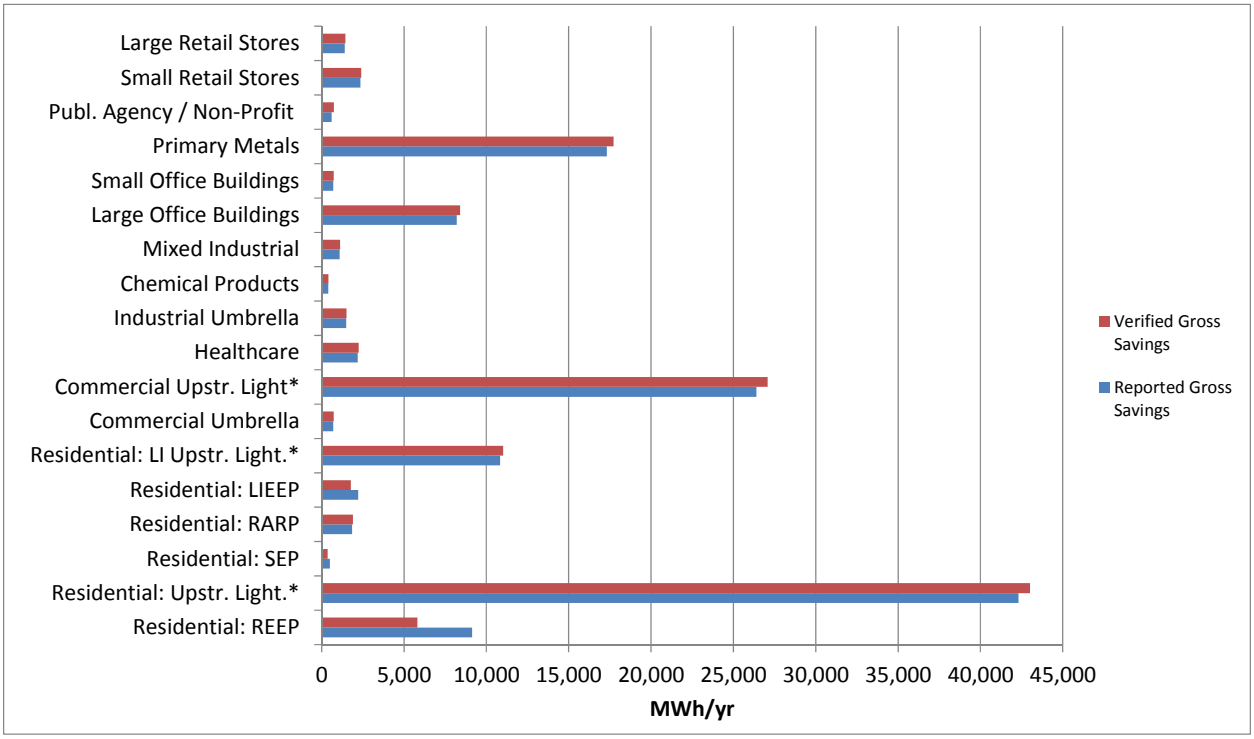
Sector	Participants*	Phase II Gross Verified Energy Savings (MWh/yr)	Phase II Gross Verified Demand Reduction (MW)	Incentives ($1,000)
Residential	29,075	51,076	2.945	$1,813
Low-Income	5,631	12,798	0.711	$446
Small Commercial and Industrial	195	33,587	8.838	$685
Large Commercial and Industrial	92	30,219	4.227	$1,253
Government, Nonprofit, and Institutional	36	740	0.171	$84
Program Year 5 Total	35,029	128,421	16.892	$4,280
Phase II Total	35,029	128,421	16.892	$4,280

*Count for Upstream Lighting not included in Residential, Low-Income, or Commercial because these participants are not known

1.2 Summary of Energy Impacts

A summary of the reported and verified energy savings by program for Program Year 5 is presented in Figure 1-4.[4]

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

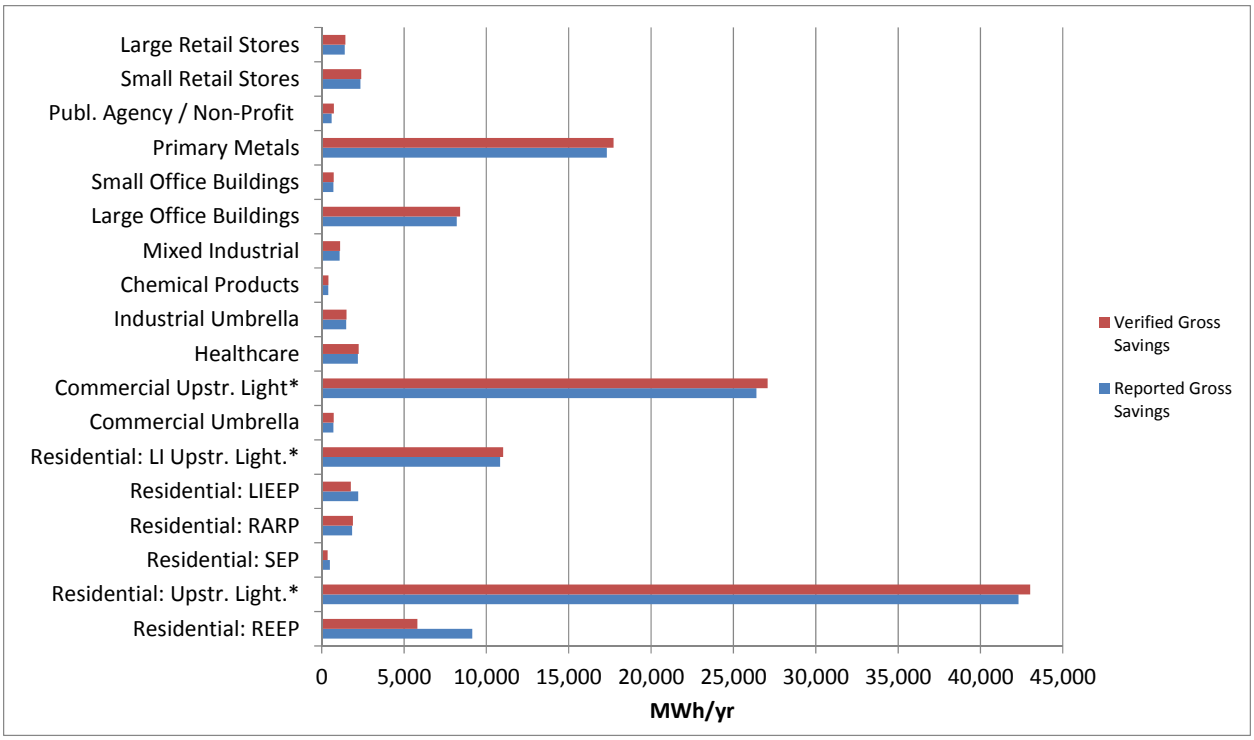


* The allocation of Upstream Lighting savings into Residential, Low-income, and Commercial for PY5 is based on evaluation research Navigant conducted early in Program Year 5, which determined that 12.6% of bulbs were sold to commercial customers, 17.8% to low income customers and 69.6% to non-low-income residential customers.

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

[4] Savings from 56 PY4 Commercial projects (verified as 6,012,614 kWh, 868.1 kW), 1 PY4 GNI project (verified as 18,232 kWh, 6.5 kW)), and 3 PY4 Industrial projects (verified as 10,523,892 kWh, 1,211.9 kW) were verified in PY5. These projects could not be verified in PY4 and so they are included in the appropriate program totals for PY5. The incentives associated with the 57 Commercial and GNI projects are also included in the relevant tables. Incentives for the 3 Industrial projects were included in the PY4 report and so are not included in this PY5 report. The savings from all of these PY4 projects are excluded from the cost effectiveness calculations for the PY5 programs.

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



* The allocation of Upstream Lighting savings into Residential, Low-income, and Commercial for PY5 is based on evaluation research Navigant conducted early in Program Year 5, which determined that 12.6% of bulbs were sold to commercial customers, 17.8% to low income customers and 69.6% to non-low-income residential customers.

Summaries of energy impacts by program through Program Year 5 are presented in Table 1-5 and Table 1-6.

Table 1-5: Reported Participation and Gross Energy Savings by Program

Program	Participants**		Reported Gross Impact (MWh/Yr)	
	PYTD	Phase II	PYTD	Phase II
Residential: EE Program (REEP): Rebate Program	25,619	25,619	9,140	9,140
Residential: EE Program (Upstream Lighting)*	N/A	N/A	42,307	42,307
Residential: School Energy Pledge	1,284	1,284	499	499
Residential: Appliance Recycling	2,172	2,172	1,849	1,849
Residential: Low Income EE	5,631	5,631	2,222	2,222
Residential: Low Income EE (Upstream Lighting)*	N/A	N/A	10,842	10,842
Commercial Sector Umbrella EE	20	20	714	714
Commercial Sector Umbrella EE (Upstream Lighting)*	N/A	N/A	26,400	26,400
Healthcare EE	8	8	2,192	2,192
Industrial Sector Umbrella EE	2	2	1,484	1,484
Chemical Products EE	9	9	398	398
Mixed Industrial EE	11	11	1,091	1,091
Office Building – Large – EE	51	51	8,202	8,202
Office Building – Small EE	25	25	712	712
Primary Metals EE	7	7	17,312	17,312
Public Agency / Non-Profit	36	36	612	612
Retail Stores – Small EE	137	137	2,350	2,350
Retail Stores – Large EE	17	17	1,400	1,400
TOTAL PORTFOLIO	35,029	35,029	129,726	129,726

* The allocation of Upstream Lighting savings into Residential, Low-income, and Commercial for PY5 is based on evaluation research Navigant conducted early in Program Year 5, which determined that 12.6% of bulbs were sold to commercial customers, 17.8% to low income customers and 69.6% to non-low-income residential customers.

**Count for Upstream Lighting not included, because these participant counts are not known.

Table 1-6: 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	9,140	64%	5,804	0.9%	5,804	1.0%
Residential: EE Program (Upstream Lighting)*	42,307	102%	43,016		43,016	
Residential: School Energy Pledge	499	73%	365	6.0%	365	6.8%
Residential: Appliance Recycling	1,849	102%	1,892	3.8%	1,892	4.3%
Residential: Low Income EE	2,222	80%	1,774	0.8%	1,774	0.9%
Residential: Low Income EE (Upstream Lighting)*	10,842	102%	11,024		11,024	
Commercial Sector Umbrella EE	714	103%	732	1.6%	732	1.8%
Commercial Sector Umbrella EE (Upstream Lighting)*	26,400	103%	27,079	1.6%	27,079	1.8%
Healthcare EE	2,192	103%	2,248	1.6%	2,248	1.8%
Industrial Sector Umbrella EE	1,484	102%	1,519	1.5%	1,519	1.7%
Chemical Products EE	398	102%	407	1.5%	407	1.7%
Mixed Industrial EE	1,091	102%	1,116	1.5%	1,116	1.7%
Office Building – Large – EE	8,202	103%	8,413	1.6%	8,413	1.8%
Office Building – Small EE	712	103%	730	1.6%	730	1.8%
Primary Metals EE	17,312	102%	17,715	1.5%	17,715	1.7%
Public Agency / Non-Profit	612	121%	740	10.3%	740	11.8%
Retail Stores – Small EE	2,350	103%	2,411	1.6%	2,411	1.8%
Retail Stores – Large EE	1,400	103%	1,436	1.6%	1,436	1.8%
TOTAL PORTFOLIO	**129,726**	**99%**	**128,421**	0.7%	**128,421**	0.8%
Phase 1 Carryover	**N/A**	**N/A**	**N/A**	**N/A**	**133,717**	**N/A**
Total Ph II+CO	**N/A**	**N/A**	**N/A**	**N/A**	**262,138**	**N/A**

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

* The allocation of Upstream Lighting savings into Residential, Low-income, and Commercial for PY5 is based on evaluation research Navigant conducted early in Program Year 5, which determined that 12.6% of bulbs were sold to commercial customers, 17.8% to low income customers and 69.6% to non-low-income residential customers.

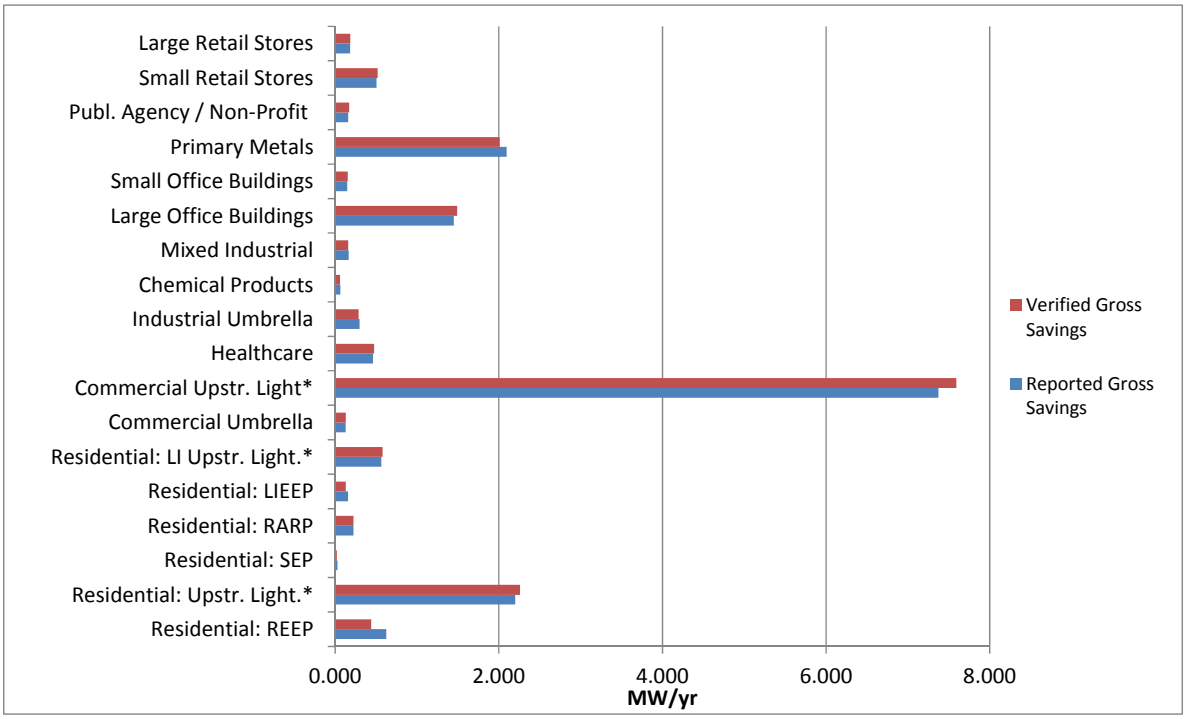
1.3 Summary of Fuel Switching Impacts

Duquesne Light did not offer fuel switching measure in PY5, and no results are reported within this section.

1.4 Summary of Demand Impacts

A summary of the reported and verified demand reduction by program for Program Year 5 is presented in Figure 1-6. The impacts below reflect the line loss factors shown in Table 1-11.

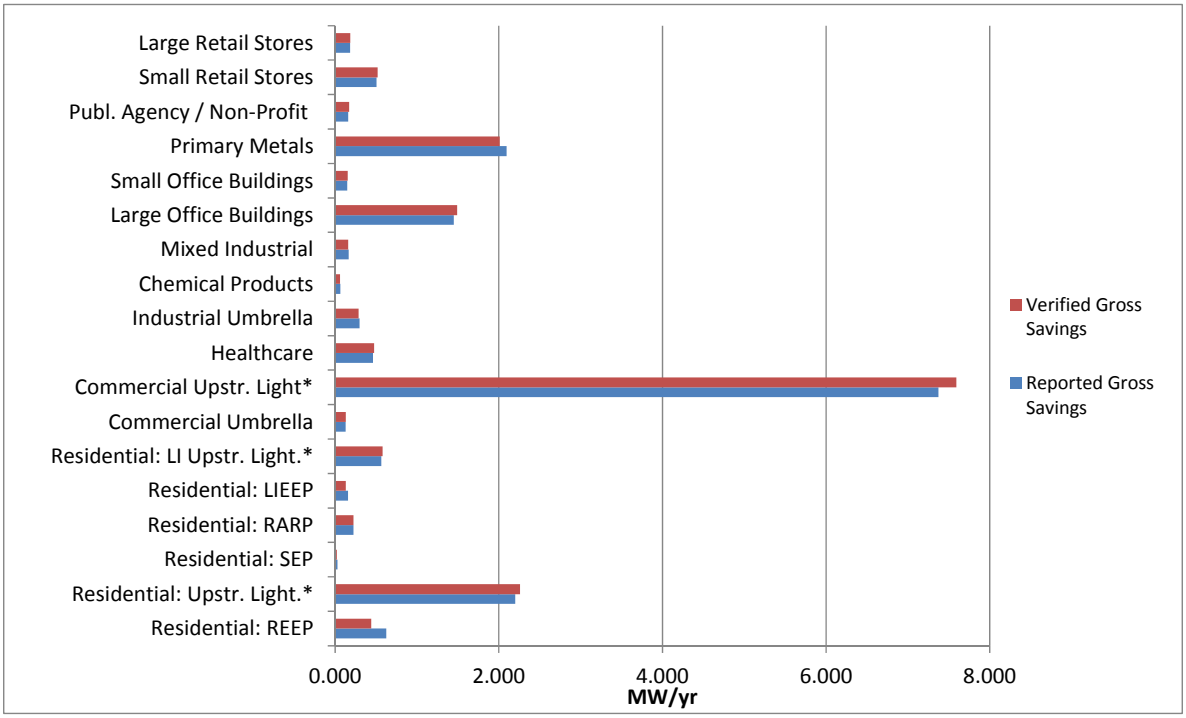
Figure 1-6: PYTD Reported and Verified Demand Reduction by Program



* The allocation of Upstream Lighting savings into Residential, Low-income, and Commercial for PY5 is based on evaluation research Navigant conducted early in Program Year 5, which determined that 12.6% of bulbs were sold to commercial customers, 17.8% to low income customers and 69.6% to non-low-income residential customers.

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 Demand Reduction by Program



* The allocation of Upstream Lighting savings into Residential, Low-income, and Commercial for PY5 is based on evaluation research Navigant conducted early in Program Year 5, which determined that 12.6% of bulbs were sold to commercial customers, 17.8% to low income customers and 69.6% to non-low-income residential customers.

Summaries of demand reduction impacts by program through Program Year 5 are presented in Table 1-7 and Table 1-8.

Table 1-7: 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	25,619	25,619	0.625	0.625
Residential: EE Program (Upstream Lighting)*	N/A	N/A	2.200	2.200
Residential: School Energy Pledge	1,284	1,284	0.028	0.028
Residential: Appliance Recycling	2,172	2,172	0.224	0.224
Residential: Low Income EE	5,631	5,631	0.156	0.156
Residential: Low Income EE (Upstream Lighting)*	N/A	N/A	0.564	0.564
Commercial Sector Umbrella EE	20	20	0.126	0.126
Commercial Sector Umbrella EE (Upstream Lighting)*	N/A	N/A	7.373	7.373
Healthcare EE	8	8	0.462	0.462
Industrial Sector Umbrella EE	2	2	0.298	0.298
Chemical Products EE	9	9	0.063	0.063
Mixed Industrial EE	11	11	0.165	0.165
Office Building – Large – EE	51	51	1.449	1.449
Office Building – Small EE	25	25	0.148	0.148
Primary Metals EE	7	7	2.096	2.096
Public Agency / Non-Profit	36	36	0.158	0.158
Retail Stores – Small EE	137	137	0.505	0.505
Retail Stores – Large EE	17	17	0.181	0.181
TOTAL PORTFOLIO	35,029	35,029	16.823	16.823

* The allocation of Upstream Lighting savings into Residential, Low-income, and Commercial for PY5 is based on evaluation research Navigant conducted early in Program Year 5, which determined that 12.6% of bulbs were sold to commercial customers, 17.8% to low income customers and 69.6% to non-low-income residential customers.

**Count for Upstream Lighting not included in because these participant counts are not known.

Table 1-8: 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	0.625	70%	0.440	0.8%	0.440	1.0%
Residential: EE Program (Upstream Lighting)*	2.200	103%	2.260		2.260	
Residential: School Energy Pledge	0.028	76%	0.021	6.0%	0.021	6.8%
Residential: Appliance Recycling	0.224	100%	0.224	3.8%	0.224	4.4%
Residential: Low Income EE	0.156	84%	0.132	0.9%	0.132	1.0%
Residential: Low Income EE (Upstream Lighting)*	0.564	103%	0.579		0.579	
Commercial Sector Umbrella EE	0.126	103%	0.130	2.2%	0.130	2.5%
Commercial Sector Umbrella EE (Upstream Lighting)*	7.373	103%	7.591	2.2%	7.591	2.5%
Healthcare EE	0.462	103%	0.476	2.2%	0.476	2.5%
Industrial Sector Umbrella EE	0.298	96%	0.286	1.7%	0.286	1.9%
Chemical Products EE	0.063	96%	0.061	1.7%	0.061	1.9%
Mixed Industrial EE	0.165	96%	0.158	1.7%	0.158	1.9%
Office Building – Large – EE	1.449	103%	1.492	2.2%	1.492	2.5%
Office Building – Small EE	0.148	103%	0.153	2.2%	0.153	2.5%
Primary Metals EE	2.096	96%	2.012	1.7%	2.012	1.9%
Public Agency / Non-Profit	0.158	108%	0.171	10.8%	0.171	12.5%
Retail Stores – Small EE	0.505	103%	0.520	2.2%	0.520	2.5%
Retail Stores – Large EE	0.181	103%	0.186	2.2%	0.186	2.5%
TOTAL PORTFOLIO	**16.823**	**100%**	**16.892**	1.3%	**16.892**	1.5%
Phase 1 Carryover	**N/A**	N/A	N/A	N/A	**0**	N/A
Total Ph II+CO	**N/A**	N/A	N/A	N/A	**16.892**	N/A

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

* The allocation of Upstream Lighting savings into Residential, Low-income, and Commercial for PY5 is based on evaluation research Navigant conducted early in Program Year 5, which determined that 12.6% of bulbs were sold to commercial customers, 17.8% to low income customers and 69.6% to non-low-income residential customers.

1.5 Summary of Program Year 5 Net-to-Gross Ratios

Per the 2013 TRC Order, EDCs are required to conduct net-to-gross (NTG) research. NTG ratios are not applied to gross savings and are not used for compliance purposes, but are used for cost effectiveness reporting and future program planning purposes. Table 1-9 presents a summary of NTG ratios by program.

Table 1-9: Program Year 5 NTG Ratios by Program

Program Name	Free Ridership	Spillover	NTG Ratio Program Year 5	NTG Categories Included
Residential: EE Program (REEP): Rebate Program	38%	11%	73%	FR, Part. SO
Residential: EE Program (Upstream Lighting)	57%	8%	51%	FR, Part. SO
Residential: School Energy Pledge	36%	21%	85%	FR, Part. SO
Residential: Appliance Recycling	65%	12%	47%	FR, Part. SO
Residential: Low Income EE	42%	17%	75%	FR, Part. SO
Residential: Low Income EE (Upstream Lighting)	57%	8%	51%	FR, Part. SO
Commercial Sector Umbrella EE	49%	1%	52%	FR, Part. SO
Commercial Sector Umbrella EE (Upstream Lighting)	49%	1%	52%	FR, Part. SO
Healthcare EE	49%	1%	52%	FR, Part. SO
Industrial Sector Umbrella EE	24%	2%	78%	FR, Part. SO
Chemical Products EE	24%	2%	78%	FR, Part. SO
Mixed Industrial EE	24%	2%	78%	FR, Part. SO
Office Building – Large – EE	49%	1%	52%	FR, Part. SO
Office Building – Small EE	49%	1%	52%	FR, Part. SO
Primary Metals EE	24%	2%	78%	FR, Part. SO
Public Agency / Non-Profit	49%	1%	52%	FR, Part. SO
Retail Stores – Small EE	49%	1%	52%	FR, Part. SO
Retail Stores – Large EE	49%	1%	52%	FR, Part. SO
(weighted by program savings for Programs reporting NTG Ratios)	**50%**	**5%**	**55%**	**N/A**

1.6 Summary of Portfolio Finances and Cost-Effectiveness

A breakdown of the portfolio finances is presented in Table 1-10.

