Final Annual Report
to the
Pennsylvania Public Utility Commission

For the Period
June 2012 through May 2013
Program Year 4

For Pennsylvania Act 129 of 2008
Energy Efficiency and Conservation Plan

Prepared by Navigant Consulting, Inc.

For

Duquesne Light

Revised January 6, 2014

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Acronyms

C&I	Commercial and Industrial
CATI	Computer-Aided Telephone Interview
CFL	Compact Fluorescent Lamp
CPITD	Cumulative Program/Portfolio Inception to Date
CPITD-Q	Cumulative Program/Portfolio Inception through Current Quarter
CSP	Conservation Service Provider or Curtailment Service Provider
CVR	Conservation Voltage Reduction
CVRf	Conservation Voltage Reduction factor
DLC	Direct Load Control
DR	Demand Response
EDC	Electric Distribution Company
EE&C	Energy Efficiency and Conservation
EM&V	Evaluation, Measurement, and Verification
GNI	Government, Non-Profit, Institutional
HVAC	Heating, Ventilating, and Air Conditioning
IQ	Incremental Quarter
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
PA PUC	Pennsylvania Public Utility Commission
PY1	Program Year 2009, from June 1, 2009 to May 31, 2010
PY2	Program Year 2010, from June 1, 2010 to May 31, 2011
PY3	Program Year 2011, from June 1, 2011 to May 31, 2012
PY4	Program Year 2012, from June 1, 2012 to May 31, 2013
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 critical to understanding values presented in this report. For other definitions, please refer to the Act 129 glossary.

REPORTING PERIODS

Cumulative Program Inception to Date (CPITD)
Refers to the period of time since the start of the Act 129 programs. CPITD is calculated by totaling all program year results, including the current program year to date results. For example, CPTID results for PY4 Q3 is the sum of PY1, PY2, PY3, PY4 Q1, PY4 Q2, and PY4 Q3 results.

Incremental Quarter (IQ)
Refers to the current reporting quarter only. Activities occurring during previous quarters are not included. For example, IQ results for PY4 Q3 will only include results that occurred during PY4 Q3 and not PY4 Q2.

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 PY4 Q3 will only include results that occurred during PY4 Q1, PY4 Q2, and PY4 Q3. It will not include results from PY1, PY2 and PY3.

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 EDC or the program implementer). Also known as *ex-ante*, or “before the fact” (using the annual evaluation activities as the reference point).

Verified Gross
Refers to results of the program or portfolio determined by the evaluation activities. Also known as *ex-post*, or “after the fact” (using the annual evaluation activities as the reference point).

TRC COMPONENTS[1]

Administration Costs
Includes the administrative CSP (rebate processing), tracking system, and general administration and clerical costs.

EDC Costs
Per the 2011 Total Resource Cost Test Order, the Total EDC Costs refer to EDC incurred expenditures only.

Management Costs
Includes the EDC program management, CSP program management, general management oversight and major accounts.

Participant Costs
Per the 2011 Total Resource Cost Test Order, the net participant costs are the costs for the end use customer.

Total TRC Costs
Total TRC Costs includes EDC Evaluation Costs, Total EDC Costs and Participant Costs.

Total TRC 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.

[1] All TRC definitions are subject to the 2011 Total Resource Cost Test Order.

1 Overview of Portfolio

Pennsylvania Act 129 of 2008 signed on October 15, 2008 mandated energy savings and coincident peak demand reduction goals for the largest electric distribution companies (EDCs) in Pennsylvania. Each EDC submitted energy efficiency and conservation (EE&C) plans—which were approved by the Pennsylvania Public Utility Commission (PA PUC)—pursuant to these goals. This report documents the progress and effectiveness of the EE&C accomplishments for Duquesne Light Company (DLC) in the 4th quarter of Program Year 4 (PY4), defined as June 1, 2012 through May 31, 2013, as well as the cumulative accomplishments of the programs since inception.

Navigant Consulting, Inc. has evaluated the programs, which included measurement and verification of the savings. The final verified savings for PY4 and the cumulative verified savings since inception of the programs are included in this final annual report.

This report is organized into two major sections. The first section provides an overview of activities for the entire portfolio. This includes summary information and portfolio level details regarding the progress towards compliance goals, energy and demand impacts, net-to-gross ratios, finances, and cost-effectiveness. The following sections include program specific details, including program updates, impact evaluation findings, and process evaluation findings.

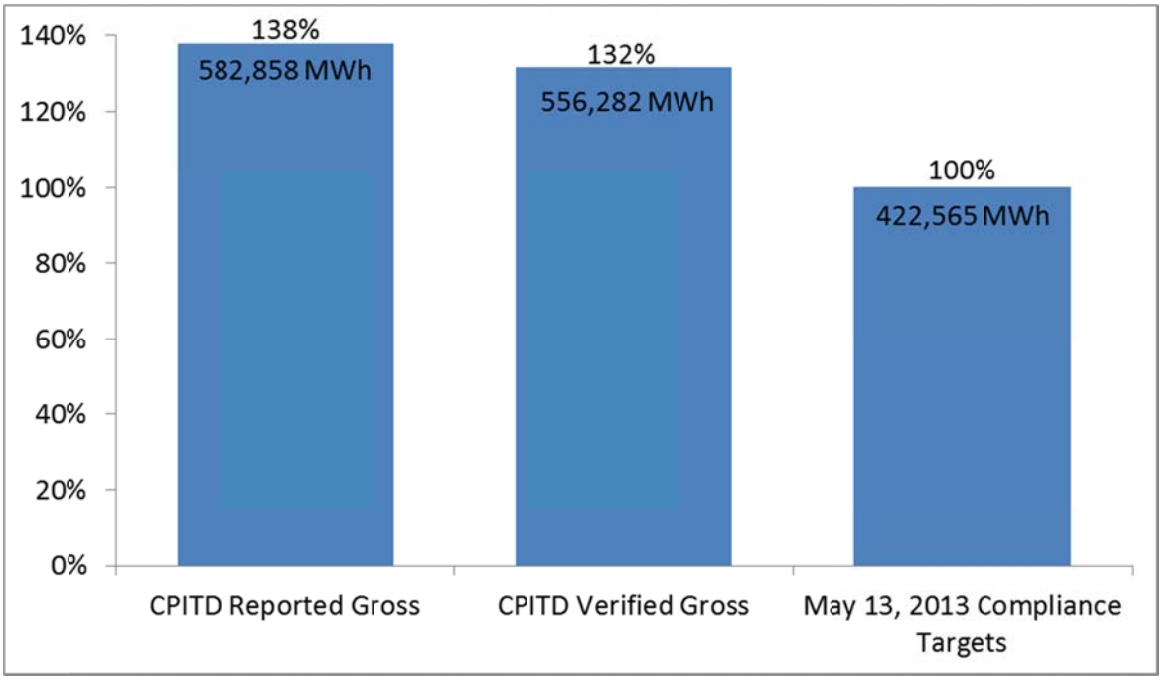
1.1 Summary of Progress Toward Compliance Targets

The energy savings[2] compliance target for Duquesne Light is 422,565 MWh/yr and must be achieved by May 31, 2013 per Act 129. Based on CPITD verified gross energy savings[3], Duquesne Light has achieved 132% percent of the energy savings compliance target. These figures are shown in Figure 1-1. The PUC will determine compliance using CPITD verified gross energy savings.

[2] Herein, energy savings refers to annualized energy savings and is measured in kWh/year or MWh/year. Energy savings are reported at the meter.

[3] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated.

Figure 1-1: Portfolio CPITD Energy Savings[4]



A line loss factor of 1.074 has been used in calculations of all demand savings for Duquesne Light to gross up demand savings from the meter level to the system level. The system peak demand reduction[5] compliance target for Duquesne Light is 113 MW per Act 129 and must be achieved by May 31, 2013. Duquesne Light has achieved 123 percent of the demand reduction compliance target during the Top 100 Hours of 2012 based only on installations in place and generating demand reductions during those hours. Including demand reductions occurring after the top 100 hours, Duquesne Light achieved 141 percent of the demand reduction compliance target based on CPITD verified gross demand reduction[6] achieved through Quarter 4 (CPITD-Q), as shown in Figure 1-2. The PUC will determine compliance using CPITD verified gross demand reduction during the Top 100 Hours.