Table 1-10: Summary of Portfolio Finances

	Actual PYTD Costs ($1,000)	Actual Phase II Costs ($1,000)
EDC Incentives to Participants	4,280	4,280
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	4,280	4,280
Design & Development	239	239
Administration, Management, and Technical Assistance[1]	8,662	8,662
Marketing[2]	912	912
Subtotal EDC Implementation Costs	**9,813**	**9,813**
EDC Evaluation Costs	**441**	**441**
SWE Audit Costs	**750**	**750**
Total EDC Costs[3]	**14,535**	**14,535**
Participant Costs[4]	**9,157**	**9,157**
Total NPV TRC Costs[5]	**20,161**	**20,161**
Total NPV Lifetime Energy Benefits	**43,349**	**43,349**
Total NPV Lifetime Capacity Benefits	**3,525**	**3,525**
Total NPV TRC Benefits[6]	**49,664**	**49,664**
TRC Benefit-Cost Ratio[7]	**2.46**	**2.46**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

1.7 Summary of Cost-Effectiveness by Program

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. Table 1-11 shows the TRC ratios by program and other key factors used in the TRC ratio calculation for Phase II programs.

Table 1-11: PYTD TRC Ratios by Program

Program	TRC NPV Benefits ($1000)	TRC NPV Costs ($1000)	TRC Benefit-Cost Ratio	Discount Rate	Energy Line Loss Factor	Demand Line Loss Factor
REEP Residential Energy Efficiency	18,553	7,301	2.54	6.9%	1.074	1.074
SEP School Energy Pledge	108	271	0.40	6.9%	1.074	1.074
RRP Refrigerator Recycling	716	593	1.21	6.9%	1.074	1.074
LIEEP Low Income Residential	4,953	1,916	2.59	6.9%	1.074	1.074
Office Buildings - Small	336	199	1.69	6.9%	1.074	1.074
Office Buildings-Large	5,254	1,804	2.91	6.9%	1.074	1.074
CSUP Commercial Umbrella	10,131	1,093	9.27	6.9%	1.074	1.074
Retail Stores	1,845	921	2.00	6.9%	1.074	1.074
HEEP (Health Care)	195	843	0.23	6.9%	1.074	1.074
ISUP Industrial Umbrella	1,121	409	2.74	6.9%	1.074	1.074
Mixed Industrial	789	385	2.05	6.9%	1.074	1.074
Primary Metals	4,856	2,628	1.85	6.9%	1.074	1.074
Chemical Products	285	258	1.10	6.9%	1.074	1.074
Non Profit	261	502	0.52	6.9%	1.074	1.074
Education	158	277	0.57	6.9%	1.074	1.074
PAPP Public Agency Partnership	104	174	0.59	6.9%	1.074	1.074

1.8 Comparison of Program Year 5 Performance to Approved EE&C Plan

Table 1-12 below shows Program Year 5 expenditures compared to the budget estimates set forth in the EE&C plan.

Table 1-12: Comparison of Program Expenditures to EE&C Plan

Program	Budget from EE&C Plan	Actual Expenditures	% Difference from EE&C Plan [(Planned – Actual)/Planned]
Residential: EE Program (REEP): Rebate Program	$5,837	$5,124	88%
Residential: EE Program (Upstream Lighting)*			
Residential: School Energy Pledge	$428	$204	48%
Residential: Appliance Recycling	$135	$529	392%
Residential: Low Income EE	$1,381	$1,582	115%
Residential: Low Income EE (Upstream Lighting)*			
Commercial Sector Umbrella EE	$1,460	$975	67%
Commercial Sector Umbrella EE (Upstream Lighting)*			
Healthcare EE	$567	$894	158%
Industrial Sector Umbrella EE	$330	$178	54%
Chemical Products EE	$816	$134	16%
Mixed Industrial EE	$730	$289	40%
Office Building – Large – EE	$1,000	$1,329	133%
Office Building – Small EE			
Primary Metals EE	$2,246	$1,209	54%
Public Agency / Non-Profit	$1,874	$473	25%
Retail Stores – Small EE	$460	$588	128%
Retail Stores – Large EE			

* The allocation of Upstream Lighting incentive costs into Residential, Low-income, and Commercial for PY5 is based on evaluation research Navigant conducted early in Program Year 5, which determined that 12.6% of bulbs were sold to commercial customers, 17.8% to low income customers and 69.6% to non-low-income residential customers.

Table 1-13 show Program Year 5 program savings compare to the energy and demand savings estimates filed in the EE&C plan.

Table 1-13: Comparison of Actual Program Savings to EE&C Plan

Program	MWh Savings Projected in EE&C Plan*	Actual Reported MWh Savings	% Difference [(Planned – Actual)/Planned]	MW Savings Projected in EE&C Plan*	Actual Reported MW Savings	% Difference [(Planned – Actual)/Planned]
Residential: EE Program (REEP): Rebate Program	28,021	51,446	184%	1.541	2.825	183%
Residential: EE Program (Upstream Lighting)*						
Residential: School Energy Pledge	1,186	499	42%	0.038	0.028	74%
Residential: Appliance Recycling	1,326	1,849	139%	0.164	0.224	136%
Residential: Low Income EE	4,151	13,065	315%	0.208	0.720	345%
Residential: Low Income EE (Upstream Lighting)*						
Commercial Sector Umbrella EE	4,327	714	16%	0.725	0.126	17%
Commercial Sector Umbrella EE (Upstream Lighting)*	2,792	26,400	946%	0.656	7.373	1124%
Healthcare EE	3,424	2,192	64%	0.573	0.462	81%
Industrial Sector Umbrella EE	1,536	1,484	97%	0.258	0.298	115%
Chemical Products EE	3,803	398	10%	0.639	0.063	10%
Mixed Industrial EE	3,399	1,091	32%	0.571	0.165	29%
Office Building – Large – EE	6,042	8,914	148%	1.012	1.598	158%
Office Building – Small EE						
Primary Metals EE	10,467	17,312	165%	1.758	2.096	119%
Public Agency / Non-Profit	9,224	612	7%	1.371	0.158	12%
Retail Stores – Small EE	2,776	3,750	135%	0.465	0.685	147%
Retail Stores – Large EE						

* Duquesne Light's saving goals in the EE&C are designed to achieve 20% higher savings than required to achieve the utility's compliance target. This is to allow for evaluation-based realization rates to reduce initial reported savings and still achieve compliance targets. The "Savings Projected in EE&C Plan" of this table have been reduced to the level required to achieve the official compliance target.

About half of the programs (or program groupings) have achieved significantly higher savings than those projected for them in the Duquesne Light EE&C plan, and they also have the highest TRC ratios. The most extreme examples of this, with TRC ratios over 2.5 and savings more than 180% of goals, (REEP, LIEEP and Commercial Sector Umbrella) are most successful due to the high levels of participation for Upstream Lighting. Program acceptance among customers has been overwhelming and program acceptance, adoption among retailers has been strong, and the cost-effectiveness of the upstream approach has been demonstrated.

SEP, Healthcare, Public Agency Partnership/Non-profit and most industrial programs did not meet their PY5 goals, and all but the industrial programs in this group also had low TRC ratios. However, this is not likely to materially affect Duquesne Light's ability to achieve its overall residential or non-residential

sector savings goals. Regarding SEP, the program has been operating for several years now and has been implemented in a wide range of schools. The program implementation strategy has not been to repeat the program in a school, which may now be a limiting factor. Duquesne Light has indicated having a substantial pipeline of projects on the non-residential side that could greatly aid the utility's ability to achieve individual program or program group goals.

Only the Retail, Mixed Industrials and Primary Metals program PY5 TRC ratios are approximately the same as those forecast in the utility's Phase II EE&C filing. Other programs are either significantly more cost effective or significantly less cost effective after this first year of Phase II than originally projected for them. The three programs affected by Upstream Lighting are all significantly more cost effective than projected, as are, to a lesser extent, the Industrial Sector Umbrella and Offices programs. The others are less cost effective than originally projected, especially SEP, Healthcare and the GNI sector programs (Public Agency Partnership/Non-profit/Education).

In recent years, the evaluation team has seen increasing repeat participation by individual non-residential customers in Duquesne Light's programs, including in the healthcare and government/non-profit sectors, due to the condensed nature of the utility's service territory. According to the utility, the simpler projects have been completed at these customer sites and there is a need to pursue projects that are more complex, involve significant up-front engineering and M&V work (sometimes having to be conducted over multiple seasons), and have a longer implementation cycle from initiation to completion than do projects in the past. In addition, there is a window of opportunity with the customer for some of these complex projects that, once missed, does not appear again for months, further delaying project implementation. Duquesne Light reports that these projects are not being entered into the tracking system until the needed research has been completed. These factors have resulted in the reporting of significant up-front costs with much less significant reported savings. The utility maintains that this phenomenon contributes strongly to the Healthcare and GNI sector programs having much lower TRC ratios than originally estimated for them according the Phase II Act 129 EE&C filing. The evaluation team will monitor this phenomenon over the next few years of Phase II.

1.9 Portfolio Level/Cross-cutting Process Evaluation Summary for Program Year 5

The PY5 process evaluation activities examined the program design, program administration, program implementation and delivery, and market response. Specifically, the process evaluation activities included the following tasks:

- Review of reported measure savings against the 2013 Pennsylvania TRM
- Review of program materials
- Interviewing Duquesne program staff and CSPs to assess program implementation administration processes
- In-depth interviews with trade allies

- Telephone surveys with participants and, for the residential sector, non-participants

Key cross-cutting recommendations include the following:

- Residential customers are not very aware of Duquesne Light's residential programs. The utility should become more active in promoting and cross-promoting its programs.
- Duquesne Light should continue its encouragement of CSPs to provide detailed information regarding projects they submit. The accuracy and completeness of the documentation provided for evaluation purposes has improved since Phase I.

Other recommendations addressed the specifics of individual programs and can be found in Sections 2-7 of this report.

2 Residential Energy Efficiency Program (REEP)

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

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

A fourth component, O-Power, was added to the REEP program in PY4. The O-Power program provides Home Energy Reports that deliver personalized information about customer energy usage and how it compares to that of similar customers. This is done to encourage customers to make efficiency improvements, especially among customers having high consumption. It also provides easy to follow tips which lead to energy savings.

2.1 Program Updates

The O-Power component previously described for PY4 was not active in PY5. Otherwise, programs remained the same in PY5 as they were in PY4.

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 PY5. 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 achieving its goals. By the end of PY5, Duquesne Light reported savings totaling 174% of its PY5 gross savings goal of 28,021 MWh. Table 2-1 shows REEP participation, savings and incentives for PY5.

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

Sector	Participants*	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
REEP	25,619	51,446	2.826	$1,813
Phase II Total	25,619	51,446	2.826	$1,813

*Count for upstream lighting not included because these participants are not known

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 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.
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.
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 PY5 Sampling Plan, the annual sample size target for REEP was 27 – including 23 Kit participants and 4 Rebate participants – with a targeted level of confidence and precision of 10% at 90% confidence.[5] Table 2-2, below, presents the targeted and achieved sample sizes for the program.

Table 2-2: REEP Sampling Strategy for Program Year 5

Stratum	Population Size[6]	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size*	Evaluation Activity
Rebates	1,960	85%/48.1%	4	67	Telephone verification
Kits	22,598	85%/15.5	23	64	Telephone verification
Upstream Lighting	N/A	N/A	N/A	N/A	Database verification
Program Total	24,558	85%/15%	27	131	

*Rebates Achieved Sample Size represents 67 rebates from 50 participants

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 PY5 sampled rebate applications and supporting proof or purchase data were requested and reviewed to ensure proof of purchase supported the rebate request. In PY5 no exceptions were noted.

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 savings values and/or protocols incorporating in-service

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

[6] Unique line item in PMRS

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 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 2013 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 2013 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, as summarized below:

A realization rate (or ratio estimate) was calculated for each REEP 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)[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 Upstream Lighting program component. 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 (formerly ECOS), with respect to numbers of units, wattages and savings claims. Cross-sector sales to non-residential customers were determined through in-store intercept surveys completed early in PY5 and used in the PY4 evaluation. These findings are applied to PY5 because the program did not change. A study to update these results is expected to be completed during PY6. 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.

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[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 2-3: Program Year 5 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	309	99%	305	0.11	2.0%
Kits	8,831	62%	5,499	0.42	7.6%
Upstream Lighting	42,307	102%	43,016	0.00	0.0%
Program Total	51,446	95%	48,820		0.9%

Table 2-4: Program Year 5 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	0.116	100%	0.116	0.00	0.0%
Kits	0.509	64%	0.324	0.42	7.6%
Upstream Lighting	2.200	103%	2.260	0.00	0.0%
Program Total	2.826	96%	2.700		0.8%

The low realization rates reported for the kit component of the REEP program result from a significant portion of participants having not installed the smart strips (34%) or any LED nightlights (36%). The smart strips have a significant impact on the realization rate due to their high reported savings relative to that of the LED nightlights.

2.3 Impact Evaluation Net Savings

Free Ridership

Navigant used a self-report method of estimating free ridership for the Act 129 programs, to help provide Duquesne Light with a general understanding of the extent to which efficiency actions being taken as part of Act 129 programs would have been undertaken even without the program (i.e., free ridership). As indicated in the SWE's Evaluation Framework, "it is very unlikely that this approach [self-reports] yields an accurate quantitative point estimate of free-ridership," but "the SWE believes it is reasonable to conclude that NTG free-rider and spillover questions result in measurement of something that is positively correlated with true free-ridership, and thus can be useful in assessing changes over time or differences across programs."[9] The free ridership assessment presented below provides an estimation of the extent to which participants would have installed the equipment they received through the program on their own. The estimation of free ridership was completed separately for the Equipment Rebates and Efficiency Kits. Equipment Rebate and Efficiency Kit free ridership estimation followed the protocols outlined by the SWE Guidance Memorandum GM-024 ("Common Approach for Measuring Free-riders for Downstream Programs"). Free ridership for the Upstream Lighting program component participants relied on the analysis conducted in early PY5 as part of the PY4 evaluation.

Equipment 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 participants decision to purchase the rebated equipment
    e. How influential was the program advertisement in the participants decision to purchase the rebated equipment
    f. How influential was any contact with Duquesne Light staff in the participants decision to purchase the rebated equipment

[9] *Evaluation Framework for Pennsylvania Act 129 Phase II Energy Efficiency and Conservation Programs*, June 30, 2013.

2. In estimating free ridership for this program, participants were assigned an intention score and an influence score each representing 50% of the total free ridership score. The intention score is based on questions which were 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 is assessed by asking the respondent how much influence – from 1 (no influence) to 5 (great influence) – various program elements had on the decision to do the project the way it was done.
    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 program rebate or seen program advertisements. The options and associated intention score range from zero, if nothing would have been purchased/installed, up to 50, if the same measure would have been purchased/installed.

Using the SWE guidance, the calculated free ridership values were weighted based on the savings associated with each measure individuals indicated they would have been likely to purchase and install without the program. Note that some individuals purchased/installed more than 1 item. However, the counts reflect the combined responses, weighted by energy savings, for all items the respondents were asked about.

The REEP Equipment Rebate component free ridership is estimated to be 52%, which indicates that, while the program influenced many participant decisions regarding the rebated equipment, it does not seem to have been influential for about half of participants. Participants were asked free ridership questions about each measure that they purchased. A total of 50 respondents were asked about a total of 67 rebated appliances. These results show a much higher free ridership than did the results from the evaluation of the PY4 program, but the free ridership methodology used for that program was different. It is therefore not clear whether free ridership has increased substantially or whether the two different values merely reflect the difference in methodology that was used.

Efficiency Kit Free Ridership

Similar to the REEP Equipment Rebate free ridership score, the Efficiency Kit free ridership score is based on an intention and influence score each representing 50% 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
a. How influential were program education materials in the participants decision to receive and install kit measures
b. How influential were program advertisements in the participants decision to receiving and install kit measures
c. How influential was any contact with Duquesne Light staff in the participants 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. The options and associated intention score range from zero, if nothing would have been installed, up to 50, if the same measure would have been installed.

The calculated free ridership values were weighted based on the savings achieved by each kit item for each individual who indicated they would have been likely to purchase and install without the program.

The overall efficiency kit program component free ridership was estimated to be 37%, by taking the average free ridership for each product in the kits, weighted by the savings associated with that product. Individually, free ridership estimates for CFLs, smart strips, and LED nightlights were 42%, 34%, and 36%, respectively. These results indicate that, of all Efficiency Kit products, participants would be most likely to purchase the CFLs in the absence of the program.

Free ridership is higher than PY4 for the REEP Kits. Respondents indicated some level of free ridership for all components whereas a 0% free ridership was estimated in PY4 for smart strips, for example. The free ridership methodology used for PY4 was different. It is therefore not clear whether free ridership has increased substantially or whether the two different values merely reflect the difference in methodology that was used.

Upstream Lighting Free Ridership

The free ridership for the Upstream Lighting component was estimated as part of the evaluation of the PY4 program, and those results are applied to the PY5 program as well. A study to update the net-to-gross estimates for the Upstream Lighting program component is expected to be completed sometime

in PY6. In PY4, free ridership was estimated by evaluating participant in-store intercept and telephone survey responses to several questions. The results from respondents of each survey were weighted by the number of bulbs they purchased to determine the average free ridership. The steps taken to evaluate the free ridership were conducted separately for CFLs and LEDs.

The calculated free ridership percentages for standard CFLs, specialty CFLs, and LEDs are 55%, 69%, and 47%, respectively. Free ridership is estimated at 57% for the entire Upstream Lighting component.

In order to determine the overall free ridership ratio for the REEP program, the free riderships of each component were weighted by the savings achieved by each measure type. The results are presented in Table 2-6 below.

Additional details on the free ridership estimation approach and results can be found in the Residential Energy Efficiency Programs PY5 Process Evaluation report.

Spillover

In the NTG surveys administered to REEP customers, respondents were also asked 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. The survey effort asked these questions of respondents who participated in both the REEP Rebate and Kit program components. The methodology for estimating spillover savings is based on the approach outlined by the SWE Guidance Memorandum GM-025. 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. Measure savings were sourced from Duquesne Light's PY5 tracking data (PMRS) that references deemed savings values from the 2013 TRM. Generally, savings for a given spillover action rely on 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 PY5.

For each participant, spillover savings are calculated as:

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

The survey asked participants on a 0 to 5 scale, with 0 meaning "not at all influential" and 5 meaning "extremely influential," how influential various program parameters were on their decision to take the spillover actions. Program influence scores range from 0% for scores of 0 or 1, 50% for scores of 2 or 3, and 100% for scores of 4 or 5. The SWE guidance specifies that the final influence score is equal to the maximum influence score indicated by participants when asked about the various program parameters.

The same methodology applied to each of the Equipment Rebate and Efficiency Kit components. On average, Equipment Rebate participants achieve an additional 70 kWh in savings and Efficiency Kit

participants achieve an additional 25 kWh. The evaluation relied on PY4 results to inform the Upstream Lighting component spillover. The PY4 evaluation estimated a spillover factor of 8.4% for CFLs. That is, for every 1 kWh saved by an Upstream Lighting CFL an additional 0.084 kWh is saved through spillover activities. Spillover per participant is not known because customer counts for Upstream Lighting are not known. This spillover factor was then applied to the verified PY5 Upstream Lighting program savings associated with CFLs to estimate total spillover savings. Divided the spillover savings by the total program verified savings found a spillover factor of 7.7%. The PY4 effort did not examine spillover associated with LEDs.

In order to determine a spillover factor for the Rebate and Efficiency Kit components of the REEP program the savings per participant were multiplied by the number of unique PY5 participants for each program component. In this way, a Duquesne Light customer would not be counted for double spillover savings if they received two rebates during the PY5 period. This yields a total spillover savings for each component. The total spillover savings is then divided by the gross program energy savings to determine a spillover factor. For Upstream Lighting, the spillover factor is derived from the PY4 spillover factor as previously described.

Additional details on the spillover estimation approach and results can be found in the Residential Energy Efficiency Programs PY5 Process Evaluation report.

Table 2-5: REEP Sampling Strategy for Program Year 5 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 to Achieve Sample
Rebates	N/A	1,960	0.5	90%/27.3%	11	67	80%
Kits	N/A	22,598	0.5	90%/10.4%	64	64	100%
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Program Total	N/A	24,558		90%/10%	75	131	90%

*Rebates achieved sample size represents 67 rebates from 50 participants

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

NTG = 1-FR+Spillover

Table 2-6 summarizes the NTG ratio for each program component and the overall REEP NTG. The overall REEP NTG is determined by weighting the NTG for each program component by the savings associated with that program component. Due to the significant savings, high free ridership and relatively low spillover associated with the Upstream Lighting component, this component drives the overall REEP net-to-gross ratio down to 55%.

Table 2-6: Program Year 5 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	52%	33%	0.81	1.18	20.7%
Kits	37%	10%	0.73	0.62	11.3%
Upstream Lighting	57%	8%	0.51	0.00	0.0%
Program Total[10]	54%	8%	0.55		1.7%

2.4 Process Evaluation

The process evaluation for the REEP program group in PY5 included the following activities:

- Review of the 2013 Pennsylvania TRM and program materials
- Interviews with Duquesne program staff
- In-depth interviews with trade allies, appliance retailers and market outreach partners.
- Surveys with 50 REEP Rebate and 64 REEP Kits participants sampled randomly from the entire PY5 population for each program segment (Rebates and Kits) between April 9 and August 5, 2014. These surveys included both verification questions and selected process evaluation questions.

The process evaluation also included a general population study to supplement the program process evaluation. The general population survey effort examined the general residential market as well as non-participants and their awareness of Duquesne Light's programs.

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. The Upstream Lighting component was excluded from the process evaluation in PY5.

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

Table 2-7: REEP Sampling Strategy for Program Year 5

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	Evaluation Activity
Rebate	N/A	1,960	0.5	90%/27.3%	11	50	80%	Telephone verification
Kits	N/A	22,598	0.5	90%/10.4%	64	64	100%	Telephone verification
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Program Total	N/A	24,558	0.5	90%/10%	75	114	90%	

*This reflects process interviews completed.

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 Residential Energy Efficiency Programs PY5 Process Evaluation report. Highlights of the process evaluation are summarized below:

- REEP achieved 174% of its PY5 energy savings compliance goal. This was due largely to the success of the Upstream Lighting component, which accounted for 88% of these savings. Costs were slightly above the budgeted amount for PY5.
- REEP Market Outreach Partnership efforts are well received by the various organizations and individuals interacting with the utility. Navigant determined that both parties are benefitting from these relationships and that REEP participation levels, particularly for the efficiency kits, are directly impacted. Some other findings include the following:
    - Certain organizations possess significant knowledge and expertise in areas related to the REEP program components.
    - Duquesne Light's partner organizations want to better understand the specific constituent benefits that result from promoting REEP program components. Quantifying the value of the REEP program for an organization's constituency is useful information, especially for non-profits which are subject to budget constraints and grant approvals.
    - Partners are typically active only around an organization's annual event, when Duquesne Light responds to invitations to these events (e.g., as vendor at a booth).
- Program offerings are well received by select retailers who have knowledge and are aware of program specifics. The utility could enhance its relationships with retailers at both the store and

corporate level. A primary barrier for REEP (and to all programs) appears to be market awareness. Other findings:

  - Most of the retailers contacted were aware of Duquesne Light's energy efficiency programs, but few carried Duquesne Light informational materials and rebate forms.
  - Retailers indicated that the only types of dehumidifiers they carry are the ENERGY STAR versions.

- Participant survey respondents indicated that retail stores (28%), online/website (23%), and bill inserts (18%) are the most common sources of awareness for the REEP Rebate component.
- Participant survey respondents indicated that television advertisements (26%), family or friends (19%), and bill inserts (17%) are the most common sources of awareness for the REEP Kit component.
- Participant survey respondents reported high satisfaction with the overall REEP components: 4.2 out of 5 (where 5 means very satisfied) for Rebates, and 4.2 out of 5 for Kits.
- Over half of the general population survey respondents (60%) who did not participate in REEP indicated that they had purchased an appliance in the past two years and approximately 59% of appliance purchases were reported to be high efficiency appliances. The most common reason for not participating in the Duquesne Light Rebate program was lack of awareness. Those who indicated that they did not participate because they did not know about the program were asked how likely they would be to participate in the future. The average response on a 5 point scale where 1 is "very unlikely" and 5 is "very likely" was 4.6.

2.5 Recommendations for Program

The REEP program achieved an energy savings realization rate of 95% and the evaluation found a 0.55 NTG ratio. Table 2-8 shows the evaluation's recommendations and additional details can be found in the PY5 Process Evaluation report.

Table 2-8: REEP Status Report on Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Deepen relationships with the market outreach partners that have special interest in the utility's energy efficiency programs, to leverage for deeper marketing and promotional support.	Being considered
Tailor communications for the specific partner organization to convey the benefits associated with promoting REEP to their constituencies, including finding ways to quantify these benefits.	Being considered

Duquesne Light should consider visiting participating stores more regularly, holding workshops for the retailer's sales associates, providing program promotional materials and rebate forms to the store manager to distribute to sales associates and throughout the store, and forming more direct relationships with corporate decision-makers for the stores.	Being considered
Duquesne Light should reassess whether it should be offering rebates for ENERGY STAR dehumidifiers, which appear to be the standard dehumidifier product offered to customers (notwithstanding the participant survey results to the contrary)	Being considered

2.6 Financial Reporting

REEP is performing well above plan levels, achieving 174% of the PY5 energy savings goal and spending 88% of the targeted budget for the year. This result is mostly due to the success of the Upstream Lighting component of the program. Participation for Upstream Lighting has been overwhelming and program acceptance with retailers has been growing steadily. A breakdown of the program finances is presented in Table 2-9.

Table 2-9: Summary of REEP Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	1,813	1,813
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	1,813	1,813
Design & Development	39	39
Administration, Management, and Technical Assistance[1]	2,650	2,650
Marketing[2]	623	623
Subtotal EDC Implementation Costs	**3,311**	**3,311**
EDC Evaluation Costs	72	72
SWE Audit Costs	122	122
Total EDC Costs[3]	5,196	5,196
Participant Costs[4]	3,795	3,795
Total NPV TRC Costs[5]	**7,301**	**7,301**
Total NPV Lifetime Energy Benefits	**16,040**	**16,040**
Total NPV Lifetime Capacity Benefits	**543**	**543**
Total NPV TRC Benefits[6]	**18,553**	**18,553**
TRC Benefit-Cost Ratio[7]	**2.54**	**2.54**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

3 Residential Appliance Recycling Program (RARP)

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

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

3.1 Program Updates

No changes occurred for the RARP program in PY5.

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 PY5. 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

The Residential Appliance Recycling Program is achieving its goals. By the end of PY5, Duquesne Light reported savings totaling 143% of its PY5 gross savings goal of 1,326 MWh, while spending is at 392% of planned levels. Table 3-1 shows RARP participation, savings and incentives for PY5.

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

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)*
Residential	2,172	1,849	0.224	$0
Phase II Total	2,172	1,849	0.224	$0

*Incentives paid to participants are considered marketing costs for this program.

Measurement and Verification Methodology

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

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

- 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 PY5 Sampling Plan, the annual sample size target for RARP was 25 participants, with a targeted level of precision of 15% at 85% confidence.[11] Table 3-2 below, presents the targeted and achieved (actual) sample sizes for the program.

[11] The target verification sample size of 25 was thought sufficient to achieve the 85%/15% confidence and precision requirement for the program. However, because the same telephone surveys were used for net-to-gross and process evaluation purposes, assumed to have higher variation in responses, the actual sample sizes were increased to a total of 68.

Table 3-2: RARP Sampling Strategy for Program Year 5

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
RARP	2,251	85%/15%	25	86	Telephone verification
Program Total	2,251	85%/15%	25	86	

This high sample size was targeted to refine estimates on the distribution of refrigerators and freezers recycled and replaced with ENERGY STAR units vs. non-ENERGY STAR units for future reporting. The PY5 estimate is currently 92% ENERGY STAR and 8% non-ENERGY STAR.

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

1. Participant has a valid utility account number: All sampled participants had active Duquesne Light account numbers (these were found to be validated in PMRS via linkage to the Customer Information System).
2. Proof of Participation: PY5 RARP detailed data were requested from JACO and reviewed as a check on the accuracy of the participant database. In PY5 no exceptions were noted.
3. Rebate payment date is in the current program period being verified. No exceptions.

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

Step 4 – Deemed Savings Verification: All energy efficiency measures delivered by the RARP have deemed savings specified in the 2013 TRM. The TRM provides a value specific to the appliance type and to the retirement or replacement activity associated with the appliance removal. Unit savings are defined as below:

Table 3-3: Refrigerator/Freezer Recycling – References

Appliance	Activity Component	kWh Savings	kW Savings
Refrigerator	Retirement	1,026	0.116
Refrigerator	Replaced with ENERGY STAR	622	0.066
Refrigerator	Replaced with Non-ENERGY STAR	506	0.052
Freezer	Retirement	1,170	0.145
Freezer	Replaced with ENERGY STAR	753	0.093
Freezer	Replaced with Non-ENERGY STAR	667	0.083

When the refrigerator or freezer is picked up, the implementation contractor JACO records whether the appliance is a primary or secondary unit, and whether or not it was replaced. Based on the responses to these two questions, the resulting energy and demand savings are determined. For primary refrigerators, it is assumed that every unit is replaced (100%). For secondary units, if they were not reported as replaced, they are assumed to be retired. For replaced units, data from telephone verification surveys conducted with program participants from PY4 were used to estimate the percentage of refrigerator/freezer replacement participants who replaced their refrigerator/freezer with an ENERGY STAR refrigerator/freezer versus a non-ENERGY STAR refrigerator/freezer[12]. As previously stated, that survey found that 92% of replacements were ENERGY STAR while the remaining 8% were non-ENERGY STAR. For replacement refrigerators, PMRS reports the weighted average energy savings of replacing with an ENERGY STAR unit or a non-ENERGY STAR/standard unit, or (92% x 622 + 8% x 506) = 613 kWh. Table 3-4 shows the reported energy savings assigned to each participant based on the type of unit recycled and the replacement action.

[12] The PY5 survey found these percentages to be 93% ENERGY STAR and 7% non-ENERGY STAR. Because statistically, these numbers are the same as the 92%/8% values found in the previous year's survey and incorporated into the program tracking system, the tracking system values were left in place.

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

Appliance	Unit	Action	Replacement Type	kWh Savings per unit	kW Savings per Unit
Refrigerator	Primary Unit	Replace	ENERGY STAR (92%)	(92% * 622) + (8% * 506) = 613	(92% * 0.066) + (8% * 0.052) = 0.065
			Standard (8%)		
	Secondary Unit	Replace	ENERGY STAR (92%)	613	0.065
			Standard (8%)		
		Retire	N/A	1,026	0.116
Freezer	Primary Unit	Replace	ENERGY STAR (92%)	(92% * 753) + (8% * 667) = 746	(92% * 0.093) + (8% * 0.083) = 0.092
			Standard (8%)		
	Secondary Unit	Replace	ENERGY STAR (92%)	746	0.092
			Standard (8%)		
		Retire	N/A	1,170	0.145

For example, if a participant recycled a primary unit, their reported savings are 613 kWh and 0.065 kW. If a participant recycled a secondary unit and said that they did not replace it (the secondary unit was retired), their savings are 1,026 kWh and 0.116 kW.

Step 5 – Program Realization Rate: As related in the M&V methodology in Section 2.2, the program realization rate is calculated using the verified energy and demand savings from telephone interviews. Further, the survey effort confirmed for any replacements whether new units were ENERGY STAR or non-ENERGY STAR. The verified savings reflect the specific appliance type instead of the blended replacement. For example, if an interview respondent confirmed that a freezer replacement was an ENERGY STAR unit then the reported savings of 746 kWh were verified as 753 kWh.

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

Table 3-5: Program Year 5 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	1,849	102%	1,892	0.25	3.8%
Program Total	1,849	102%	1,892		3.8%

Table 3-6: Program Year 5 RARP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
RARP	0.224	100%	0.224	0.25	3.8%
Program Total	0.224	100%	0.224		3.8%

Generally, the verification effort confirm that appliances were recycled. Realization rates differing from 100% reflect the confirmation of ENERGY STAR or non-ENERGY STAR appliances. Also, there were four instances where reported replacements were verified as retirements and where four units were incorrectly categorized (e.g., reported refrigerator verified as a freezer).

The telephone survey effort also found a new mix of ENERGY STAR and non-ENERGY STAR refrigerators and freezers. When combining survey findings for both RARP and LIEEP RARP, there were 104 units recycled by the 100 survey respondents, 81 units were replaced. Of these 81 replacements, 75 units, or 93 percent, were ENERGY STAR and the remaining 7 percent were non-ENERGY STAR.

3.3 Impact Evaluation Net Savings

Free Ridership

Navigant used a self-report method of estimating free ridership for the Act 129 programs, to help provide Duquesne Light with a general understanding of the extent to which efficiency actions being taken as part of Act 129 programs would have been undertaken even without the program (i.e., free ridership). As indicated in the SWE's Evaluation Framework, "it is very unlikely that this approach [self-reports] yields an accurate quantitative point estimate of free-ridership," but "the SWE believes it is reasonable to conclude that NTG free-rider and spillover questions result in measurement of something that is positively correlated with true free-ridership, and thus can be useful in assessing changes over time or differences across programs."[13] The free ridership assessment presented below provides an estimation of the extent to which participants would have recycled the appliances removed by the program on their own. The estimation of free ridership was completed jointly for refrigerators and

[13] *Evaluation Framework for Pennsylvania Act 129 Phase II Energy Efficiency and Conservation Programs*, June 30, 2013.

freezers as well as for retired and replaced units, separately for the Equipment Rebates and Efficiency Kits. RARP free ridership estimation followed the protocols outlined by the SWE Guidance Memorandum GM-026 ("Common Approach for Measuring Net Savings for Appliance Retirement Programs").

Equipment Rebate Free Ridership

Free ridership for the RARP program was determined by evaluating participant's responses to several questions relating to their motivation in participating in RARP. The methodology, based on the SWE guidance memo, 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 was not available, would the respondent have removed or kept the appliance?
    b. If the Duquesne Light Appliance Recycling program was not available, what would the respondent have most likely done with the refrigerator/freezer when they were ready to dispose of it?
    c. Would the respondent have purchased a replacement appliance if the Duquesne Light program had not been available?
2. In estimating free ridership for this program, the following assumptions were made 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 (e.g. sold, given away, provided to retailer, or hauled away/discarded).
    c. Each respondent is then assigned a net savings value based on what would have happened to the appliance in absence of the program based on the diagram shown in Figure 1 of the SWE's guidance memo.

Each respondent's net savings were then divided by their verified savings to determine a free ridership rate. The program level free ridership is the ratio of the total net savings of the sample divided by the total verified savings of the sample.

Free ridership is estimated to be 65%, which indicates that, while the program influenced many participant decisions regarding removing operational appliances from the grid, it does not seem to have been influential for over half of participants. A total of 83 RARP respondents were asked about a total of 87 recycled appliances. Seventy-nine respondents recycled one appliance and four respondents recycled 2 appliances each. The respondents recycled 70 refrigerators and 17 freezers. Free ridership for refrigerators is estimated to be 65% while free ridership for freezers is 62%. However, Duquesne Light reports the overall and combined RARP free ridership below in Table 3-6. These results show a much

higher free ridership than did the results from the evaluation of the PY4 program, but the free ridership methodology used for that program was different. It is therefore not clear whether free ridership has increased substantially or whether the two different values merely reflect the difference in methodology that was used.

Spillover

In the NTG surveys administered to RARP customers, respondents were also asked 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. Similar to the methodology described in Section 2.3, the methodology for estimating spillover savings is based on the approach outlined by the SWE Guidance Memorandum GM-025. 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. Measure savings were sourced from Duquesne Light's PY5 tracking data (PMRS) that references deemed savings values from the 2013 TRM. Generally, savings for a given spillover action rely on 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 PY5.

For each participant, spillover savings are calculated as:

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

The survey asked participants on a 0 to 5 scale, with 0 meaning "not at all influential" and 5 meaning "extremely influential," how influential various program parameters were on their decision to take the spillover actions. Program influence scores range from 0% for scores of 0 or 1, 50% for scores of 2 or 3, and 100% for scores of 4 or 5. The SWE guidance specifies that the final influence score is equal to the maximum influence score indicated by participants when asked about the various program parameters.

On average, RARP participants achieved an additional 103 kWh in savings. In order to determine a spillover factor for the program the savings per participant were multiplied by the number of unique PY5 participants for the program. For example, a Duquesne Light customer would not be counted for double spillover savings if they recycled two appliances during the PY5 period. This leads to a total spillover savings for the program. The total spillover savings is then divided by the gross program energy savings to determine a spillover factor.

Additional details on the spillover estimation approach and results can be found in the Residential Energy Efficiency Programs PY5 Process Evaluation report.

Table 3-7: RARP Sampling Strategy for Program Year 5 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 to Achieve Sample
RARP	N/A	2,251	0.5	90%/10%	68	86	100%
Program Total	N/A	2,251	0.5	90%/10%	68	86	100%

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

NTG = 1-FR+Spillover

Table 3-8 summarizes the NTG ratio for the RARP program. The significant free ridership drives the net-to-gross ratio down to 47%.

Table 3-8: Program Year 5 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	65%	12%	0.47	1.27	19.5%
Program Total	65%	12%	0.47		19.5%

3.4 Process Evaluation

Similar to the evaluation described previously in Section 2.4, the process evaluation for the RARP program in PY5 included the following activities:

- Review of the 2013 Pennsylvania TRM and program materials
- Interviews with Duquesne program staff and the implementation contractor
- Surveys with 83 RARP participants sampled randomly from the entire PY5 population between April 9 and August 5, 2014. These surveys included both verification questions and selected process evaluation questions.

The process evaluation also included a general population study to supplement the program process evaluation. The general population survey effort examined the general residential market as well as non-participants and their awareness of Duquesne Light's programs.

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 3-9: RARP Sampling Strategy for Program Year 5

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	Evaluation Activity
RARP	N/A	2,251	0.5	90%/10%	68	83	33%	Telephone verification
Program Total	N/A	2,251	0.5	90%/10%	68	83	33%	

*This reflects process interviews completed.

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 Residential Energy Efficiency Programs PY5 Process Evaluation report. Additionally, the process evaluation found the following highlights:

- While savings are about 40% higher than the PY5 projected levels, expenditures for this program are nearly four times higher than budgeted for PY5. When asked to explain this phenomenon the utility indicated that a substantial portion of the cost of actual recycling had inadvertently been left out of the cost projection, resulting in costs that were only 47% of what they should have been. If this is indeed the case, then the costs are much more in line with projections, given that program energy savings were at 143% of projected levels.
- Participant survey respondents reported high satisfaction with various RARP aspects, and reported an average satisfaction of 4.7 out of 5 for the overall RARP experience (where 5 means very satisfied).
- JACO representatives reported that all interactions with Duquesne Light staff have gone smoothly. They indicate that the customer application process is running smoothly and they have not received complaints about the sign up process or the availability of collection appointments.

- Participant survey respondents indicated that the most common sources of program awareness are bill inserts (20%), television (18%), and newspapers (14%). Participants also indicated that they heard about the program elsewhere afterwards and the internet (43%) and retailers (23%) were the most common sources of other program information.
- JACO indicated that it has not completed any marketing for the RARP program since the beginning of Phase II. The company indicated that the program targets were met by Q3 without any JACO marketing.
- There are opportunities to enhance marketing efforts through RARP for both RARP and other programs.
- Free ridership may appear higher than it actually is, due to the lack of follow-up survey questions to gain a deeper understanding of the actual likelihood of specific "free rider" actions being taken in the absence of the program. It is important to ask follow up questions when ascertaining whether a participant would have actually removed an appliance and taken it "off the grid" in the absence of the program.
    - RARP and LIEEP RARP participants were asked about what they would have done in the absence of the program. Without the program's support, a total of 12 respondents indicated they would have hauled their appliance to the dump or a recycling center themselves. However, when asked if they had a truck or other means to accomplish the task, only nine indicated that they did.
    - Similarly, 19 RARP and LIEEP RARP respondents indicated that they would have hired someone to take their unit for them to a dump or recycling center. However, when asked, only four indicated that they had someone specifically in mind to hire at the time of the survey.
- The RARP deemed savings algorithm discounts program savings unnecessarily by assuming that all replacements have been caused by the program and therefore subtracting the consumption of the new "replacement" appliance from the savings achieved by having the recycled appliance removed. Only a small fraction of replacement appliance purchases are likely to have been caused by the program.
- RARP program addresses many barriers related to recycling older appliances, the in-depth interviews with appliance retailers also found that several stores address this barrier by offering appliance recycling services. Specifically, six of the nine retailers interviewed offer an appliance removal service, and four offer this service free of charge to purchasing customer, one charges $15, and one offers this free of charge for purchases over $500.

3.5 Recommendations for Program

The RARP program achieved an energy savings realization rate of 102% and the evaluation found a 0.47 NTG ratio. Table 3-10 shows the evaluation's recommendations and additional details can be found in the PY5 Process Evaluation report.

Table 3-10: RARP Status Report on Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne Light should document the proper budget estimates for this program, so that future program assessments can use more realistic benchmarks against which to compare actual program performance. The utility may want to adjust its EE&C plan filing to more accurately reflect these proper budget estimates. Should further review of the projected budgets indicate that these costs are valid, the utility will need to determine the source of the disconnect between planning estimates and actual performance.	Being considered
Duquesne Light should consider ramping up Watt Choices marketing efforts through RARP, assuming the aforementioned budget issues can be understood/addressed and the program can support such efforts.	Being considered
Duquesne Light should consider requesting a modification to the SWE required approach for estimating free ridership for this program, in which follow-up questions about the practicality or likelihood of respondents actually following through on their stated intentions are figured into the free ridership results.	Being considered
Duquesne Light should work with the Program Evaluation Group (PEG) and SWE to ensure that the replacement appliance deemed savings value is adjusted to account for the fact that the majority of appliance replacements are not induced, and that these units would have been purchased regardless of the Duquesne Light/utility program.	Being considered

3.6 Financial Reporting

RARP is performing above plan levels, having achieved 143% of the energy savings target for PY5 but having spent 392% of the targeted budget to achieve those savings (though it reports that the targeted budget is inaccurate and should be substantially higher and much closer to parity with the savings). A breakdown of the program finances is presented in Table 3-11.

Table 3-11: Summary of RARP Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	0	0
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	0	0
Design & Development	6	6
Administration, Management, and Technical Assistance[1]	443	443
Marketing[2]	80	80
Subtotal EDC Implementation Costs	**529**	**529**
EDC Evaluation Costs	11	11
SWE Audit Costs	18	18
Total EDC Costs[3]	540	540
Participant Costs[4]	35	35
Total NPV TRC Costs[5]	**593**	**593**
Total NPV Lifetime Energy Benefits	**665**	**665**
Total NPV Lifetime Capacity Benefits	**51**	**51**
Total NPV TRC Benefits[6]	**716**	**716**
TRC Benefit-Cost Ratio[7]	**1.21**	**1.21**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] 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 PY5.

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 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 PY5. 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

The School Energy Pledge program is currently not achieving its goals. By the end of PY5, Duquesne Light reported savings totaling 31% of its PY5 gross savings goal of 1,186 MWh. The program has also spent only 48% of its program year budget for PY5. Table 4-1 shows SEP participation, savings and incentives for PY5.

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

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	1,284	499	0.028	$0
Phase II Total	1,284	499	0.028	$0

Measurement and Verification Methodology

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

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

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

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

SEP Measurement and Verification

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

The sample design for the SEP program involved the use of the simple ratio estimator. In Duquesne Light's PY5 Sampling Plan, the annual sample size target for SEP was 25 participants, with a targeted level of precision of 15% at 85% confidence.[14] Table 4-2 below, presents the targeted and achieved (actual) sample sizes for the program.

[14] The target verification sample size of 25 was thought sufficient to achieve the 85%/15% confidence and precision requirement for the program. However, because the same telephone surveys were used for net-to-gross and process evaluation purposes, assumed to have higher variation in responses, the actual sample sizes were increased to a total of 68.

Table 4-2: SEP Sampling Strategy for Program Year 5

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
SEP	1,284	85%/15%	25	75	Telephone verification
Program Total	1,284	85%/15%	25	75	

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 2013 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 M&V methodology in Section 2.2, the final step involves multiplying the total gross ex-ante kWh and kW impacts for each record in the PMRS population from which the sample was drawn by the kWh-weighted average realization rate and the kW-weighted average realization rate, respectively, found for sample. The sum of this exercise, the ex-post impacts, are divided by the reported, ex-ante, savings to calculate the program level realization rate.

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

Table 4-3: Program Year 5 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	499	73%	365	0.37	6.0%
Program Total	499	73%	365		6.0%

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

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
SEP	0.028	73%	0.021	0.37	6.0%
Program Total	0.028	73%	0.021		6.0%

The low realization rates reported for the SEP EE Kits result from a somewhat significant portion of participants having not installed the smart strips (24%) or any LED limelights (27%). The smart strips have a significant impact on the realization rate due to their high reported savings relative to that of the LED limelights.

4.3 Impact Evaluation Net Savings

Free Ridership

Navigant used a self-report method of estimating free ridership for the Act 129 programs, to help provide Duquesne Light with a general understanding of the extent to which efficiency actions being taken as part of Act 129 programs would have been undertaken even without the program (i.e., free ridership). As indicated in the SWE's Evaluation Framework, "it is very unlikely that this approach [self-reports] yields an accurate quantitative point estimate of free-ridership," but "the SWE believes it is reasonable to conclude that NTG free-rider and spillover questions result in measurement of something that is positively correlated with true free-ridership, and thus can be useful in assessing changes over time or differences across programs."[15] The free ridership assessment presented below provides an estimation of the extent to which participants would have installed the equipment they received through the program on their own. The free ridership estimation followed the protocols outlined by the SWE Guidance Memorandum GM-024 ("Common Approach for Measuring Free-riders for Downstream Programs").

Efficiency Kit Free Ridership

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

3. The free ridership percentage was estimated for each survey respondent, based on the respondent's answers to a series of key survey questions:
    b. What is likely to have happened if the respondent had not received the kit or seen program advertisements
    d. How influential were program education materials in the participants decision to receive and install kit measures
    e. How influential were program advertisements in the participants decision to receiving and install kit measures
    f. How influential was any contact with Duquesne Light staff in the participants decision to received and install kit measures
4. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
    c. The influence score was determined based on the maximum influence score of the three influence questions respondents were asked. Participants who reported a

[15] *Evaluation Framework for Pennsylvania Act 129 Phase II Energy Efficiency and Conservation Programs*, June 30, 2013.

maximum influence of 1 (no influence) received an influence score of 50, those who reported a maximum influence of 5 (great influence) were assigned an influence score of 0.

d. The intention score was determined based on what participants reported would have been likely to happen if they had not received the kit and program education materials or seen program advertisements. The options and associated intention score range from zero, if nothing would have been installed, up to 50, if the same measure would have been installed.