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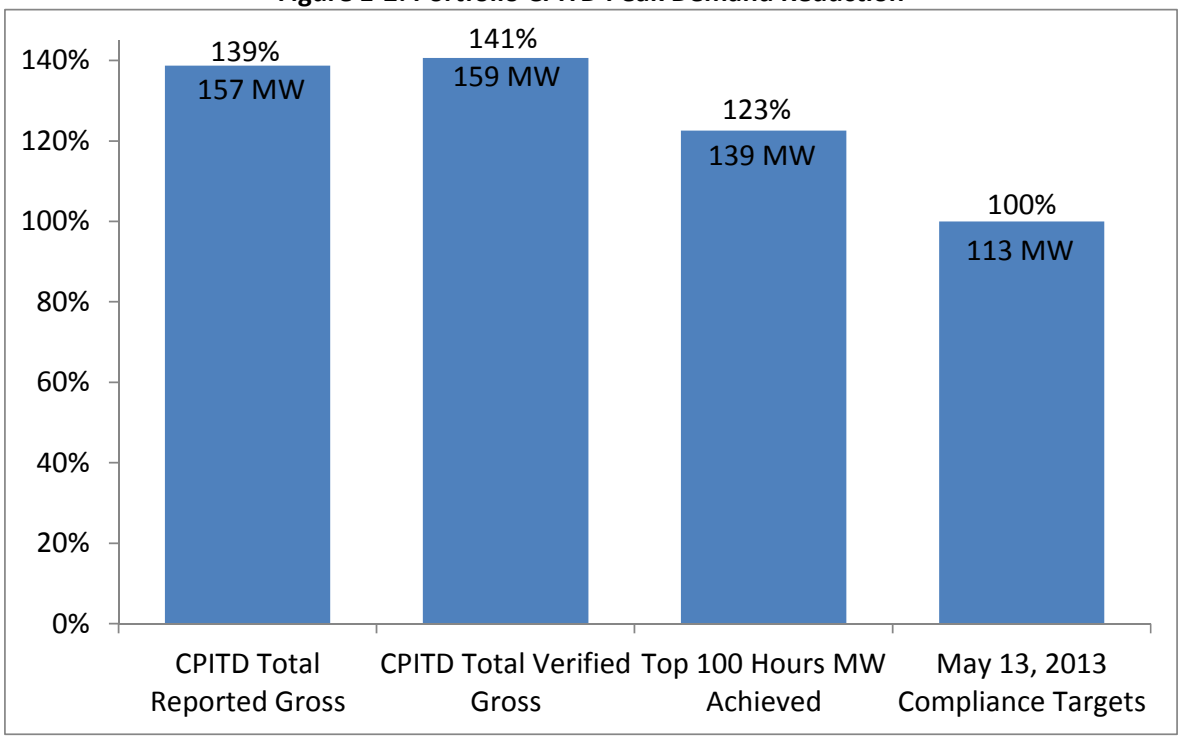
4 For PY4, verification rates used for the School Energy Pledge program (SEP) were based on the verification rates estimated for PY3 (63% for energy savings and 67% for demand reduction). Additional field verification of PY4 was not undertaken because: (1) verification rates for PY2 and PY3 were essentially the same; (2) there were no program changes which might lead to changes in installation of distributed measures; and (3) the very small savings and budgets for this program. Based on these considerations, the value of the information did not justify additional field work for PY4 for this small program.

[5] Herein, demand reduction refers to the EDC's system peak demand reduction in the EDC's top 100 hours of highest demand, as defined by the PA PUC and is measured in kW or MW.

[6] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated.

Figure 1-2: Portfolio CPITD Peak Demand Reduction



Act 129 mandates that the number of measures offered to the low-income sector be proportionate to the low-income sector's share of total energy usage.[7] There are 8 measures available to the low-income sector. The measures offered to the low-income sector therefore comprise 16 percent of the total of 51 measures offered to Duquesne Light customers. This exceeds the fraction of the electric consumption of the utility's low-income households divided by the total electricity consumption in the Duquesne Light territory (7.88 percent). These values are shown in Table 1-1.