The calculated free ridership values were weighted based on the savings achieved by each kit item for each individual who indicated they would have been likely to purchase and install without the program.

The overall program free ridership was estimated to be 36%, by taking the average free ridership for each product in the kits, weighted by the savings associated with that product. Individually, free ridership estimates for CFLs, smart strips, and LED limelights were 49%, 25%, and 37%, respectively. These results indicate that, of all Efficiency Kit products, participants would be most likely to purchase the CFLs in the absence of the program.

Spillover

In the NTG surveys administered to SEP customers, respondents were also asked 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. Similar to the methodology described in Section 2.3, the methodology for estimating spillover savings is based on the approach outlined by the SWE Guidance Memorandum GM-025. 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. Measure savings were sourced from Duquesne Light's PY5 tracking data (PMRS) that references deemed savings values from the 2013 TRM. Generally, savings for a given spillover action rely on 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 PY5.

For each participant, spillover savings are calculated as:

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

The survey asked participants on a 0 to 5 scale, with 0 meaning "not at all influential" and 5 meaning "extremely influential," how influential various program parameters were on their decision to take the spillover actions. Program influence scores range from 0% for scores of 0 or 1, 50% for scores of 2 or 3,

and 100% for scores of 4 or 5. The SWE guidance specifies that the final influence score is equal to the maximum influence score indicated by participants when asked about the various program parameters.

On average, SEP participants achieved an additional 61 kWh in savings. In order to determine a spillover factor for the program the savings per participant were multiplied by the number of unique PY5 participants for the program. This leads to a total spillover savings for the program. The total spillover savings is then divided by the gross program energy savings to determine a spillover factor.

Additional details on the spillover estimation approach and results can be found in the Residential Energy Efficiency Programs PY5 Process Evaluation report.

Table 4-5: SEP Sampling Strategy for Program Year 5 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 to Achieve Sample
Upstream Lighting	N/A	1,284	0.5	90%/10%	68	75	100%
Program Total	N/A	1,284	0.5	90%/10%	68	75	100%

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

NTG = 1-FR+Spillover

Table 4-6 summarizes the NTG ratio for the SEP program. While spillover is significant, the free ridership drives the net-to-gross ratio down to 85%.

Table 4-6: Program Year 5 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	36%	21%	0.85	0.70	11.5%
Program Total	36%	21%	0.85		11.5%

4.4 Process Evaluation

Similar to the evaluation described previously in Section 2.4, the process evaluation for the SEP program in PY5 included the following activities:

- Review of the 2013 Pennsylvania TRM and program materials
- Interviews with Duquesne program staff
- In-depth interviews with site coordinators
- Surveys with 75 SEP participants sampled randomly from the entire PY5 population between April 9 and August 5, 2014. These surveys included both verification questions and selected process evaluation questions.

The process evaluation also included a general population study to supplement the program process evaluation. The general population survey effort examined the general residential market as well as non-participants and their awareness of Duquesne Light's programs.

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.

The sampling strategy for the SEP process evaluation is shown below.

Table 4-7: SEP Sampling Strategy for Program Year 5

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	Evaluation Activity
SEP	N/A	1,284	0.5	90%/10%	68	75	100%	Telephone verification
Program Total	N/A	1,284	0.5	90%/10%	68	75	100%	

*This reflects process interviews completed.

The process evaluation findings and details can be found in the Residential Energy Efficiency Programs PY5 Process Evaluation report. The process evaluation found the following:

- SEP achieved only 31 percent of its PY5 savings goals (based on verified savings), and while spending was consistent with that level of savings, unless action is taken the program is not likely to achieve its Phase II savings targets.
- Generally, the program is well received by school site coordinators, who administer the program functions from the kick-off assembly through to the collection of applications and their delivery to Duquesne Light. Site coordinators indicated that the program is well organized with no significant burdens or issues. Interactions with Duquesne Light staff were also positive. These positive experiences have resulted in site coordinators recommending the program to other schools.
- Some schools view the program primarily as a fundraiser, rather than a way to improve energy efficiency, and the funds received from Duquesne Light are not usually spent at the school on energy efficiency.
- Participant survey respondents (families) reported high satisfaction with various SEP aspects, and reported an average satisfaction of 4.8 out of 5 for the overall SEP program (where 5 means very satisfied).
- Navigant found that the majority of site coordinators handed off lesson materials to teachers and had no knowledge of how lessons were used in classrooms.
- Goals and prizes appear to be effective motivators for participation in the program by students and their families.

4.5 Recommendations for Program

The SEP program achieved an energy savings realization rate of 73% and the evaluation found a 0.85 NTG ratio. Table 4-8 shows the evaluation's recommendations and additional details can be found in the PY5 Process Evaluation report.

Table 4-8: SEP Status Report on Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne Light should consider re-engaging with schools that have participated in SEP in previous years, focusing on the earliest participating schools first, perhaps first as a pilot effort.	Being considered
Continue to promote the energy efficiency aspects of the program, providing specific suggestions for how incentive funds could be used to further increase energy efficiency. Continue to leverage the fact that schools use the program as a fundraiser.	Being considered

Duquesne Light should consider incorporating goals and prizes into the program design, or promote the idea that participating schools do so.	Being considered
Duquesne Light should determine the extent to which teachers are using (or are able to use) the lessons materials provided and possibly modify the program accordingly.	Being considered

4.6 Financial Reporting

SEP achieved 31% of the energy savings target for PY5 and spent 48% of the targeted budget to achieve those savings. A breakdown of the program finances is presented in Table 4-9.

Table 4-9: Summary of SEP Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	0	0
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	0	0
Design & Development	6	6
Administration, Management, and Technical Assistance[1]	197	197
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**204**	**204**
EDC Evaluation Costs	11	11
SWE Audit Costs	20	20
Total EDC Costs[3]	215	215
Participant Costs[4]	36	36
Total NPV TRC Costs[5]	**271**	**271**
Total NPV Lifetime Energy Benefits	**104**	**104**
Total NPV Lifetime Capacity Benefits	**4**	**4**
Total NPV TRC Benefits[6]	**108**	**108**
TRC Benefit-Cost Ratio[7]	**0.40**	**0.40**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

5 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 PY5, 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.

Additionally, a portion of the Upstream Lighting program is allocated to the Low Income sector based on the findings from the PY4 general population survey which found that 20.4% of bulbs purchased were installed in Low Income households. These PY4 findings are used in PY5 and it is likely that a follow-up study will be performed for the Upstream Lighting component in PY6 to update that sector allocation.

5.1 Program Updates

The O-Power component previously described for PY4 was not active in PY5. Otherwise, programs remained the same in PY5 as they were in PY4.

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 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 PY5. 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).

5.2 Impact Evaluation Gross Savings

The Low Income Energy Efficiency Program is exceeding its goals. By the end of PY5, Duquesne Light reported savings totaling 308% of its PY5 unverified gross savings goal of 4,151 MWh. Table 5-1 shows LIEEP participation, savings and incentives for PY5.

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

Sector	Participants*	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
LIEEP	5,622	13,065	0.720	$446
Phase II Total	5,622	13,065	0.720	$446

*Count for upstream lighting not included because these participants are not known

Measurement and Verification Methodology

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

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

- 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, first, four strata were defined: 1) Efficiency Rebates (non-kits), 2) Efficiency Kits, 3) RARP, and 4) SEP. This approach was used under the assumption that while installation rates might not vary very much for rebated products through Efficiency Rebates such as ENERGY STAR refrigerators and that recycling confirmations for might not also vary very much for appliances removed by the LIEEP RARP component, it was certainly possible that installation of each item in an EFficiency Kits might vary among the participants who received them. Further, installation rates across LIEEP Efficiency Kits and LIEEP SEP might vary also well due to the different program implementation approaches.

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 20.4% through a telephone survey completed and used in the PY4 evaluation and also used in this PY5 analysis.

Also, refrigerator replacements and Smart Strip installations, which contributed very little to overall program savings, were excluded from the PY5 evaluation activities. However, those measures reported within PMRS were reviewed against the 2013 TRM to confirm deemed values were referenced correctly.

In Duquesne's PY5 Sampling Plan, the annual sample size target for LIEEP was 21 – including 3 Rebate participants, 10 Kit participants, 5 RARP participants, and 5 SEP participants – with a targeted level of confidence and precision of 15% at 85% confidence.[16] Table 5-2, below, presents the targeted and achieved sample sizes for the program.

Table 5-2: LIEEP Sampling Strategy for Program Year 5

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Upstream Lighting	N/A	N/A	N/A	N/A	Database verification
Rebates	33	85%/64%	3	3	Telephone verification
Kits	3,982	85%/24.9%	10	40	Telephone verification
RARP	411	85%/39.6%	5	17	Telephone verification
SEP	657	85%/65.8%	3	25	Telephone verification
DI Smart Strips	738	N/A	N/A	N/A	N/A
Refrigerator Replacement	48	N/A	N/A	N/A	N/A
Program Total	5,869	85%/15%	21	85	

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.

[16] The target verification sample size of 21 was thought sufficient to achieve the 85%/15% confidence and precision requirement for the program. However, because the same telephone surveys were used for net-to-gross and process evaluation purposes, assumed to have higher variation in responses, the actual sample sizes were increased to a total of 146.

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 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. 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, 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 participants at no cost). Telephone surveys were identical to the surveys used for the market rate programs (REEP, RARP, and SEP) and tailored to the product promotion and included questions designed to verify that participants obtained and installed the EE products.

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

For the Upstream Lighting program component, the program administrator's invoices and related detailed documentation were reviewed to ensure that measure counts and reported savings were both accurate (per the TRM) and the same as what the utility's tracking system was reporting. This activity occurred in tandem with the review of the non-low-income Upstream Lighting program component.

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 2013 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 2013 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 (formerly ECOS), with respect to numbers of units, wattages and savings claims. Cross-sector sales to non-residential customers were determined through in-store intercept surveys completed early in PY5 and used in the PY4 evaluation. These findings, along with the 20.4% low income sector allocation, are applied to PY5 because the program did not change. However, a study to update these results is expected to be completed during PY6. 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 sums of this exercise, the ex-post impacts, are divided by the reported, ex-ante, savings to calculate the program level realization rate.

As LIEEP Upstream Lighting accounts for a large fraction of total 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 5-3 and Table 5-4.

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[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 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 5-3: Program Year 5 LIEEP Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings (MWh/yr)	Energy Realization Rate (%)	Verified Gross Energy Savings (MWh/yr)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Upstream Lighting	10,842	102%	11,024	0.00	0.0%
Rebates	4	100%	4	0.00	0.0%
Kits	1,429	69%	991	0.42	9.7%
RARP	366	103%	376	0.12	4.2%
SEP	255	93%	236	0.27	8.0%
Program Total	12,897	98%	12,631		0.8%

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

Stratum	Reported Gross Demand Savings (MW)	Demand Realization Rate (%)	Verified Gross Demand Savings (MW)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Upstream Lighting	0.564	103%	0.579	0.00	0.0%
Rebate	0.001	100%	0.001	0.00	0.0%
Kits	0.083	69%	0.058	0.42	9.7%
RARP	0.044	104%	0.045	0.18	6.5%
SEP	0.015	93%	0.014	0.27	8.0%
Program Total	0.706	99%	0.697		0.9%

The low realization rates reported for the EE Kit component of the LIEEP program (a similar kit to the REEP Kit) result from a significant portion of participants having not installed the smart strips (37%) or

any LED nightlights (42%). The smart strips have a significant impact on the realization rate due to their high reported savings relative to that of the LED nightlights. Conversely, LIEEP SEP experienced a higher realization rate and installation rate. This is attributed to the promotional and educational efforts taken on by the participating schools.

Similar to RARP, the LIEEP RARP verification effort confirm that appliances were recycled. Realization rates differing from 100% reflect the confirmation of ENERGY STAR or non-ENERGY STAR appliances.

5.3 Impact Evaluation Net Savings

Free Ridership

The free ridership ratios for each LIEEP component were determined by evaluating participant's responses to several questions relating to their motivation in participating in the programs. The steps to evaluate the free ridership in individual programs are the same as presented in the sections for each of the market rate program counterparts. The LIEEP components used the same survey instrument as the previously mentioned residential programs and targeted low income participants. Specifically, the estimation followed the protocols outlined by the SWE Guidance Memorandum GM-024 ("Common Approach for Measuring Free-riders for Downstream Programs"). Free ridership for the LIEEP Upstream Lighting program component participants relied on the analysis conducted as part of the PY4 evaluation.

Spillover

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

Additional details on the spillover estimation approach and results can be found in the Residential Energy Efficiency Programs PY5 Process Evaluation report.

Table 5-5: LIEEP Sampling Strategy for Program Year 5 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 to Achieve Sample
Rebates	N/A	33	0.5	90%/30%	8	3	100%
Kits	N/A	3,982	0.5	90%/13.6%	38	40	100%
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A
RARP	N/A	411	0.5	90%/18.1%	22	17	100%
SEP	N/A	657	0.5	90%/28.7%	10	25	71%
Program Total	N/A	5,084	0.5	90%/7.8%	78	85	82%

*Denotes unique customers rather than unique project numbers

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

NTG = 1-FR+Spillover

Table 5-6 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 5-6: Program Year 5 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
Rebates	66%	14%	0.48	0.59	82.0%
Kits	37%	23%	0.86	0.69	16.0%
Upstream Lighting	57%	8%	0.51	0.00	0.0%
RARP	66%	5%	0.38	1.17	43.7%
SEP	34%	10%	0.76	0.39	11.3%
Program Total[19]	55%	9%	0.54		2.7%

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

5.4 Process Evaluation

The process evaluation for the LIEEP program group in PY5 included the following activities:

- Review of the 2013 Pennsylvania TRM and program materials
- Interviews with Duquesne program staff
- In-depth interviews with trade allies, appliance retailers, market outreach partners, JACO the RARP/LIEEP RARP implementer, and SEP site coordinators
- Surveys with 3 Rebate, 38 EE Kit, 17 RARP, and 25 SEP participants sampled randomly from the entire PY5 population for each program segment between April 9 and August 5, 2014. This group of 83 surveys included both verification questions and selected process evaluation questions. Survey instruments used for the similar non-low-income programs previously described were also used for LIEEP program components.

The process evaluation also included a general population study to supplement the program process evaluation. The general population survey effort examined the general residential market as well as non-participants and their awareness of Duquesne Light's programs.

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. The LIEEP Upstream Lighting component was excluded from the process evaluation in PY5.

Table 5-7: LIEEP Sampling Strategy for Program Year 5

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	Evaluation Activity
Rebates*	N/A	33	0.5	90%/30%	8	3	100%	Telephone verification
Kits	N/A	3,982	0.5	90%/13.6%	38	38	100%	Telephone verification
Upstream Lighting	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Database verification
RARP	N/A	411	0.5	90%/18.1%	22	17	100%	Telephone verification
SEP	N/A	657	0.5	90%/28.7%	10	25	71%	Telephone verification
Program Total	N/A	5,084	0.5	90%/7.8%	78	83	82%	

*Rebates achieved sample size represents 3 rebates from 3 participants

*This reflects process interviews completed.

The process evaluation findings and details can be found in the Residential Energy Efficiency Programs PY5 Process Evaluation report. Because the LIEEP program participation relies almost exclusively on participation by qualified low-income customers in REEP, RARP and SEP, the evaluation findings and recommendations from the process evaluation research conducted for these programs are also applicable to LIEEP. See the process evaluation sections of each of the program-specific sections of this report for more information. A detailed discussion of the residential program process evaluations can be found in Duquesne Light's *Residential Energy Efficiency Programs – PY5 Process Evaluation*. That document notes the following highlights specific to LIEEP:

- Satisfaction ratings were very high for the LIEEP components. For example, survey respondents rated their overall experience with the components on a 5 point scale where 5 means very satisfied. EE Kits were rated with 4.8, RARP was rated with 4.9, and SEP was rated with 4.8.LIEEP
- EE Kit respondents indicated that TV advertisements (30%), family or friends (12%), and bill inserts (12%) were the most common sources of awareness for LIEEP Kits.
- RARP respondents indicated that the most common sources of program awareness are television (35%), bill inserts (18%), and friends/family/neighbors (18%)

5.5 Recommendations for Program

The LIEEP program achieved an energy savings realization rate of 98% and the evaluation found a 0.54 NTG ratio. Because LIEEP participants are almost exclusively participants of other residential programs who happen to be identified as low-income qualified in the Duquesne Light customer information system, the recommendations for this program are the same as those for the other residential programs in which LIEEP customers participated.

Table 5-8: LIEEP Status Report on Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
See recommendations for each of the other residential programs from which LIEEP participation was derived	

5.6 Financial Reporting

LIEEP is performing well above plan levels, achieving 308% of the PY5 energy savings goal and spending 115% of the targeted budget for the year. This result is mostly due to the success of the Upstream Lighting component of the program. Participation for Upstream Lighting has been overwhelming and program acceptance with retailers has been growing steadily. A breakdown of the program finances is presented in Table 5-9.

Table 5-9: Summary of LIEEP Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	446	446
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	**446**	**446**
Design & Development	23	23
Administration, Management, and Technical Assistance[1]	991	991
Marketing[2]	122	122
Subtotal EDC Implementation Costs	**1,136**	**1,136**
EDC Evaluation Costs	42	42
SWE Audit Costs	71	71
Total EDC Costs[3]	1,624	1,624
Participant Costs[4]	666	666
Total NPV TRC Costs[5]	**1,916**	**1,916**
Total NPV Lifetime Energy Benefits	**4,306**	**4,306**
Total NPV Lifetime Capacity Benefits	**142**	**142**
Total NPV TRC Benefits[6]	**4,953**	**4,953**
TRC Benefit-Cost Ratio[7]	**2.59**	**2.59**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

6 Commercial Program Group Programs

Duquesne's Act 129 Commercial Program Group includes an overall umbrella program and four market segment programs. The umbrella program provides energy efficiency services to smaller customer segments not directly served by specific market segment programs. The market segment programs, including Small Office, Large Office, Public Agency, Small Retail, Large Retail, and Healthcare, are implemented by specialized contractors or Duquesne staff implementing programs tailored to overcome known segment-specific barriers to program participation. All programs provide the same measures and incentive levels to ensure fair and transparent treatment of customers across all segments.

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

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

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

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

6.1 Commercial Umbrella: Duquesne Light Program Updates

The most significant impact to the Commercial programs in the PY5 was the definition of the peak demand period. In Phase I the top 100 hours were used to determine peak demand and in PY5 the definition was changed to the PJM peak demand period, which is from 2 pm to 6 pm, weekdays, non-holidays, from June through August. In PY4 there was more of a focus on peak period management through custom commissioning projects but this was not as much of a focus in PY5.

6.1.1 Definition of Participant

A participant for this program is a customer participating in the program within an individual program quarter (Q1, Q2, Q3 or Q4), represented by a unique participant account number within the tracking system. Participants in Table 6-1 represent a summation of the unique customer participant account numbers in the tracking system for the program in each of the four quarters of PY5. Customers

participating more than once within a quarter are counted once; customers participating more than once but in different quarters are counted more than once (once in each quarter).

6.2 Impact Evaluation Gross Savings

At the end of PY5, Duquesne reported cumulative (CPITD) Commercial Program gross savings totaling 145% of the 30,286 MWh cumulative estimate projected for Phase II in the utility's EE&C Plan.

Table 6-1: Phase II Commercial Program Reported Results by Customer Sector*

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Small Commercial EE	182	30,176	8.153	$511
Large Commercial EE	76	11,794	2.092	$779
Government & Non-Profit EE	36	612	0.158	$84
Phase II Total	294	42,582	10.403	$1,374

*Includes 57 PY4 projects verified in PY5

The sample design for the Commercial Program Group used the stratified ratio estimator (Lohr 1999)[20]. A stratified ratio estimator is used to adjust the ex ante savings contained in PMRS. The approach is similar to that used for the residential programs except that the sample is stratified by ex ante energy savings (kWh) rather than by sub-program. Additionally, unlike with residential, all strata standard errors are estimated consistent with Lohr (1999) assuming a continuous distribution of the realization rate. The stratified ratio estimation approach takes advantage of information that is reported in the PMRS tracking system for each project in the program. The two key parameters in the stratified ratio estimate are a) the ratio between ex post and ex ante savings and b) the standard error of the estimate. The ratio between ex post and ex ante savings, which is sometimes referred to as the realization rate, measures the accuracy of the tracking estimates from project to project across the sample of projects. The standard error of the ratio estimate is a measure of the variability in the relationship between the ex post and ex ante estimates. Both estimates help to define the relationship (e.g., the ratio as well as the relative precision of the ratio) between the tracking estimates of savings and the actual project savings.

Ratios are calculated within each stratum and strata weights are applied to arrive at a program-level ratio. A stratum is a subset of the projects in the population that are grouped together based on ex ante

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

savings that are known information. In other words, a stratification of the population into strata is a classification of all units in the population into mutually exclusive strata that span the population. Under this design, each stratum is sampled according to simple random sampling protocols and the weighted estimates of parameters are then applied to the entire population.

Per the utility's EM&V Plan and PY5 Commercial/Industrial Sample Design Memorandum, for the purpose of conducting cost-effective EM&V, certain industrial and commercial programs were grouped based on shared characteristics. Commercial sector umbrella, large retail, small retail, healthcare, large office, and small office were similar enough in structure to be treated as one evaluation group. The Government, Non-Profit and Institutional (GNI) was treated as its own evaluation group, per the SWE directive to do so if savings exceeded 20% of the non-residential sector savings in the previous year.

In PY5, impact evaluation verification work was completed in three phases: in spring of 2014 for projects reported in the first two quarters of PY5, in summer of 2014 for projects completed in the third quarter of PY5, and in fall of 2014 for projects completed in the fourth quarter of PY5. Commercial Evaluation Group projects completed between 6/1/2013 and 11/30/2013 (Q1 and Q2), between 12/1/2013 and 2/28/2013 (Q3) and between 3/1/2014 and 5/31/2014 (Q4), were extracted from Duquesne Light's program tracking system and placed into strata based on each project's reported kWh savings.

Additionally, 57 Commercial and Government/Non-profit projects that were completed in PY4 but processed too late in the year to be included in the evaluation cycle were verified as part of the PY5 evaluation. For the purposes of verification, these 57 projects were treated as one "program" and were included as separate strata within the sample design for Commercial and Government/Non-profit projects. The 57 projects fall into the following three strata: Post PY4 Large Commercial, Post PY4 Small Commercial, and Post PY4 GNI.

The strata used in calculating the overall realization rate and relative precision are described below in Table 6-2.

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

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Large Commercial	6	85%/15%	6	6	Onsite Verification
Medium Commercial	14	85%/15%	8	8	Onsite Verification
Small Commercial	182	85%/15%	10	12	Onsite and Telephone Verification
Commercial Upstream Lighting	N/A	N/A	N/A	N/A	Previous Year Surveys
Post PY4 – Large Commercial	6	85%/15%	6	5	Onsite Verification
Post PY4 – Small Commercial	50	85%/15%	3	2	Onsite and telephone verification
Medium GNI	9	85%/15%	8	8	Onsite and Telephone Verification
Small GNI	26	85%/15%	12	11	Onsite and Telephone Verification
Post PY4 GNI	1	85%/15%	1	1	Onsite Verification
Program Total	294	85%/15%	54	53	

Per the utility's EM&V Plan[21], for measures with rebates less than $2,000, the basic level of verification rigor (telephone verification) was employed. The enhanced level of rigor verification (on-site verification) was applied when measure rebates were equal to or greater than $2,000. The sampling unit for the commercial program was the project, each project having a project ID in the Duquesne tracking system.

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

[21] Evaluation Measurement and Verification Plan: Duquesne Light Act 129—Phase II Energy Efficiency and Conservation Portfolio Programs 5 to 7, December 31, 2013 (EM&V Plan), Section 3.2, Page 10.

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.

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 savings allocated to the Commercial Umbrella Program. Verification efforts consisted only of confirming that energy and demand savings reported in Duquesne'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. The percentage of bulbs assigned to the commercial sector were determined through the approach described in Appendix D. The overall realization rate of the commercial program was applied to the upstream lighting savings that were assigned to the commercial sector.[22]

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

[22] The energy realization rate, 100%, was used for both energy and demand with respect to the upstream lighting savings allocated to the commercial sector. The sector's realization rates of 103% exceeds 100%, which is not a logical possibility in this situation.

Table 6-3: Program Year 5 Commercial Program Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings (MWh/yr)	Energy Realization Rate (%)	Verified Gross Energy Savings (MWh/yr)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Large Commercial	4,401.80	103%	4,540.80	0.27	0.00%
Medium Commercial	2,994.50	96%	2,887.07	0.52	19.30%
Small Commercial	3,279.60	98%	3,208.95	0.15	6.40%
Commercial Upstream Lighting	26,399.69	100%	26,399.69	0.00	0.00%
Post PY4 – Large Commercial	3,989.39	128%	5,108.13	0.29	9.40%
Post PY4 – Small Commercial	904.39	100%	904.48	0.00	0.00%
Large GNI	396.16	121%	480.52	0.24	4.60%
Small GNI	197.96	122%	241.25	0.88	31.50%
Post PY4 GNI	18.23	100%	18.23	0.00	0.00%
Program Total	42,581.72	103%	43,789.12		1.50%

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

Stratum	Reported Gross Demand Savings	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.
Large Commercial	0.64	119%	0.76	0.22	0.00%
Medium Commercial	0.56	115%	0.64	0.68	25.60%
Small Commercial	0.59	120%	0.7	0.59	25.70%
Commercial Upstream Lighting	7.37	100%	7.37	0.00	0.00%
Post PY4 – Large Commercial	0.74	96%	0.71	0.03	1.40%
Post PY4 – Small Commercial	0.16	100%	0.16	0.00	0.00%
Large GNI	0.1	109%	0.11	0.38	11.20%
Small GNI	0.04	109%	0.05	0.72	30.90%
Post PY4 GNI	0.01	100%	0.01	0.00	0.00%
Program Total	10.21	103%	10.51		2.20%

Navigant completed a total of 30 sites visits for the 53 projects in the commercial program that were selected in PY5 for verification, nine of which were government/non-profit projects. The Navigant field staff included: Chris Yoder, Steven Nguyen, Lisa Cassell, Emily Merchant, Jamie Falk, and Eric Shum. Navigant followed their 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 12 commercial projects and 11 government/non-profit projects sampled in PY5 that had an incentive less than $2,000 and received telephone verification with no on-site visit.

In general, Navigant found that most of the projects were installed as reported. The most common adjustment to the ex-ante savings was due to adjusting the hours of use and coincidence factors using customer reported information. SWE Guidance Memo 27 was released after a majority of the PY5 projects were submitted; therefore, few projects used customer reported information and the projects that did use customer reported information only had adjustments made to the hours of use. In

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

Navigant also found three projects where the measure quantities and descriptions did not align with what was reported. The invoice quantities often aligned with what was reported but the on-site findings were significantly different. There was one instance where Navigant sampled two lighting projects submitted by the same customer and Navigant found none of the rebated measures at one of the sites and significantly different quantities and measure types at the other site. In another instance, Navigant's on-site findings were significantly different from the way that the measures were broken out in the project files. The customer was unable to provide any insight on the discrepancies therefore it is unclear why the project documentation did not align with what was actually installed. None of the nine government/non-profit projects selected for verification had significant differences found on-site, other than the hours of use and coincidence factors.

6.3 Impact Evaluation Net Savings

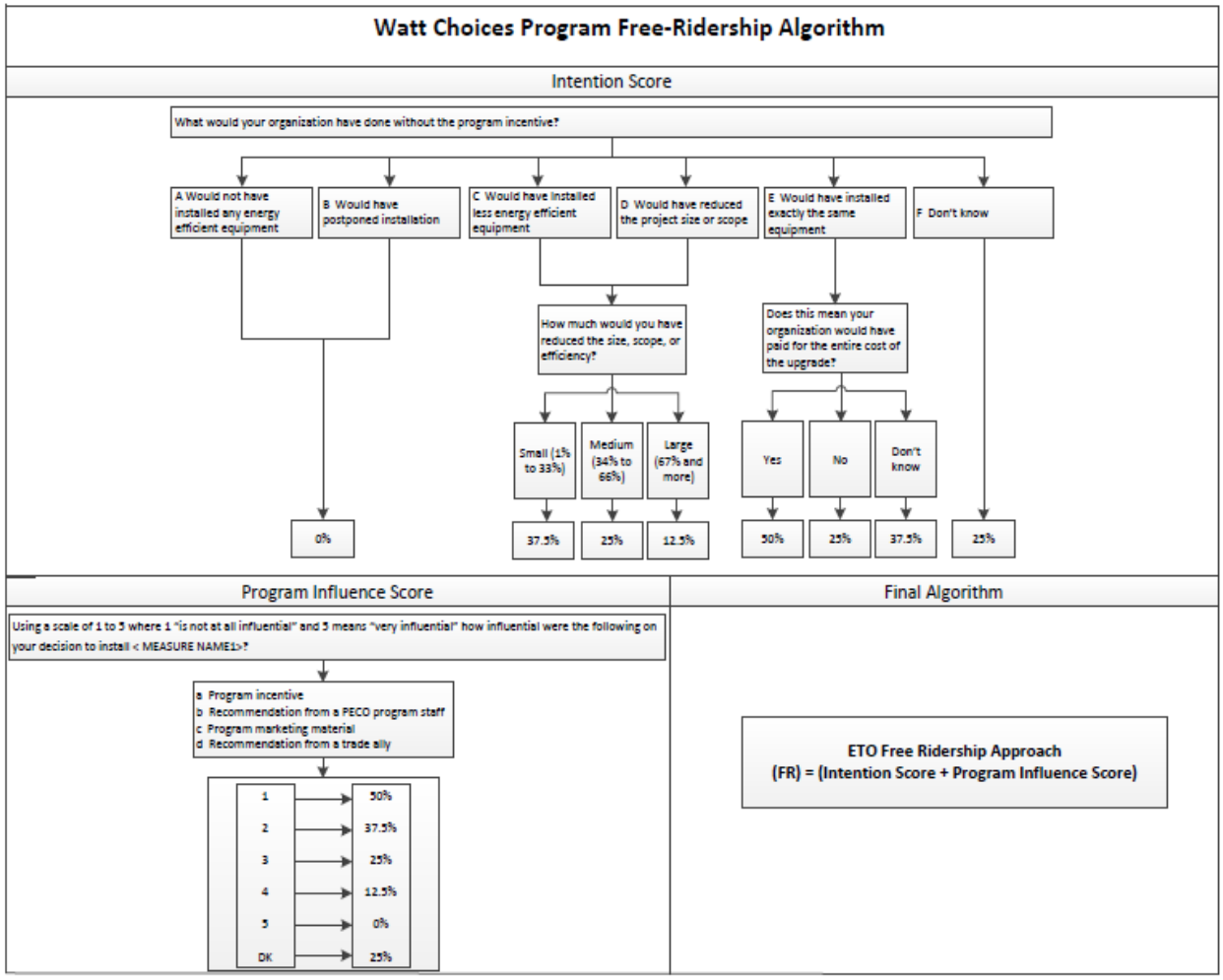
The primary objective of the net to gross analysis was to determine the program's net effect on customer energy consumption. After the Navigant team calculated verified gross program impacts, the team derived net program impacts by estimating an NTG ratio that quantifies the percentage of the gross program 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.[23] 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 6-1 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.

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

Figure 6-1 :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 – PY5 Process Evaluation*, submitted separately.

In total, 68[24] program participants responded the battery of NTG questions, including 58 commercial program participants and 10 industrial program participants. The evaluation team found a commercial NTG kWh-weighted ratio at the program level of 0.52.

The evaluation team found that 23 out of the 58 commercial program participants (40% of respondents) gave inconsistent answers to the questions used to calculate the intention and the program influence scores. These respondents stated that they would have installed exactly the same equipment if the program had not been available. Then, when asked to rank the influence of several program elements in their decision to purchase the energy-efficient equipment, the same respondents gave a high level of influence to one or more program elements in their decision to purchase the equipment. These inconsistent answers decrease the free-ridership score and therefore, increase the NTG ratio estimated.

Based on the net-to-gross research findings in PY5, the evaluation team recommends adding a control question to summarize answers to the intention and influence questions, which would allow the respondent to correct inconsistent answers.

Table 6-5 presents the free ridership and spillover results for the Commercial program.

[24] The 68 program participants surveyed include the 60 respondents that completed the telephone survey and the 8 respondents with the largest savings who completed in-depth interviews.

Table 6-5: Commercial PY5 NTG Results

	Estimated Free Ridership	Estimated Spillover	Net-to-Gross Ratio
Program Total	0.49	0.01	0.52

Source: Navigant NTG Analysis, PY5

Table 6-6: Commercial Program Sampling Strategy for Program Year 5 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 to Achieve Sample
All Commercial	N/A	294	0.5	90%/10%	Census	58	100%
Program Total	N/A	294	0.5	90%/10%	Census	58	100%

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

Target Group or Stratum (if appropriate)	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Observed Coefficient of Variation or Proportion	Relative Precision
All Commercial	0.43	0.01	0.58	2.78	47.70%
Program Total	0.43	0.01	0.58	2.78	47.70%

6.4 Process Evaluation

The PY5 process evaluation was combined for the Commercial and Industrial programs , given the small number of unique participants for the Industrial program and the similarity in the delivery method for the programs. It was conducted using five primary research activities, in addition to secondary research reviewing marketing plans, operational materials, and the online program application portal. The primary research activities included the following:

1. In-depth interviews with program staff and CSPs
2. Telephone surveys with 60 program participants
3. In-depth interviews with 8 of the top 20 participants with the largest program savings
4. Telephone interviews with 10 trade allies and two Trade Associations
5. Review of the program tracking system, program materials and project files

The sampling strategy for the Commercial program is shown in the table below.

Table 6-8: Commercial Program Sampling Strategy for Program Year 5

Target Group or Stratum	Stratum Boundaries	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	Evaluation Activity
All Commercial	N/A	294	0.5	90%/10%	Census	58	100%	Surveys
Program Total	N/A	294	0.5	90%/10%	Census	58	100%	Surveys

A detailed description of the Commercial and Industrial process evaluation appears in Duquesne Light's *Commercial and Industrial Energy Efficiency Programs – PY 5 Process Evaluation*.

Key findings from this research for the Commercial and Industrial programs include the following:

- The Commercial and Industrial programs are on target to hit their Phase II savings goals, having exceeded their PY5 savings goals. However, this high level of savings includes the impacts of a group of PY4 projects not counted in Phase I that were verified in Phase II. Without a similar injection of savings in PY6, the Commercial program is still on track to exceed its goals but the Industrial program is achieving only about half of the savings needed to meet its annual goals. Duquesne Light reports, however, that there is a significant pipeline of industrial projects likely to be completed in Phase II.
- The programs have well-documented implementation plans and tracking system.
- More than half of program participants have reviewed the program website and seen the program's marketing materials. About half of those who did so said they found them useful.
- More than three fourths of participants reported being either very (58%) or somewhat (18%) satisfied with the program. Among those who reported being less satisfied:
    - Some participants indicated that their expectations regarding the participation process were not realistic, i.e., they were not aware of the amount of time, effort, paperwork or monitoring and verification that would be required.
    - Others expressed dissatisfaction with the fact that rebate checks, which might come long after the project has been completed (for a number of reasons) do not clearly identify the project that was done, confounding their bookkeeping.
- Almost 60% of program participants perceived barriers to participating in Duquesne Light's program. The top three barriers mentioned were: paperwork too burdensome (14%), initial cost of equipment (12%) and other (9%).

- Some participants said the eligibility window for the program creates both a customer relations problem and a barrier to participation in the program, because some customers have difficulty aligning the timing of coordinating their projects with the timing of receiving utility approvals and incentive payments.
- The two steps in the efficiency project implementation process with which participants most frequently (~20% of respondents) reported having had the most difficulty were estimating energy savings and estimating cost savings regarding efficiency improvements they were considering making. To a lesser extent, obtaining approval from their upper-level management to make these improvements was also reported as being difficult.
- Duquesne Light has not fully automated the way it processes and reviews program applications as well as its monthly reporting process. Monthly reports have to be generated manually, and applications are handwritten as opposed to submitted electronically.
- Participants most frequently pointed to the need for more detailed information and more proactive communications from Duquesne Light, when asked how the program could be improved.

6.5 Recommendations for Program

Table 6-9 provides program specific recommendations based on Navigant's findings in PY5, as well as the status of the recommendations being implemented by Duquesne Light.

Table 6-9: Commercial Program Status Report on Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne Light should continue to closely track its Industrial program project pipeline, to ensure that Phase II goals can be reached.	Being considered
The utility should find a way to identify the projects for which rebate payments are being made and include that information along with the incentive payment when it is made, to facilitate customers' internal accounting and improve participant satisfaction.	Being considered
Duquesne Light should consider marketing its programs directly to Trade Allies, and train interested TAs to navigate the application process. A piece of this effort might include leave-behind brochures or flyers that clearly explain the many steps involved in program participation, to better align customer expectations with what will occur.	Being considered

Duquesne Light should continue its efforts to work with CSPs, to ensure that CSPs are transparent about the various assumptions and data used in estimating savings, particularly for custom projects. Screenshot of calculators are often included in the project files, but not the actual calculator. For the sake of transparency, it would be helpful if the calculators were also included.	Being considered
Duquesne Light should take steps to automate the application form and the application review process. This will prevent errors in data transfer and will allow program staff to give feedback to program participants in a timelier manner.	Being considered
Duquesne Light should continue its efforts to ensure that its CSPs have taken steps to ensure that the correct TRM is being used in estimating project savings, especially for motors and VFDs.	Being considered

6.6 Financial Reporting

A breakdown of the program finances is presented in Tables 6-10 through 6-17.

Table 6-10: Summary of Office-Small Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	55	55
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	55	55
Design & Development	12	12
Administration, Management, and Technical Assistance[1]	70	70
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**82**	**82**
EDC Evaluation Costs	4	4
SWE Audit Costs	7	7
Total EDC Costs[3]	141	141
Participant Costs[4]	106	106
Total NPV TRC Costs[5]	**199**	**199**
Total NPV Lifetime Energy Benefits	**294**	**294**
Total NPV Lifetime Capacity Benefits	**41**	**41**
Total NPV TRC Benefits[6]	**336**	**336**
TRC Benefit-Cost Ratio[7]	**1.69**	**1.69**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 6-11: Summary of Commercial Umbrella Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	285	285
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	**285**	285
Design & Development	15	15
Administration, Management, and Technical Assistance[1]	589	589
Marketing[2]	86	86
Subtotal EDC Implementation Costs	**690**	**690**
EDC Evaluation Costs	27	27
SWE Audit Costs	46	46
Total EDC Costs[3]	1,002	1,002
Participant Costs[4]	330	330
Total NPV TRC Costs[5]	**1,093**	**1,093**
Total NPV Lifetime Energy Benefits	**8,458**	**8,458**
Total NPV Lifetime Capacity Benefits	**1,360**	**1,360**
Total NPV TRC Benefits[6]	**10,131**	**10,131**
TRC Benefit-Cost Ratio[7]	**9.27**	**9.27**

NOTES

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[2] Includes the marketing CSP and marketing costs by program CSPs.
[3] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 6-12: Summary of Retail Store Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	257	257
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	**257**	**257**
Design & Development	15	15
Administration, Management, and Technical Assistance[1]	316	316
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**331**	**331**
EDC Evaluation Costs	27	27
SWE Audit Costs	46	46
Total EDC Costs[3]	614	614
Participant Costs[4]	518	518
Total NPV TRC Costs[5]	**921**	**921**
Total NPV Lifetime Energy Benefits	**1,624**	**1,624**
Total NPV Lifetime Capacity Benefits	**221**	**221**
Total NPV TRC Benefits[6]	**1,845**	**1,845**
TRC Benefit-Cost Ratio[7]	**2.00**	**2.00**

NOTES

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[2] Includes the marketing CSP and marketing costs by program CSPs.
[3] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 6-13: Summary of Education Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	25	25
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	25	25
Design & Development	13	13
Administration, Management, and Technical Assistance[1]	112	112
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**125**	**125**
EDC Evaluation Costs	25	25
SWE Audit Costs	42	42
Total EDC Costs[3]	175	175
Participant Costs[4]	85	85
Total NPV TRC Costs[5]	**277**	**277**
Total NPV Lifetime Energy Benefits	**147**	**147**
Total NPV Lifetime Capacity Benefits	**11**	**11**
Total NPV TRC Benefits[6]	**158**	**158**
TRC Benefit-Cost Ratio[7]	**0.57**	**0.57**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 6-14: Summary of Public Agency Partnership Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	19	19
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	**19**	**19**
Design & Development	8	8
Administration, Management, and Technical Assistance[1]	70	70
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**79**	**79**
EDC Evaluation Costs	16	16
SWE Audit Costs	27	27
Total EDC Costs[3]	113	113
Participant Costs[4]	54	54
Total NPV TRC Costs[5]	**174**	**174**
Total NPV Lifetime Energy Benefits	**89**	**89**
Total NPV Lifetime Capacity Benefits	**15**	**15**
Total NPV TRC Benefits[6]	**104**	**104**
TRC Benefit-Cost Ratio[7]	**0.59**	**0.59**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 6-15: Summary of Office-Large Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	528	528
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	**528**	**528**
Design & Development	24	24
Administration, Management, and Technical Assistance[1]	639	639
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**664**	**664**
EDC Evaluation Costs	63	63
SWE Audit Costs	106	106
Total EDC Costs[3]	1,254	1,254
Participant Costs[4]	972	972
Total NPV TRC Costs[5]	**1,804**	**1,804**
Total NPV Lifetime Energy Benefits	**4,712**	**4,712**
Total NPV Lifetime Capacity Benefits	**542**	**542**
Total NPV TRC Benefits[6]	**5,254**	**5,254**
TRC Benefit-Cost Ratio[7]	**2.91**	**2.91**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2013 Total Resource Cost Test Order. Please see the "Report Definitions" section of this report for more details.

[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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 6-16: Summary of Health Care Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	165	165
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	165	165
Design & Development	13	13
Administration, Management, and Technical Assistance[1]	715	715
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**728**	**728**
EDC Evaluation Costs	25	25
SWE Audit Costs	42	42
Total EDC Costs[3]	918	918
Participant Costs[4]	48	48
Total NPV TRC Costs[5]	**843**	**843**
Total NPV Lifetime Energy Benefits	**168**	**168**
Total NPV Lifetime Capacity Benefits	**28**	**28**
Total NPV TRC Benefits[6]	**195**	**195**
TRC Benefit-Cost Ratio[7]	**0.23**	**0.23**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 6-17: Summary of Non Profit Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	40	40
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	**40**	**40**
Design & Development	20	20
Administration, Management, and Technical Assistance[1]	166	166
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**186**	**186**
EDC Evaluation Costs	37	37
SWE Audit Costs	63	63
Total EDC Costs[3]	262	262
Participant Costs[4]	217	217
Total NPV TRC Costs[5]	**502**	**502**
Total NPV Lifetime Energy Benefits	**219**	**219**
Total NPV Lifetime Capacity Benefits	**42**	**42**
Total NPV TRC Benefits[6]	**261**	**261**
TRC Benefit-Cost Ratio[7]	**0.52**	**0.52**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

7 Industrial Program Group Programs

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

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

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

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

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

7.1 Program Updates

The most significant impact to the Industrial programs in the PY5 was the definition of the peak demand period. In Phase I the top 100 hours were used to determine peak demand and in PY5 the definition was changed to the PJM peak demand period, which is from 2 pm to 6 pm, weekdays, non-holidays, from June through August. In PY4 there was more of a focus on peak period management through custom commissioning projects but this was not as much of a focus in PY5.

7.1.1 Definition of Participant

A participant for this program is a customer participating in a 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 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 PY5. Customers may have participated more than once (received rebates for multiple programs within a quarter, participated in multiple quarters for the same or different programs, or both), and the program tracking database would represent these as separate projects (i.e., as separate participants).

7.2 Impact Evaluation Gross Savings

At the end of PY5, Duquesne reported cumulative (CPITD) gross savings totaling 108% of the 19,205 MWh cumulative estimate projected for Phase II in the utility's EE&C Plan.

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

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Small Industrial EE	13	2,575	0.463	174
Large Industrial EE	16	17,710	2.159	474
Phase II Total	29	20,285	2.623	648

*Includes 3 PY4 projects verified in PY5

As with the Commercial Program Group, the sample design for the Industrial Program Group used the stratified ratio estimator (Lohr 1999)[25]. 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[26], rather than an entire project. The reason why the actual sample size for the small industrial sample is significantly greater than the targeted sample size for that stratum is because 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

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

[26] 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.

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 PY5, impact evaluation verification work was completed in three phases: in spring of 2014 for projects reported in the first two quarters of PY5, in summer of 2014 for projects completed in the third quarter of PY5, and in fall of 2014 for projects completed in the fourth quarter of PY5. Industrial Program Group projects completed between 6/1/2013 and 11/30/2013 (Q1 and Q2), between 12/1/2013 and 2/28/2014 (Q3), and between 3/1/2014 and 5/31/2014 (Q4), were extracted from Duquesne Light's program tracking system and broken into strata based on each project measure's reported kWh savings.

Three industrial projects from PY4 were carried over to PY5 and are grouped together as one entity in the Post PY4 Industrial Stratum. A large industrial customer completed a custom project that was implemented in four phases. The nature of the project necessitated that all phases be complete before savings can be estimated effectively. Three of the projects were submitted in PY4 and the last project was completed in PY5. Navigant selected the final phase of the project in their PY5 Q3 sample and it is included in the Large Industrial Stratum. The other three phases are grouped together in the Post PY4 Industrial Stratum.

Table 7-2: Industrial Program Sampling Strategy for Program Year 5

Stratum	Population Size	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Large Industrial	4	85%/15%	3	4	Onsite Verification
Medium Industrial	16	85%/15%	5	12	Onsite Verification
Small Industrial	117	85%/15%	6	59	Onsite and Telephone Verification
Post PY4 Industrial	1	85%/15%	1	1	Onsite Verification
Program Total	138	85%/15%	15	76	

Per the utility's EM&V Plan[27], for measures 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.

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

Table 7-3: Program Year 5 Industrial Program Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings (MWh/yr)	Energy Realization Rate (%)	Verified Gross Energy Savings (MWh/yr)	Observed Coefficient of Variation (C_v) or Proportion in Sample Design	Relative Precision at 85% C.L.
Large Industrial	7,597.81	100%	7,625.89	0.04	0.00%
Medium Industrial	1,204.65	96%	1,150.49	0.31	10.20%
Small Industrial	958.83	152%	1,457.16	2.03	27.10%
Post PY4 Industrial	10,523.89	100%	10,523.89	0.00	0.00%
Program Total	20,285.18	102%	20,757.43		2.00%

Table 7-4: Program Year 5 Industrial Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings	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.
Large Industrial	0.84	102%	0.86	0.03	0.00%
Medium Industrial	0.15	101%	0.15	0.72	23.80%
Small Industrial	0.25	26%	0.07	4.64	62.00%
Post PY4 Industrial	1.2	101%	1.21	0.00	0.00%
Program Total	2.44	94%	2.29		2.30%

Navigant completed a total of 12 sites visits for the 13 projects in the industrial program that were selected in PY5 for verification. The Navigant field staff included: Chris Yoder, Steven Nguyen, Lisa Cassell, Emily Merchant, Jamie Falk, and Eric Shum. Navigant followed their Phase II Evaluation Plan in order to determine which sites required an on-site visit. The 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. Only one of the 13 industrial projects had an incentive less than $2,000; therefore, it was the only the project that received telephone verification.

In general, Navigant found that most of the projects were installed as reported. The most common adjustment to the ex-ante savings was due to adjusting the hours of use and coincidence factors using customer reported information. SWE Guidance Memo 27 was released after a majority of the PY5 projects were submitted; therefore, few projects used customer reported information and the projects that did use customer reported information only had adjustments made to the hours of use. In accordance with the SWE guidance memo, when Navigant used customer reported information to adjust the hours of use Navigant also adjust the coincidence factors based on the operation of the measure during the PJM peak demand period. In almost all instances where the CSPs used customer reported hours of use they used the deemed coincidence factors because the SWE guidance memo was released after a majority of the projects were submitted.

Navigant also found two projects where the measure quantities and descriptions did not align with what was reported. The invoice quantities often aligned with what was reported but the on-site findings were significantly different. One of the industrial measures selected in Navigant's sample involved replacing incandescent exit signs with LED exit signs, and Navigant did not find any of the rebated measures on-site. In another instance, the way that the lighting project was inputted into Appendix C did not reflect what was installed due to the complex lighting control strategy implemented on-site.

7.3 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.

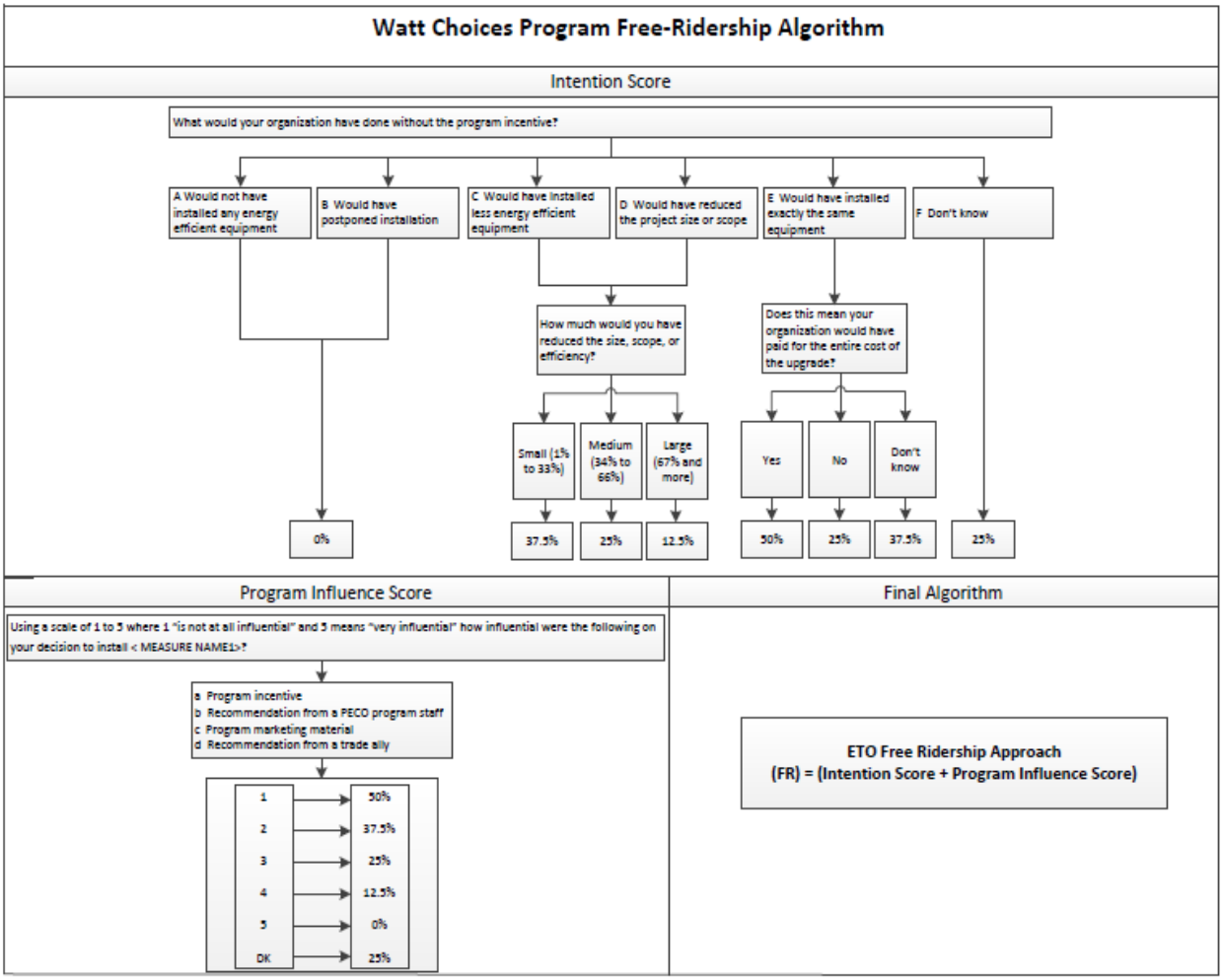
The evaluation team assessed free ridership using a customer self-report approach following the SWE framework.[28] This approach uses a survey designed to assess the likelihood that participants would have installed some or all of the energy efficiency measures incented by the program, even if the program 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.

Error! Reference source not found. 7-1 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

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

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 7-1: 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 – PY5 Process Evaluation*, submitted separately.

In total, 68[29] program participants responded the battery of NTG questions, including 58 commercial program participants and 10 industrial program participants. The evaluation team found an industrial NTG kWh-weighted ratio at the program level of 0.78.

The evaluation team found that 3 out of the 10 industrial program participants (30% of respondents) gave inconsistent answers to the questions used to calculate the intention and the program influence scores. These respondents stated that they would have installed exactly the same equipment if the program had not been available. Then, when asked to rank the influence of several program elements in their decision to purchase the energy-efficient equipment, the same respondents gave a high level of influence to one or more program elements in their decision to purchase the equipment. These inconsistent answers decrease the free-ridership score and therefore, increase the NTG ratio estimated.

Based on the net-to-gross research findings in PY5, the evaluation team recommends adding a control question to summarize answers to the intention and influence questions, which would allow the respondent to correct inconsistent answers.

Table 7-5 presents the free ridership and spillover results for the Industrial program.

[29] The 68 program participants surveyed include the 60 respondents that completed the telephone survey and the 8 respondents with the largest savings who completed in-depth interviews.

Table 7-5: Industrial PY5 NTG Results

	Estimated Free Ridership	Estimated Spillover	Net-to-Gross Ratio
Program Total	0.24	0.02	0.78

Source: Navigant NTG Analysis, PY5

Table 7-6: Industrial Program Sampling Strategy for Program Year 5 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 to Achieve Sample
All Industrial	N/A	29	0.5	90%/10%	Census	10	100%
Program Total	N/A	29	0.5	90%/10%	Census	10	100%

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

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

7.4 Process Evaluation

The PY5 process evaluation was combined for the Commercial and Industrial programs, given the small number of unique participants for the Industrial program and the similarity in the delivery method for the programs. It was conducted using five primary research activities, in addition to secondary research reviewing marketing plans, operational materials, and the online program application portal. The primary research activities included the following:

1. In-depth interviews with program staff and CSPs
2. Telephone surveys with 60 program participants
3. In-depth interviews with 8 of the top 20 participants with the largest program savings
4. Telephone interviews with 10 trade allies and two Trade Associations
5. Review of the program tracking system, program materials and project files

The sampling strategy for the Industrial program is shown in the table below.

Table 7-8: Industrial Program Sampling Strategy for Program Year 5

Target Group or Stratum	Stratum Boundaries	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	Evaluation Activity
All Industrial	N/A	29	0.5	90%/10%	Census	10	100%	Surveys
Program Total	N/A	29	0.5	90%/10%	Census	10	100%	Surveys

A detailed description of the Commercial and Industrial process evaluation appears in Duquesne Light's *Commercial and Industrial Energy Efficiency Programs – PY 5 Process Evaluation*.

Key findings from this research for both the Commercial and Industrial programs include the following:

- The Commercial and Industrial programs are on target to hit their Phase II savings goals, having exceeded their PY5 savings goals. However, this high level of savings includes the impacts of a group of PY4 projects not counted in Phase I that were verified in Phase II. Without a similar injection of savings in PY6, the Commercial program is still on track to exceed its goals, but the Industrial program is achieving only about half of the savings needed to meet its annual goals. Duquesne Light reports, however, that there is a significant pipeline of industrial projects likely to be completed in Phase II.
- The programs have well-documented implementation plans and tracking system.
- More than half of program participants have reviewed the program website and seen the program's marketing materials. About half of those who did so said they found them useful.
- More than three fourths of participants reported being either very (58%) or somewhat (18%) satisfied with the program. Among those who reported being less satisfied:
    - Some participants indicated that their expectations regarding the participation process were not realistic, i.e., they were not aware of the amount of time, effort, paperwork or monitoring and verification that would be required.
    - Others expressed dissatisfaction with the fact that rebate checks, which might come long after the project has been completed (for a number of reasons) do not clearly identify the project that was done, confounding their bookkeeping.
- Almost 60% of program participants perceived barriers to participating in Duquesne Light's program. The top three barriers mentioned were: paperwork too burdensome (14%), initial cost of equipment (12%) and other (9%).

- Some participants said the eligibility window for the program creates both a customer relations problem and a barrier to participation in the program, because some customers have difficulty aligning the timing of coordinating their projects with the timing of receiving utility approvals and incentive payments.
- The two steps in the efficiency project implementation process with which participants most frequently (~20% of respondents) reported having had the most difficulty were estimating energy savings and estimating cost savings regarding efficiency improvements they were considering making. To a lesser extent, obtaining approval from their upper-level management to make these improvements was also reported as being difficult.
- Duquesne Light has not fully automated the way it processes and reviews program applications as well as its monthly reporting process. Monthly reports have to be generated manually, and applications are handwritten as opposed to submitted electronically.
- Participants most frequently pointed to the need for more detailed information and more proactive communications from Duquesne Light, when asked how the program could be improved.

7.5 Recommendations for Program

Table 7-9 provides program specific recommendations based on Navigant's findings in PY5, as well as the status of the recommendations being implemented by Duquesne Light.

Table 7-9: Recommendation Status Report on Recommendations

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
Duquesne Light should continue to closely track its Industrial program project pipeline, to ensure that Phase II goals can be reached.	Being considered
The utility should find a way to identify the projects for which rebate payments are being made and include that information along with the incentive payment when it is made, to facilitate customers' internal accounting and improve participant satisfaction.	Being considered
Duquesne Light should consider marketing its programs directly to Trade Allies, and train interested TAs to navigate the application process. A piece of this effort might include leave-behind brochures or flyers that clearly explain the many steps involved in program participation, to better align customer	Being considered

Recommendations	EDC Status of Recommendation (Implemented, Being Considered, Rejected AND Explanation of Action Taken by EDC)
expectations with what will occur.	
Duquesne Light should continue its efforts to work with CSPs, to ensure that CSPs are transparent about the various assumptions and data used in estimating savings, particularly for custom projects. Screenshot of calculators are often included in the project files, but not the actual calculator. For the sake of transparency, it would be helpful if the calculators were also included.	Being considered
Duquesne Light should take steps to automate the application form and the application review process. This will prevent errors in data transfer and will allow program staff to give feedback to program participants in a timelier manner.	Being considered
Duquesne Light should continue its efforts to ensure that its CSPs have taken steps to ensure that the correct TRM is being used in estimating project savings, especially for motors and VFDs.	Being considered

7.6 Financial Reporting

A breakdown of the program finances is presented in Tables 7-10 through 7-13.Table 1-8

Table 7-10: Summary of Industrial Umbrella Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	129	129
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	129	129
Design & Development	4	4
Administration, Management, and Technical Assistance[1]	45	45
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**49**	**49**
EDC Evaluation Costs	7	7
SWE Audit Costs	12	12
Total EDC Costs[3]	184	184
Participant Costs[4]	341	341
Total NPV TRC Costs[5]	**409**	**409**
Total NPV Lifetime Energy Benefits	**1,003**	**1,003**
Total NPV Lifetime Capacity Benefits	**118**	**118**
Total NPV TRC Benefits[6]	**1,121**	**1,121**
TRC Benefit-Cost Ratio[7]	**2.74**	**2.74**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 7-11: Summary of Mixed Industrial Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	45	45
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	45	45
Design & Development	8	8
Administration, Management, and Technical Assistance[1]	236	236
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**244**	**244**
EDC Evaluation Costs	15	15
SWE Audit Costs	25	25
Total EDC Costs[3]	303	303
Participant Costs[4]	102	102
Total NPV TRC Costs[5]	**385**	**385**
Total NPV Lifetime Energy Benefits	**724**	**724**
Total NPV Lifetime Capacity Benefits	**65**	**65**
Total NPV TRC Benefits[6]	**789**	**789**
TRC Benefit-Cost Ratio[7]	**2.05**	**2.05**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 7-12: Summary of Primary Metals Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	451	451
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	451	451
Design & Development	24	24
Administration, Management, and Technical Assistance[1]	734	734
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**758**	**758**
EDC Evaluation Costs	45	45
SWE Audit Costs	76	76
Total EDC Costs[3]	1,254	1,254
Participant Costs[4]	1,749	1,749
Total NPV TRC Costs[5]	**2,628**	**2,628**
Total NPV Lifetime Energy Benefits	**4,538**	**4,538**
Total NPV Lifetime Capacity Benefits	**318**	**318**
Total NPV TRC Benefits[6]	**4,856**	**4,856**
TRC Benefit-Cost Ratio[7]	**1.85**	**1.85**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Table 7-13: Summary of Chemical Products Finances

	PYTD ($1,000)	Phase II ($1,000)
EDC Incentives to Participants	22	22
EDC Incentives to Trade Allies	0	0
Subtotal EDC Incentive Costs	22	22
Design & Development	9	9
Administration, Management, and Technical Assistance[1]	102	102
Marketing[2]	0	0
Subtotal EDC Implementation Costs	**111**	**111**
EDC Evaluation Costs	17	17
SWE Audit Costs	28	28
Total EDC Costs[3]	150	150
Participant Costs[4]	102	102
Total NPV TRC Costs[5]	**258**	**258**
Total NPV Lifetime Energy Benefits	**260**	**260**
Total NPV Lifetime Capacity Benefits	**25**	**25**
Total NPV TRC Benefits[6]	**285**	**285**
TRC Benefit-Cost Ratio[7]	**1.10**	**1.10**

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] Per the 2013 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenses only. EDC costs include EDC Incentive Costs; Design & Development; Administration, Management, Technical Assistance; Marketing, EDC Evaluation Costs, and SWE Audit Costs categories.
[4] Per the 2013 Total Resource Cost Test Order, the Participant Costs are the costs for the end-use customer.
[5] Total TRC Costs includes Total EDC Costs and Participant Costs.
[6] 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.
[7] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Appendix A: EM&V Information

Participant Definitions

Table A1: Program Year 5 Participant Definition by Program

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

Program Year 5 Evaluation Activities

Table A-2: Program Year 5 Actual Evaluation Activities

Programs (Sub Programs if necessary)	Sectors	Records Review	Participant Surveys	Nonparticipant Surveys	Phone Verifications	Site Visits	Metering [30]
Commercial	C/I	33	43	0	12	21	5
Government/Non-profit	C/I	20	15	0	11	9	0
Industrial	C/I	13	10	0	1	12	2
REEP	Res	24	104	401	104	0	0
RARP	Res	*	86		86	0	0
SEP	Res	*	75		75	0	0
LIEEP	Res	*	83		83	0	0

*Records not reviewed in PY5, due to high accuracy in previous years.

[30] Does not include statistical billing analysis

Appendix B: TRC Incremental Costs

Program	ID	Description	Incremental Cost	Incremental Measure Cost Source
Residential	KT15	EE Kit: 1-13W, 2-18W, 1-23W (4-BULB KIT)	$7.80	Contract Price
Residential	KT25	EE Kit: 2-13W, 1-20W, 1-23W, 2-LED NL, 1-Smart Strip	$28.20	Contract Price
Residential	KT35	EE Kit: Single 13W	$1.50	Contract Price
Residential	KT40	EE Kit: Single 18W	$1.99	Contract Price
Residential	KT50	EE Kit: Single 23W	$2.19	Contract Price
Residential	RF1.1	Energy Star Dehumidifiers RA1	$30.49	See Dehumidifier Price Points tab
Residential	RF1.2	Dehumidifier 25-35 pints/day	$22.72	See Dehumidifier Price Points tab
Residential	RF1.3	Dehumidifier 35-45 pints/day	$25.00	See Dehumidifier Price Points tab
Residential	RF1.4	Dehumidifier 45-54 pints/day	$23.03	See Dehumidifier Price Points tab
Residential	RF1.5	Dehumidifier 54-75 pints/day	$82.08	See Dehumidifier Price Points tab
Residential	RF1.6	Dehumidifier 75-185 pints/day	$510.50	See Dehumidifier Price Points tab
Residential	RF11	Dishwasher with Electric Water Heater	$10.00	SWE 2.27-1
Residential	RF12	Clothes Washer - Electric Water Heater and Electric Dryer	$50.00	SWE 2.26-1
Residential	RF13	Clothes Washer - Electric Water Heater and Gas Dryer or N	$50.00	SWE 2.26-1
Residential	RF14	Clothes Dryer, Electric Clothes Dryer with Moisture Sensor.	$111.73	SWE 2.2-1
Residential	RF15	Electric Water Heater - 0.93 Energy Factor	$70.00	SWE 2.3-1
Residential	RF17	Electric Water Heater - 0.95 Energy Factor	$116.00	SWE 2.3-3
Residential	RF18	Heat Pump Water Heater	$945.00	SWE 2.6-1
Residential	RF2.1	Energy Star Freezer RA2	$4.76	SWE 2.25-1
Residential	RF2.2	Freezer Upright w/automatic defrost	$8.74	SWE 2.25-2
Residential	RF2.3	Freezer - Chest Freezer	$5.23	SWE 2.25-3
Residential	RF19	ENERGY STAR Television <20"	$14.30	DEER Update Study pg 3-13
Residential	RF20	ENERGY STAR Television 20 - <30"	$14.30	DEER Update Study pg 3-13
Residential	RF21	ENERGY STAR Television 30 - <40"	$14.30	DEER Update Study pg 3-13
Residential	RF22	ENERGY STAR Television 40 - <50"	$14.30	DEER Update Study pg 3-13
Residential	RF23	ENERGY STAR Television 50 - <60"	$14.30	DEER Update Study pg 3-13
Residential	RF24	ENERGY STAR Television =60"	$14.30	DEER Update Study pg 3-13

Appendix B: TRC Incremental Costs – *continued*

Program	ID	Description	Incremental Cost	Incremental Measure Cost Source
Residential	RF3.1	Refrigerator Manual Defrost	$25.25	SWE 2.24-8
Residential	RF3.2	Refrigerator Partial Automatic Defrost	$25.25	SWE 2.24-8
Residential	RF3.3	Refrigerator Top mount freezer without door ice	$21.83	SWE 2.24-2
Residential	RF3.4	Side mount freezer without door ice	$64.65	SWE 2.24-3
Residential	RF3.5	Refrigerator bottom mount freezer without door ice	$14.41	SWE 2.24-4
Residential	RF3.6	Refrigerator Bottom mount freezer with door ice	$20.17	SWE 2.24-7
Residential	RF3.9	Refrigerator only-single door without ice	$25.25	SWE 2.24-8
Residential	RF4	Energy Star Room Air Conditioner RA4	$40.00	SWE 2.29-1
Residential	RF5	Refrigerator Recycling - Retire	$0.00	All Costs treated as Admin
Residential	RF6	Refrigerator Recycling - Replace	$29.82	DEER Update Study pg 3-12
Residential	RF7	Freezer Recycling - Retire	$0.00	All Costs treated as Admin
Residential	RF8	Freezer Recycling - Replace	$29.82	DEER Update Study
Residential	RF9	Refrigerator Recycling - LI Replace (DI - DLC Cost Share)	$619.04	DEER Update Study pg 3-12
Residential	RL1.1	ECOS	$2.33	Actual ECOVA Reported
Residential	RL4	Interior Compact Fluorescent Fixture, >= 26 watts RL4	$15.00	SWE 2.30-10
Residential	RL5	Energy Star Outdoor Fixture RL5	$20.00	SWE 2.30-11
Residential	RO5	Insulation - Ceiling & Wall Insulation RO5	$1.98	SWE 2.21-1-7
Residential	RO6	Occupancy sensor based control RO6	$60.00	SWE 2.37-1
Residential	RO6.1	Smart Strip - Surge Protector	$32.97	SWE 2.13-1
Residential	RO6.2	Swimming Pool Pump, Two-Speed	$175.00	SWE 2.42 -1
Residential	RO7	High Efficiency Pool Pump and Motor RO7	$175.00	SWE 2.42 -1
Residential	RS1	Central Air Conditioner SEER 15	$1,319.00	SWE 2.1-9
Residential	RS1.1	Central Air Conditioner SEER 16	$2,499.23	SWE 2.1 - 10
Residential	RS1.2	Central Air Conditioner SEER 17	$2,499.23	SWE 2.1 - 10
Residential	RS1.3	Central Air Conditioner SEER 18	$2,499.23	SWE 2.1 - 10
Residential	RS1.5	Central Air Conditioner SEER 20	$2,499.23	SWE 2.1 - 10
Residential	RS2	Heat Pump - 14 SEER / 8.6 HSPF A/C Heat Pump	$1,442.30	SWE 2.1-21
Residential	RS2.2	Heat Pump - 16 SEER / 8.4 HSPF A/C Heat Pump	$1,442.30	SWE 2.1-21
Residential	RS4	High Efficiency Fan Heating RS4	$200.00	SWE Res Cost Database 2.1-39

Appendix B: TRC Incremental Costs – *continued*

Program	ID	Description	Incremental Cost	Incremental Measure Cost Source
Residential	RS5	Programmable Thermostat RS5	$64.00	SWE 2.11-1
Residential	RS6	Whole House Fans (CAC HP Cooling) RS6	$533.86	SWE 2.16-1
Residential	RS7	Ductless Mini-Split Heat Pumps	$1,566.99	SWE-2.17-1
Nonresidential	CM1	Custom, C&I, Interior Lighting	Actual	Invoice
Nonresidential	CM11	Custom, C&I, Other	Actual	Invoice
Nonresidential	CM2	Custom, C&I, Other	Actual	Invoice
Nonresidential	CM3	Custom, C&I, Cooling	Actual	Invoice
Nonresidential	CM4	Custom, C&I, Cooling	Actual	Invoice
Nonresidential	CM8	Custom, C&I, Ventilation	Actual	Invoice
Nonresidential	CM9	Custom, C&I, Process	Actual	Invoice
Nonresidential	FC1	FC1 ES Freezer with 1 door and 19-30 cu ft	Actual	Invoice
Nonresidential	FC2	FC2 ES Freezer, 2 doors, 31-60 cubic feet	Actual	Invoice
Nonresidential	FC3	FC3 ES Freezer, 3 doors, 61-90 cubic feet	Actual	Invoice
Nonresidential	KT25	FC6 ES Refrigerator Replacement Public Agency - LI	Actual	Invoice
Nonresidential	LA1	LA1 Screw-in Compact Fluorescent Lamp: 5-25 watts	$2.26	ECOVA Sales
Nonresidential	LB1	LB1 Interior compact fluorescent fixture 5-25 watts	$25.00	SWE 3.2-29
Nonresidential	LB2	LB2 Interior compact fluorescent fixture, 26-65 watts	$30.00	SWE 3.2-29,30
Nonresidential	LB4	LB4 Interior compact fluorescent fixture, >90 watts	$35.00	SWE 3.2-30
Nonresidential	LB5	LB5 Exterior compact fluorescent fixture, <=70W replacement	$17.00	SWE 2.30
Nonresidential	LC1	Cold cathode fluorescent lamp: 2-18 watts	$16.18	See Cold Cathode tab
Nonresidential	LD1	LD1 Induction lamp and fixture, 55-100 watts	Actual	Invoice
Nonresidential	LD2	LD2 Induction lamp and fixture >100 watts	Actual	Invoice
Nonresidential	LE1.2	T5-4' 2 lamp HO electronic ballast	$57.23	C&I FLS-2
Nonresidential	LE10	T8-25W 3 ft 2 lamp electronic ballast	$57.16	C&I FLS-12
Nonresidential	LE13.1	T8-30W 4 ft 1 lamp (or 24" U tube) electronic ballast	$48.62	C&I FLS-15
Nonresidential	LE13.2	T8-28W 4 ft 1 lamp (or 24" U tube) electronic ballast	$50.02	C&I FLS-20
Nonresidential	LE14.1	T8-30W 4 ft 2 lamp electronic ballast	$49.15	C&I FLS-16
Nonresidential	LE14.2	T8-28W 4 ft 2 lamp electronic ballast	$51.95	C&I FLS-21
Nonresidential	LE15.1	T8-30W 4 ft 3 lamp electronic ballast	$55.09	C&I FLS-17
Nonresidential	LE15.2	T8-28W 4 ft 3 lamp electronic ballast	$59.29	C&I FLS-22
Nonresidential	LE16.1	T8-30W 4 ft 4 lamp electronic ballast	$58.45	C&I FLS-18

Appendix B: TRC Incremental Costs – *continued*

Program	ID	Description	Incremental Cost	Incremental Measure Cost Source
Nonresidential	LE16.2	T8-28W 4 ft 4 lamp electronic ballast	$64.05	C&I FLS-23
Nonresidential	LE16.3	T8-25W 4 ft 4 lamp electronic ballast	$76.66	C&I FLS-28
Nonresidential	LE17.1	T8-30W 4 ft 6 lamp electronic ballast	$80.33	C&I FLS-19
Nonresidential	LE17.2	T8-28W 4 ft 6 lamp electronic ballast	$80.30	C&I FLS-24
Nonresidential	LE17.4	T8-28W replacing 32W, lamp only (1st to 2nd gen retrofit) Δ4	$2.50	SWE 3.2-23
Nonresidential	LE17.6	T8 25W replacing 28W, lamp only (2nd to 3rd gen retrofit) Δ3	$2.50	SWE 3.2-22
Nonresidential	LE2	T5 4 ft 3 lamp HO electronic ballast	$67.45	C&I FLS-3
Nonresidential	LE20	T8 8 ft 2 lamp electronic ballast	$69.40	C&I FLS-32
Nonresidential	LE23	T8 8 ft 2 lamp HO electronic ballast	$148.93	C&I FLS-35
Nonresidential	LE3	T5 4 ft 4 Lamp HO Electronic ballast	$49.05	C&I FLS-4
Nonresidential	LE4.1	T5 4 ft 6 lamp HO electronic ballast	$14.31	C&I FLS-5
Nonresidential	LE5	T8-17W 2 ft 1 lamp electronic ballast	$44.94	C&I FLS-7
Nonresidential	LE6	T8-17W 2 ft 2 lamp electronic ballast	$51.35	C&I FLS-8
Nonresidential	LE7	T8-17W 2 ft 3 lamp electronic ballast	$56.17	C&I FLS-9
Nonresidential	LE9	T8-25W 3 ft 1 lamp electronic ballast	$47.59	C&I FLS-11
Nonresidential	LF1	Remove 2 ft linear fluorescent lamp	$27.27	C&I FLS-37
Nonresidential	LF2	Remove 3 ft linear fluorescent lamp	$27.27	C&I FLS-38
Nonresidential	LF3	Remove 4 ft linear fluorescent lamp	$27.27	C&I FLS-39
Nonresidential	LF4	Remove 8 ft linear fluorescent lamp	$27.27	C&I FLS-40
Nonresidential	LG1	Metal Halide, Pulse-Start Fixture, Exterior, 175W-320W	$186.93	MHL-tab
Nonresidential	LG2	Metal Halide, Pulse-Start Fixture, Exterior >320W	$478.85	MHL-tab
Nonresidential	LG4	Metal Halide, Pulse-Start Fixture, Interior 250 W	$197.99	MHL-tab
Nonresidential	LH1	Occupancy sensor, ceiling or wall mounted, <500W controlled	$116.00	SWE 3.2-47
Nonresidential	LH2	Occupancy sensor, ceiling or wall mounted, ≥500W controlle	$116.00	SWE 3.2-47
Nonresidential	LH3	Occupancy sensor, high bay fixture-integrated	$129.00	SWE 3.2-46
Nonresidential	LH4	Dimming electronic ballast, for daylighting	Actual	Invoice
Nonresidential	LJ1.1	Single-Sided LED Exit Signs replacing Incandescent Exit Sign	$48.00	SWE 3.2-38
Nonresidential	LJ1.2	Dual-Sided LED Exit Signs replacing Incandescent Exit Signs	$48.00	SWE 3.2-39
Nonresidential	LJ1.3	Single-Sided LED Exit Signs replacing Fluorescent Exit Signs	$48.00	SWE 3.2-38
Nonresidential	LJ1.4	Dual-Sided LED Exit Signs replacing Fluorescent Exit Signs	$48.00	SWE 3.2-39

Appendix B: TRC Incremental Costs – *continued*

Program	ID	Description	Incremental Cost	Incremental Measure Cost Source
Nonresidential	LJ15	LED PAR 20 7-9W	$25.33	ECOVA Contract
Nonresidential	LJ16	LED PAR 30 10-13W	$18.09	ECOVA Contract
Nonresidential	LJ17	LED PAR 38 10-21W	$20.41	ECOVA Contract
Nonresidential	LJ18	LED MR16 4-7W	$7.70	ECOVA Contract
Nonresidential	LJ19	LED A-Line 8-12W	$12.23	ECOVA Contract
Nonresidential	LJ20	LED Decorative 2-4W	$10.03	ECOVA Contract
Nonresidential	RA13	Door with anti-sweat heater for vertical frozen food display cas	Actual	Invoice
Nonresidential	RA14	ECM Motor for walk-in freezer or cooler (TRM 3.11)	$250.00	SWE 3.11-2
Nonresidential	RA3.1	Strip Curtains, Walk-In Cooler - Supermarket	$3.80	SWE 3.17-1
Nonresidential	RA3.3	Strip Curtains, Walk-In Cooler - Restaurant	$3.80	SWE 3.17-1
Nonresidential	RA3.6	Strip Curtains, Walk-In Freezer - Restaurant	$3.80	SWE 3.17-1
Nonresidential	RA4	RA4 Repl Door Gasket on main door of walk-in cooler	$4.00	SWE 3.24-1
Nonresidential	RA5	RA5 Repl Door Gasket on main door of walk-in freezer	$4.00	SWE 3.24-1
Nonresidential	RA6	RA6 Repl Door Gasket on reach-in door of walk-in cooler	$4.00	SWE 3.24-1
Nonresidential	SA1	VFD - HVAC Pump Motor	$214.00	SWE 3.4-2
Nonresidential	SA2	VFD - HVAC Fan Motor	$215.93	SWE 3.4-6

Sources

Actual Cost: Costs from product invoices, collected for applicable projects individually
SWE C&I Measure Cost Database 2-19-2013
SWE Residential Incremental Cost Database rev F (May 2014)
DEER Update Study: 2010-2012 WO017, Ex Ante Measure Cost Study, Final Report, May 27, 2014, (Refrigerators)
ECOVA transactional data for 1,553,692 CFLs and LED lamps sold in Duquesne Light's service territory in 2013
DLCo contracted delivery cost
C&I Linear Fluorescent Cost research
Dehumidifier incremental cost research
Cold cathode lamp price research
Metal Halide Lighting price research

Appendix B: TRC Incremental Costs – *Sources*

Residential ENERGY STAR Dehumidifier Incremental Cost (IMC)

ENERGY STAR						**Base**					
ES Dehumidifier - Residential Appliance						*Base Dehumidifier - Residential Appliance*					
7 ranges, 5 price points per range - 35 price points						*7 ranges, 2-5 price points per range (where available)*					
Capacity Range	Pints/day	Brand	Model	Cost	Cost	Base			IMC	IMC	ES - Websi
1-25 Range											
1-25	25	Danby	DDR25E	$ 189.99							http://www.c
1-25	25	Friedrich	D25D	$ 179.00							http://www.s
1-25	25	Frigidaire	FDR25S1	$ 144.49		NewAir	AD-250	$ 140.00			http://www.a
1-25	25	Frigidaire	FDR25S1	$ 199.00		Soleus	CFM-25	$ 180.00			http://www.l
1-25	25	Soleus Air	CFM-25E	$ 239.95	$ 190.49			$ 160.00	$ 30.49	$ 25.00	http://www.p
25-35 range											
25-35	30	Danby	DDR30E	$ 169.00							http://www.s
25-35	30	Danby	DDR30E	$ 169.96							http://www.a
25-35	30	GE	ADER30LP	$ 159.00		Comfort-Air	BHD-301	$ 140.00			http://www.a
25-35	30	Perfect Aire	PA30	$ 159.99		GE	ADEW30LP	$ 149.54			http://www.a
25-35	30	Soleus Air	DP1-30-03	$ 164.00							http://www.s
25-35	30	Sunpentown (SPT)	SD-30E	$ 183.00	$ 167.49			$ 144.77	$ 22.72	$ 25.00	http://www.l
35-45 range											
35-45	45	Danby	DDR45E	$ 199.00							http://www.s
35-45	45	Danby	DDR45E	$ 172.86							http://www.a
35-45	45	DeLonghi	DD45	$ 189.00			None not ES				http://www.s
35-45	45	DeLonghi	DD45P	$ 240.00							http://www.s
35-45	45	Soleus Air	DP2-45-03	$ 179.00	$ 195.97					$ 25.00	http://www.s
45-54 Range											
45-54	50	Comfort-Aire	BHD-501-G	$ 224.95							http://www.s
45-54	50	Danby	DDR5009REE	$ 205.00							http://www.s
45-54	50	Danby	DDR5009REE	$ 199.00							http://www.l
45-54	50	Danby	DDR5009REE	$ 185.92							http://www.a
45-54	50	DeLonghi	DD50P	$ 249.99		Kenmore	50 Pint	$ 200.00			http://www.a
45-54	50	DeLonghi	DD50P	$ 239.00		GE	ADEW50LP 50 pt	$ 194.00			http://www.s
45-54	50	Friedrich	D50D	$ 229.00							http://www.s
45-54	50	Frigidaire	FAD504TDD	$ 238.75							http://www.a
45-54	50	Winix	WDH851	$ 329.00	$ 220.03			$ 197.00	$ 23.03	$ 25.00	http://www.s
54-75 range											
55-75	60	Danby	DDR6009REE	$ 219.00							http://www.s
55-75	60	Danby	DDR6009REE	$ 229.00							http://www.l
55-75	60	Danby	DDR6009REE	$ 179.99							http://www.a
55-75	65	Santa Fe Compact	4029900	$ 1,110.00							http://www.s
55-75	65	Sunpentown (SPT)	SD-65E	$ 222.99							http://www.a
55-75	70	Danby	DDR7009REE	$ 279.00							http://www.s
55-75	70	Danby	DDR7009REE	$ 229.00							http://www.l
55-75	70	Danby	DDR7009REE	$ 213.99		Kenmore	70 Pint	$ 250.00			http://www.a
55-75	70	Danby	DDR7009REE	$ 229.49		Frigidaire	FAD704DUD - 70 Pint	$ 229.00			http://www.a
55-75	70	Frigidaire	FAD704TDP	$ 200.50							http://www.a
55-75	70	Soleus Air	DP1-70-03	$ 367.00							http://www.a
55-75	70	Winix	WDH871	$ 379.00	$ 321.58			$ 239.50	$ 82.08	$ 80.00	http://www.s
75-185 pints range											
75-185	100	Santa Fe Classic	4021400	$ 1,443.00		Fantech	GD55S - 100 Pint	$ 500.00			http://www.s
75-185	100	Therma-Stor	Hi-E Dry 100	$ 1,919.00		Ideal Air	700896 - 100 Pint	$ 616.00			http://www.s
75-185	130	Williams Air Sponge	DH130A	$ 1,099.00		Honeywell	DH150A105 150 Pint	$ 2,590.00			http://www.s
75-185	150	Santa Fe Max Dry	4027450	$ 1,879.00		Ebac	CD30 - 170 Pint	$ 699.00			http://www.s
75-185	180	Santa Fe Advance	4029800	$ 1,244.00		FanTech	CGR 180 Pints	$ 2,075.00			http://www.s
75-185	183	Therma-Stor	Hi-E Dry 195	$ 3,255.00	$ 1,806.50			$ 1,296.00	$ 510.50	$ 510.00	http://www.s
		Res DH>150 pints appear to be ducted									
				$ 1,516.80							

Web searches produce very few Residential Dehumidifiers that are *not* ENERGY STAR LISTED
Base costs are the average two models in each capacity range.

Pints/day	IMC
1-25	$25.00
25-35	$25.00
35-45	$25.00
45-54	$25.00
55-75	$80.00
75-185	$510.00

Appendix B: TRC Incremental Costs – *Sources - continued*

Source: DEER Update Study
2010-2012 WO017, Ex Ante Measure Cost Study, Final Report
Submitted to: California Public Utilities Commission by Itron, Inc. May 27, 2014; Scope of the study included all deemed measures contained in the Database for Energy Efficient Resources (DEER), as well as non-DEER deemed measures.

Summary of Table 3-6: Incremental Equipment Price Estimates for Residential Refrigerators, Clothes Washers, and Televisions

Scenario	Refrigerator Type	Door Ice	Total Volume ft^3	Base	Measure	IMC
1	Bottom Mount Freezer		16.5-25	$993.00	$1,022.00	$29.00
2	Bottom Mount Freezer		8-16.5	$817.00	$839.00	$22.00
3	Side Mount Freezer		23-31	$551.00	$586.00	$35.00
4	Side Mount Freezer	X	23-31	$1,041.00	$1,082.00	$41.00
5	Side Mount Freezer		15-23	$381.00	$413.00	$32.00
6	Side Mount Freezer	X	15-23	$894.00	$928.00	$34.00
7	Top Mount Freezer		20-25	$663.00	$689.00	$26.00
8	Top Mount Freezer		15-20	$574.00	$595.00	$21.00
9	Top Mount Freezer		10-15	$478.00	$496.00	$18.00
	Average (2011)			$710.22	$738.89	$28.67
	Average (2012 - i2%)			$724.43	$753.67	$29.24
	Average (2013 - i2%)			$738.92	$768.74	$29.82

		2012	2013
8	Low Income Direct Install (full cost)	$606.90	$619.04

Appendix B: TRC Incremental Costs – *Sources - continued*

Cold Cathode CFL Performance and Costs

CCFL Watts	CCFL Lumens	Incandescent Watts	Incandescent Lumens	Cost
2	80	10	80	$10.40
3	120	15	115	$9.99
5	200	25	210	$13.12
8	300	40	320	$13.50
13	700	60	700	$22.09
15	750	60	700	$22.09
18	1050	75	1015	$22.09
				$16.18 average

CCFL Lamp W	CCFL Lumens	Incandescent Watts	Incandescent Lumens	Bases/Sources
2	80	10	80	Litetronics Mircro-Brite 2 Watt 2700K Clear S14 Cold Cathode Lamp, 80 lumens, 2700K, CRI 80, MB-200 $12.99 (medium white MB-201), MOL-3.58" Baseline: GE S11, Order Code12188, 10 Watts, 80 lumens, 1,000 hrs, filament C-7A, Max Overall Length (MOL) 2.31"
3	120	15	115	Watt Busters; 3-Watt G25 Cold Cathode Medium Base Lamp #19831; replaces 15-30W incandescent; 120 lumens, MOL 4.6", 25,000 hours $9.99; USHIO Ordering Code, 3000475 Lamp Code CF3CC/2700/E26 S-14, 120 lumens $26.73 Litetronics, Micro-Brite, Model MB-310, Shape A19, 130 lumens, K 2700, MOL - 4.33" TCP Part 8G2003F, E26, Dimmable, 2700 K, CRI-82, MOL-4.0" (15-20W equivalent) 120 lumens, 25,000 hrs $13.97 Baseline: GE A15, Order Code: 12658, 15 Watts, 115 lumens, 2,500 hrs, C-9 filament, MOL-3.5"
5	200	25	210	Hutt Electric Supply Model #A05 200 Initial Lumens, Incandescent Equivalent 25-30W, 82 CRI, MOL 4.0", 25,000 HR http://hutt-online.com/osc/watt-cold-cathode-alam p-p-224.html - $13.12 www.ushio.com: USHIO Ordering Code 3000476, Lamp Code CF5CC/2700/E26, A-16, MOL 4.0", CRO 82, 200 lumens, 2700 K Litetronics, Micro-Brite, Model MB-500DL, Shape A19, 200 lumens, Color Temp: 2250K; Model MB-500DP Color Temp: 2850 K TCP Part 8G2505WH (30 Watt equivalent), dimmable 2700 K, CRI 82, 25,000 hrs 200 lumens MOL-4.8" Baseline: GE A19, 25W, Order No.: 97492, 25A/W-2PK, Soft White, MOL-4.25", 2,500 hrs
8	300 (280-325)	40	320	www.ushio.com: USHIO Ordering Code 3000528, Lamp Code CF8CC/2700/E26, A-19, MOL 4.5", CRO 82, 300 lumens, 2700 K www.lightbulbemporium.com Code TCP8A08L; A19 Cold Cathode, CRI 80, MOL 4.5; 280 lumens: Mfg - TCP TCP8A08LV; MaxLite 11376-ML; Litetronics MB-801DL $13.50 Litetronics, Micro-Brite, Model MB-800DL, Shape A19, 325 lumens, Color Temp: 2250K; Model MB-800DP Color Temp: 2850 K TCP, Part No.: 8G3008F, E26, CRI, 82, 2700 k, MOL 5.5", INCANDESCENT 35-40w, LUMENS 300, 25000 HRS Baseline: GE A15, 40 Watt, Order No.: 73187, 40A15/RVL/CD2-6PK, Reveal Soft White, MOL-3.5"1,000 hrs, 320 lumens
13	700	60	700 (550-865)	www.ushio.com: USHIO Ordering Code 3000510, Lamp Code CF13CC/CLT/2700/E26, MOL 4.5", CRI 82, 700 lumens, 2700 K, 25000 HRS Baseline: GE A19, 60 Watt, Order No.: 48688 60A/RVL 48PK, Reveal Soft White, MOL-4.43", 1,000 hrs, 630 lumens
15	750	60	700 (550-865)	Litetronics Micro-Brite MB-15527D, lamp code 15W/CCFL/CL/SW, 750 lumens, 2700K, CRI 82, E26, dimmable, 18,000 hrs Global Consumer, Part no.: 141, 15W, dimmable, CRI 80, 2700 K, E26, 525 lumines 40 W equivalent, Baseline: GE A19, 60 Watt, Order No.: 48688 60A/RVL 48PK, Reveal Soft White, MOL-4.43", 1,000 hrs, 630 lumens
18	1050	75 1015	1,015 (830-1200)	www.ushio.com: USHIO Ordering Code 3000513, Lamp Code CF18CC/CLT/2700/E26, MOL 4.9", CRI 82, 1050 lumens, 2700 K, 25000 HRS Baseline: GE A19, 75 Watt; range of initial lumens 830 - 1200 for Reveal Soft White - Clear, , MOL-4.43"

Appendix B: TRC Incremental Costs – *Sources - continued*

Nonresidential

Linear Fluorescent Lighting Costs

ID	Cost #	Description	No Lamps	Total Cost	Lamp Type	Lamp ea.	Source	Ballast	Source	bor Time Ho	Labaor Rate	Cost/Lamp
LE1.1	1	T5 - 4' 1 Lamp - HO - Electronic Ballast	1	$67.45	F48T5/HO-54W	$5.63	http://www.	$34.55	http://www.	0.5	$54.54	$67.45
LE1.2	2	T5 - 4' 2 Lamp - HO - Electronic Ballast	2	$73.08	F48T5/HO-54W	$5.63	http://www.	$34.55	http://www.	0.5	$54.54	$36.54
LE2	3	T5 - 4' 3 Lamp - HO - Electronic Ballast	3	$119.11	F48T5/HO-54W	$5.63	http://www.	$74.95	http://www.	0.5	$54.54	$39.70
LE3	4	T5 - 4' 4 Lamp - HO - Electronic Ballast	4	$124.74	F48T5/HO-54W	$5.63	http://www.	$74.95	http://www.	0.5	$54.54	$31.18
LE4.1	5	T5 - 4' 6 Lamp - HO - Electronic Ballast	6	$170.55	F48T5/HO-54W	$5.63	http://www.	$109.50		0.5	$54.54	$28.42
LE4.2	6	T5 - 4' 8 Lamp - HO - Electronic Ballast	8	$222.21	F48T5/HO-54W	$5.63	http://www.	$149.90		0.5	$54.54	$27.78
LE5	7	T8 17W 2' 1 Lamp - Electronic Ballast	1	$44.94	F17T8-17W	$3.82	http://www.	13.85	http://www.	0.5	$54.54	$44.94
LE6	8	T8 17W 2' 2 Lamp - Electronic Ballast	2	$51.35	F17T8-17W	$3.82	http://www.	$16.45	http://www.	0.5	$54.54	$25.68
LE7	9	T8 17W 2' 3 Lamp - Electronic Ballast	3	$56.17	F17T8-17W	$3.82	http://www.	$17.45	http://www.	0.5	$54.54	$18.72
LE8	10	T8 17W 2' 4 Lamp - Electronic Ballast	4	$75.44	F17T8-17W	$3.82	http://www.	$32.89		0.5	$54.54	$18.86
LE9	11	T8 25W 3' 1 Lamp - Electronic Ballast	1	$47.59	F25T8-25W	$5.35	http://www.	$14.98	http://www.	0.5	$54.54	$47.59
LE10	12	T8 25W 3' 2 Lamp - Electronic Ballast	2	$57.16	F25T8-25W	$5.35	http://www.	$19.19	http://www.	0.5	$54.54	$28.58
LE11	13	T8 25W 3' 3 Lamp - Electronic Ballast	3	$62.51	F25T8-25W	$5.35	http://www.	$19.19	http://www.	0.5	$54.54	$20.84
LE12	14	T8 25W 3' 4 Lamp - Electronic Ballast	4	$67.86	F25T8-25W	$5.35	http://www.	$19.19	http://www.	0.5	$54.54	$16.96
LE13.1	15	T8 30W 4' 1 Lamp - Electronic Ballast	1	$48.62	F32T8-30W	$2.11	http://www.	$19.24	http://www.	0.5	$54.54	$48.62
LE14.1	16	T8 30W 4' 2 Lamp - Electronic Ballast	2	$49.15	F32T8-30W	$2.11	http://www.	$17.66	http://www.	0.5	$54.54	$24.57
LE15.1	17	T8 30W 4' 3 Lamp - Electronic Ballast	3	$55.09	F32T8-30W	$2.11	http://www.	$21.49	http://1000b	0.5	$54.54	$18.36
LE16.1	18	T8 30W 4' 4 Lamp - Electronic Ballast	4	$58.45	F32T8-30W	$2.11	http://www.	$22.74		0.5	$54.54	$14.61
LE17.1	19	T8 30W 4' 6 Lamp - Electronic Ballast	6	$80.33	F32T8-30W	$2.11	http://www.	$40.40		0.5	$54.54	$13.39
LE13.2	20	T8 28W 4' 1 Lamp - Electronic Ballast	1	$48.62	F32T8-28W	$2.11	3 price avera	$19.24	http://www.	0.5	$54.54	$48.62
LE14.2	21	T8 28W 4' 2 Lamp - Electronic Ballast	2	$49.14	F32T8-28W	$2.11	3 price avera	$17.66	http://www.	0.5	$54.54	$24.57
LE15.2	22	T8 28W 4' 3 Lamp - Electronic Ballast	3	$55.08	F32T8-28W	$2.11	3 price avera	$21.49	http://1000b	0.5	$54.54	$18.36
LE16.2	23	T8 28W 4' 4 Lamp - Electronic Ballast	4	$58.43	F32T8-28W	$2.11	3 price avera	$22.74		0.5	$54.54	$14.61
LE17.2	24	T8 28W 4' 6 Lamp - Electronic Ballast	6	$80.30	F32T8-28W	$2.11	3 price avera	$40.40		0.5	$54.54	$13.38
LE13.3	25	T8 25W 4' 1 Lamp - Electronic Ballast	1	$50.95	F32T8-25W	$4.44	4 price avera	$19.24	http://www.	0.5	$54.54	$50.95
LE14.3	26	T8 25W 4' 2 Lamp - Electronic Ballast	2	$53.81	F32T8-25W	$4.44	4 price avera	$17.66	http://www.	0.5	$54.54	$26.90
LE15.3	27	T8 25W 4' 3 Lamp - Electronic Ballast	3	$62.08	F32T8-25W	$4.44	4 price avera	$21.49	http://www.	0.5	$54.54	$20.69
LE16.3	28	T8 25W 4' 4 Lamp - Electronic Ballast	4	$67.78	F32T8-25W	$4.44	4 price avera	$22.74	http://www.	0.5	$54.54	$16.94
LE17.3	29	T8 25W 4' 6 Lamp - Electronic Ballast	6	$94.32	F32T8-25W	$4.44	4 price avera	$40.40		0.5	$54.54	$15.72
LE18	30	T8 - 4' 8 Lamp - HO - Electronic Ballast	8	$116.18	F48T8-44W	$7.55	http://www.	$28.51	http://allday	0.5	$54.54	$14.52
LE19	31	T8 - 8' 1 Lamp - Electronic Ballast	1	$67.59	F96T8-49W	$1.82	http://www.	$38.50	http://www.	0.5	$54.54	$67.59
LE20	32	T8 - 8' 2 Lamp - Electronic Ballast	2	$69.40	F96T8-49W	$1.82	http://www.	$38.50	http://www.	0.5	$54.54	$34.70
LE21	33	T8 - 8' 4 Lamp - Electronic Ballast	3	$109.72	F96T8-49W	$1.82	http://www.	$77.00	http://www.	0.5	$54.54	$36.57
LE22	34	T8 - 8' 1 Lamp - HO - Electronic Ballast	1	$126.58	F96T8/HO-86W	$22.35	http://www.	$76.96	http://www.	0.5	$54.54	$126.58
LE23	35	T8 - 8' 2 Lamp - HO - Electronic Ballast	2	$148.93	F96T8/HO-86W	$22.35	http://www.	$76.96	http://www.	0.5	$54.54	$74.47
LE24	36	T8 - 8' 4 Lamp - HO- Electronic Ballast	4	$270.60	F96T8/HO-86W	$22.35	http://www.	$153.93	http://www.	0.5	$54.54	$67.65
LF1	37	Remove 2 ft linear fluorescent lamp	1	$27.27						0.50	$54.54	$27.27
LF2	38	Remove 3 ft linear fluorescent lamp	1	$27.27						0.50	$54.54	$27.27
LF3	39	Remove 4 ft linear fluorescent lamp	1	$27.27						0.50	$54.54	$27.27
LF4	40	Remove 8 ft linear fluorescent lamp	1	$27.27						0.50	$54.54	$27.27

Appendix B: TRC Incremental Costs – *Sources - continued*

Metal Halide Lighting

Cost Research

Primary URLs
https://www.accessfixtures.com/
http://www.bulbamerica.com/catalogsearch/result/?q=high+bay+fixtures
http://www.venturelighting.com/On-Line_Catalog.html

Price Points

	Interior	1	2	3	4	5	6
$163.99	100W	163.99					
$190.49	150W	169.99	210.99				
$152.33	175W	189.15					
$166.94	250W	197.99	213.99	224.99	203.95		
$200.49	320W	187.99	212.99				
$217.49	350W	193.99	240.99				
$203.99	400W	185.99	189.99	203.99	212.99	213.99	216.99
$666.66	750W	666.66					
$666.66	875W	666.66					
$278.99	1000W	278.99					

Not finding any 200W fixtures; 300 W fixtures represented by 320W

DEER	2008	2013 (i3%)
175wPSMHMgC208w-Rpl	$135.34	$152.33
250wPSMHMgC288w-Rpl	$148.33	$166.94

escalated @ 3%

Range Avg		Exterior	1	2	3	4	5	6	7	8	9	10
	$145.99	35W	$145.99									
	$166.28	50W	$176.99	$178.99	$147.99	$156.99	$166.99	$167.99	$167.99			
	$162.99	70W	$150.99	$151.99	$155.99	$161.99	$167.99	$169.99	$170.99	$171.99	$163.99	$163.99
$186.93	$166.77	100W	$154.99	$154.99	$164.99	$164.99	$171.99	$172.99	$174.99	$169.99	$170.99	
	$171.13	150W	$147.99	$151.99	$152.99	$153.99	$167.99	$171.99	$250.99			
	$171.99	200W	$171.99									
	$251.99	250W	$247.99	$255.99								
	$258.32	320W	$247.99	$261.99	$264.99							
	$270.49	350W	$251.99	$261.99	$264.99	$302.99						
	$274.32	400W	$261.99	$264.99	$295.99							
$478.85	$539.12	750W	$666.66	$535.70	$415.00							
	$615.99	875W	$599.99	$564.99	$632.99	$665.99						
	$694.32	1000W	$657.99	$701.99	$722.99							

Appendix C: Low-Income Participation in Non-Low-Income Programs

Low-income savings were derived from the following sources:

- Participation by low-income households in other residential programs. Duquesne Light's customer information system includes a "flag" indicating low-income status for households who have been identified as qualified for other low-income programs (e.g., LIURP). When one of these customers participates in a residential Act 129 program the costs and savings associated with their participation are automatically categorized as part of the Low-income Energy Efficiency program (LIEEP). This includes participation by these customers in REEP, RARP, and SEP.
- Participation by low-income households in the utility's Public Agency Partnership Program (PAPP). 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 achieved when additional efficiency measures are installed through the utility's LIURP (e.g., Smart Strip installations performed by LIURP in-home auditors while on site).
- Savings associated with the Upstream Lighting program component of REEP. In early PY5 Navigant conducted a survey of the general residential population that estimated the percentage of efficient lighting purchasers who qualified as low-income (20.4%). Another part of the study estimated the percentage of CFLs and LEDs that were being installed in non-residential facilities (through an in-store intercept survey). As a result of both of these research efforts, percentages were established for allocating total Upstream Lighting program light bulb savings to REEP, LIEEP and the Commercial Umbrella Program. Savings counted for LIEEP include 20.4% of the LED-related savings, and 20.4% of the residential CFL-related savings (i.e., after the appropriate percentage -- 12.55% -- of the total savings have been allocated to the Commercial Umbrella Program. Both the general population survey and the in-store intercept survey were described in Appendix A (Upstream Lighting Evaluation Methodology) of the Duquesne Light Act 129 Program Year 4 evaluation report[31].

[31] Duquesne Light Final Annual Report to the Pennsylvania Public Utilities Commission for the period June 12, 2012 through May 31, 2013, Program Year 4, January 6, 2014.

Appendix D: Residential Lighting Upstream Program Cross-Sector Sales

As noted above in Appendix C, research was conducted early in PY5 to support the evaluation of Duquesne Light's Program Year 4 Upstream Lighting Program component of REEP. Briefly, the research included the following:

- In-store intercept surveys, which 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. From these research results estimates of the percentage of CFLs (12.55%) and LEDs (0%) purchased in the participating retail stores and expected to be installed in non-residential facilities were developed.
- A telephone survey conducted with a random sample of the Duquesne Light residential customer population, screening for those who had recently purchased CFLs or LEDs at retail locations included a series of demographic questions. These questions, including questions about income level and household size, were used to estimate the number of residential efficient light bulb purchasers that qualified as low-income (20.4%).

The tables below show how the energy and demand savings and incentives associated with the PY5 Upstream Lighting program were allocated to REEP, LIEEP and Commercial Umbrella, based on the earlier research effort.

Original results of Upstream Lighting program are shown in table D-1, below:

Table D-1: Measures Counts, Incentives and Initial Savings Estimates, PY5 Upstream Lighting Program

Program Name	Measure Name	Number of Measures	Incentive	kWh	kW
Upstream Lighting Program	CFLs, LEDs	1,553,692	$ 2,380,177.41	60,164,729	2,912

The allocation of bulbs, incentives and savings to each of the three programs was as follows:

- CFL Allocation: 12.55% of CFLs to Commercial, 17.84% (0.204*0.8745) to LIEEP and 69.6% to REEP
- LED allocation: 20.4% of LEDs to LIEEP and 79.6% to REEP

This allocation is shown in Table D-2, below:

Table D-2: Final Measure, Incentive and Savings Allocations, PY5 Upstream Lighting Program

12.55%	C&I/Res Split	20.4%	REEP/LIEEP Split		*With Line Losses
Program	**Number of Measures**	**Incentive**	**Reported Impact (MWh)**	**Reported Impact (MW)**	**Reported Impact* (MW)**
REEP	1,091,626	$ 1,709,659.18	42,307	2.05	2.20
LIEEP	279,764	$ 438,153.86	10,842	0.52	0.56
Commercial Sector Umbrella	182,302	$ 232,364.37	26,400	6.86	7.37

Note that both the energy and demand impacts of the CFLs increase substantially for bulbs that are allocated to the Commercial Sector Umbrella Program, due to their longer hours of use and higher coincidence factor.

The following table shows the distribution of CFLs versus LEDs to each of the three programs:

Table D-3: Final Measure/Incentive/Savings Allocations, by Bulb Type, PY5 Upstream Lighting Program

			MW Reported (without line losses)	
Program	**Number of Measures**	**Incentive**	**Reported Impact (MWh)**	**Reported Impact (MW)***
REEP	**1,091,626**	**$ 1,709,659.18**	**42,307**	**2.05**
CFL	1,011,160	$ 1,288,839.06	38,914	1.88
LED	80,466	$ 420,820.13	3,392	0.16
LIEEP	**279,764**	**$ 438,153.86**	**10,842**	**0.52**
CFL	259,142	$ 330,305.49	9,973	0.48
LED	20,622	$ 107,848.37	869	0.04
Commercial Sector Umbrella	**182,302**	**$ 232,364.37**	**26,400**	**6.86**
CFL	182,302	$ 232,364.37	26,400	6.86
LED	0	$ -	0	0.00

*MW reductions do not include line losses. Multiplying the MW reduction values by Duquesne Light's line loss factor (1.074) yields the MW reductions shown in Table D-2.

More detail on the cross-sector sales analysis and the research conducted to support it appears in the appendix of the Duquesne Light PY4 evaluation report.

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: West Penn, 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 free drivers, free-riders, energy efficiency standards, changes in the level of energy service, and other causes of changes in energy consumption or demand. Net savings are calculated by multiplying verified savings by a NTG ratio.

Net-to-Gross (NTG): A factor representing net program savings divided by gross program savings that is applied to gross program impacts to convert them into net program load impacts.

Nonparticipant: Any consumer who was eligible but did not participate in the subject efficiency program in a given program year.

– O –

Off-Peak Energy kWh Savings: The kWh reduction that occurs during a specified period of off-peak hours for energy savings (see the PA TRM Table 1-1).

On-Peak Energy kWh Savings: The kWh reduction that occurs during a specified period of on-peak hours for energy savings (see the PA TRM Table 1-1).

– P –

Participant: A utility customer partaking in an energy efficiency program, defined as one transaction or one rebate payment in a program. For example, a customer receiving one payment for two measures within one program counts as one participant. A customer receiving two payments in two programs counts as two participants. A customer partaking in one program at two different times receiving two separate payments counts as two participants.

Participant Costs: Costs incurred by a customer participating in an energy efficiency program.

Peak Demand: The maximum level of metered demand during a specified period, such as a billing month or a peak demand period.

Peak Load: The highest electrical demand within a particular period of time. Daily electric peaks on weekdays typically occur in the late afternoon and early evening. Annual peaks typically occur on hot summer days.

Percent of Estimate Committed: The program year-to-date total committed savings as a percent of the savings targets established in each EDC EE&C Plan, calculated by dividing the PYTD total committed by the EE&C Plan program year estimate.

Portfolio: Can be defined as: (1) a collection of programs addressing the same market (e.g., a portfolio of residential programs), technology (e.g., motor efficiency programs), or mechanisms (e.g., loan programs); or (2) the set of all programs conducted by one or more organizations, such as a utility or program administrator, and which could include programs that cover multiple markets, technologies, etc.

Precision: An indication of the closeness of agreement among repeated measurements of the same physical quantity. It is also used to represent the degree to which an estimated result in social science (e.g., energy savings) would be replicated with repeated studies.

Preliminary Program Year-to-Date (PYTD) Net Impact: Net impacts reported in quarterly reports. These net impacts are preliminary in that they are based on preliminary realization rates.

Preliminary Program Year-to-Date (PYTD) Verified Impact: Verified impacts reported in quarterly reports. These verified impacts are preliminary in that they are based on preliminary realization rates.

Preliminary Realization Rate: Realization rates reported in quarterly reports based on the results of M&V activities conducted on the sample to date. These results are preliminary because the sample-to-date is likely not to have met the required levels of confidence and precision.

Prescriptive Program: An energy efficiency program focused on measures that are one-for-one replacements of the existing equipment and for which anticipated similar savings results across participants.

Process Evaluation: A systematic assessment of an energy efficiency program for the purposes of documenting program operations at the time of the examination and identifying and recommending improvements to increase the program's efficiency or effectiveness for acquiring energy resources, while maintaining high levels of participant satisfaction.

Program Administrator: Those entities that oversee the implementation of energy efficiency programs. This generally includes regulated utilities, other organizations chosen to implement such programs, and state energy offices.

Program Year Energy Savings Target: Energy target established for the given program year as approved in each EDC EE&C Plan.

Program Year Sample Participant Target: Estimated sample size for evaluation activities in the given program year.

Program Incentive: An incentive, generally monetary, that is offered to a customer through an energy efficiency program to encourage their participation. The incentive is intended to overcome one or more barriers that keep the customer from taking the energy efficiency action on their own.

Program Participant: A consumer that received a service offered through an efficiency program in a given program year. The term "service" can refer to one or more of a wide variety of services, including financial rebates, technical assistance, product installations, training, energy efficiency information, or other services, items, or conditions.

Program Year-to-Date (PYTD): Beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30).

Program Year-to-Date (PYTD) Net Impact: The total change in load that is attributable to an energy efficiency program from June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30).

Program Year-to-Date (PYTD) Participants: The number of utility customers participating in an energy efficiency program beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30).

Program Year-to-Date (PYTD) Reported Gross Impact: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency

program, regardless of why they participated, beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30). This value is unverified by an independent third-party evaluator.

Program Year-to-Date (PYTD) Sample Participants: Total participant sample beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30).

Program Year-to-Date (PYTD) Total Committed: The estimated gross impacts, including reported impacts and in-progress impacts, beginning June 1 of the current program year through the end of the current quarter (February 28/29, May 31, August 31, or November 30), calculated by adding PYTD reported gross impacts for projects in progress.

Project: An activity or course of action involving one or multiple energy efficiency measures at a single facility or site.

Projects in Progress: Energy efficiency and demand response projects currently being processed and tracked by the EDC, but that are not yet complete at the time of the report. See *Completed Project*.

– Q –

– R –

Realization Rate: The term is used in several contexts in the development of reported program savings. The primary applications include the ratio of project tracking system savings data (e.g., initial estimates of project savings) to savings that: 1) are adjusted for data errors, and 2) incorporate the evaluated or verified results of the tracked savings.

Rebate Program: An energy efficiency program in which the program administrator offers a financial incentive for the installation of energy-efficient equipment.

Rebound Effect: Also called "snap back," defined as a change in energy-using behavior that yields an increased level of service that is accompanied by an increase in energy use and occurs as a result of taking an energy efficiency action. The result of this effect is that the savings associated with the direct energy efficiency action are reduced by the resulting behavioral change.

Regression Analysis: Analysis of the relationship between a *dependent variable* (response variable) to specified *independent variables* (explanatory variables). The mathematical model of their relationship is the *regression equation*.

Regression Model: A mathematical model based on statistical analysis where the dependent variable is quantified based on its relationship to the independent variables that are believed to determine its value. In so doing, the relationship between the variables is estimated statistically from the data used.

Reliability: The quality of a measurement process that would produce similar results on: (1) repeated observations of the same condition or event, or (2) multiple observations of the same condition or event by different observers.

Renewable Energy: Energy derived from resources that are naturally replenishing. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy resources include biomass, hydro, geothermal, solar, wind, ocean thermal, wave action, and tidal action.

Reported Gross Impact: The change in energy consumption and/or demand that results directly from program-related actions taken by participants in an efficiency program, regardless of why they participated. This value is unverified by an independent third-party evaluator. Also referred to as "ex post" impact.

Reporting Period: The time following implementation of an energy efficiency activity during which results are to be determined.

Representative Sample: A sample that has approximately the same distribution of characteristics as the population from which it was drawn.

Rigor: The level of effort expended to minimize uncertainty due to factors such as sampling error and bias. The higher the level of rigor, the more confidence there is that the results of the evaluation are accurate and precise.

– S –

Sample: In program evaluation, a portion of the population selected to represent the whole. Differing evaluation approaches rely on simple or stratified samples (based on some characteristic of the population).

Sample Design: The approach used to select the sample units.

Sampling Error: The error in estimating a parameter caused by the fact that all of the disturbances in the sample are not zero.

Savings Factor (SVG): The percent of time the lights are off due to lighting controls relative to the baseline controls system (typically a manual switch). Also referred to as the *lighting controls savings factor*.

Simple Random Sample: A method for drawing a sample from a population such that all samples of a given size have an equal probability of being drawn.

Snap Back: See *Rebound Effect*.

Simulation Model: An assembly of algorithms that calculate energy use based on engineering equations and user-defined parameters.

Spillover: Reductions in energy consumption and/or demand caused by the presence of an energy efficiency program, beyond the program-related gross savings of the participants and without financial or technical assistance from the program. There can be participant and/or nonparticipant spillover. *Participant spillover* is the additional energy savings that occur when a program participant independently installs energy efficiency measures or applies energy-saving practices after having participated in the efficiency program as a result of the program's influence. *Nonparticipant spillover* refers to energy savings that occur when a program nonparticipant installs energy efficiency measures or applies energy-saving practices as a result of a program's influence.

Spillover Rate: An estimate of energy savings attributable to spillover effects expressed as a percent of savings installed by participants through an energy efficiency program.

Standard Error: A measure of the variability in a data sample indicating how far a typical data point is from the mean of a sample. In a large sample, approximately two-thirds of observations lie within one standard error of the mean, and 95% of observations lie within two standard errors.

Statistically Adjusted Engineering Models: A category of statistical analysis models that incorporate the engineering estimate of savings as a dependent variable. The regression coefficient in these models is the percentage of the engineering estimate of savings observed in changes in energy usage. For example, if the coefficient of the statistically adjusted engineering term is 0.8, the customers are, on average, realizing 80% of the savings from their engineering estimates.

Stipulated Values: See *Deemed Savings*.

Stratified Random Sampling: The population is divided into subpopulations, called *strata*, that are non-overlapping and together comprise the entire population. A simple random sample of each stratum is taken to create a sample based on stratified random sampling.

Stratified Ratio Estimation: A sampling method that combines a stratified sample design with a ratio estimator to reduce the coefficient of variation by using the correlation of a known measure for the unit (e.g., expected energy savings) to stratify the population and allocate a sample from the strata for optimal sampling.

– T –

Takeback Effect: See *Rebound Effect*.

Total Resource Cost (TRC) Test: A cost-effectiveness test that measures the net direct economic impact to the utility service territory, state, or region. The TRC Order details the method and assumptions to be used when calculating the TRC Test for EE&C portfolios implemented under Act 129. The results of the TRC Test are to be expressed as both a net present value and a benefit-cost ratio.

Total Resource Cost (TRC) Test Benefits: Benefits calculated in the TRC Test that include the avoided supply costs, such as the reduction in transmission, distribution, generation, and capacity costs, valued at a marginal cost for the periods when there is a consumption reduction. The PA TRC benefits will consider avoided supply costs, such as the reduction in forecasted zonal wholesale electric generation prices, ancillary services, losses, generation capacity, transmission capacity, and distribution capacity. The avoided supply costs will be calculated using net program savings, defined as the savings net of changes in energy use that would have happened in the absence of the program. The persistence of savings over time will also be considered in the net savings.

Total Resource Cost (TRC) Test Costs: The costs calculated in the TRC Test will include the costs of the various programs paid for by an EDC (or by a default service provider) and the participating customers, and costs that reflect any net change in supply costs for the periods in which consumption is increased in the event of load shifting. Note that the TRC Test should use the incremental costs of services and equipment. Thus, for example, this would include costs for equipment, installation, operation and maintenance, removal (less salvage value), and administrative tasks, regardless of who pays for them.

– U –

Uncertainty: The range or interval of doubt surrounding a measured or calculated value within which the true value is expected to fall with some degree of confidence.

Upstream Program: A program that provides information and/or financial assistance to entities in the delivery chain of high-efficiency products at the retail, wholesale, or manufacturing level. Such a program is intended to yield lower retail prices for the products.

– V –

Verification: An independent assessment of the reliability (considering completeness and accuracy) of claimed energy savings or an emissions source inventory.

Verified Gross Impact: Calculated by applying the realization rate to reported gross impacts. Also referred to as "ex ante" impact.

– W –

Watt: A unit of measure of electric power at a point in time as capacity or demand. One Watt of power maintained over time is equal to one Joule per second. The Watt is named after Scottish inventor James Watt, and is shortened to W and used with other abbreviations, as in kWh (kilowatt-hours).

Watt-Hour: One Watt of power expended for one hour, or one-thousandth of a kilowatt-hour.

Whole-Building Calibrated Simulation Approach: A savings measurement approach (defined in the International Performance Measurement and Verification Protocol Option D and in the American Society of Heating, Refrigerating and Air-Conditioning Engineers Guideline 14) that involves the use of an approved computer simulation program to develop a physical model of the building in order to determine energy and demand savings. The simulation program is used to model the energy used by the facility before and after the retrofit. The pre- or post-retrofit models are developed by calibration with measured energy use, demand data, and weather data.

Whole-building Metered Approach: A savings measurement approach (defined in the International Performance Measurement and Verification Protocol Option C and in the American Society of Heating, Refrigerating and Air-Conditioning Engineers Guideline 14) that determines energy and demand savings through the use of whole-facility energy (end-use) data, which may be measured by utility meters or data loggers. This approach may involve the use of monthly utility billing data or data gathered more frequently from a main meter.

– X –

– Y –

– Z –

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.