Table 1-1: Low-Income Sector Compliance Metrics

	Low-Income Sector	All Sectors	% Low-Income
# of Measures Offered	8	51	15.7%
Electric Consumption (MWh/yr)[8]	1,092,156	13,860,634	7.88%

[7] Act 129 includes a provision requiring electric distribution companies to offer a number of energy conservation 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). The legislation contains no provisions regarding targets for participation, or energy or demand savings.

[8] Act 129 Low Income Working Group Report, Docket Number M-2009-2146801, March 2010, page 6.

The CPITD reported gross energy savings for low-income sector programs (excluding low-income participation in non-low-income programs) is 0 MWh/yr.

Including low-income customer participation in non-low-income programs, the CPITD reported gross energy savings achieved is 41,358 MWh/yr; this is 7.1 percent of the CPITD total portfolio reported gross energy savings.

The CPITD verified gross energy savings achieved for low-income programs (excluding low-income participation in non-low-income programs) is 0 MWh/yr.[9]

Including low-income customer participation in non-low-income programs, the CPITD reported verified energy savings achieved is 39,589 MWh/yr; this is 7.1 percent of the CPITD total portfolio verified gross energy savings.[10] [11]

[9] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated.

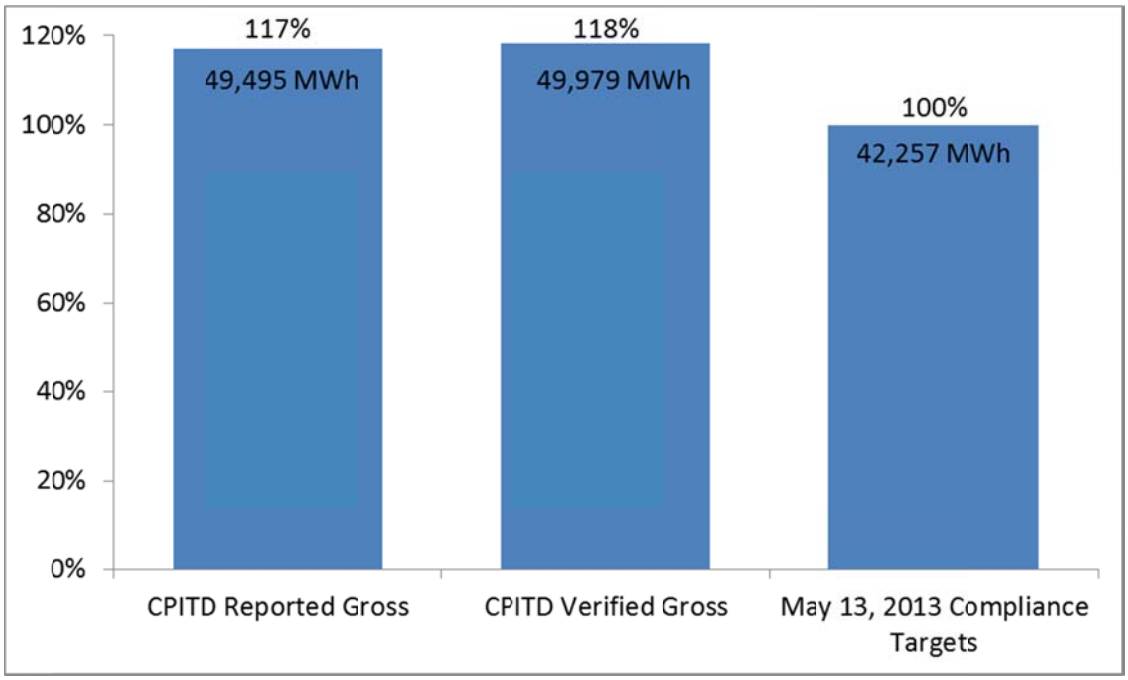
[10] Low Income customer accounts are identified in the Duquesne Light customer information system. When a customer participates in an Act 129 program and the customer information system indicates that the customer represents a low-income household, the customer's savings and related costs are tracked as low-income program savings and costs. For the upstream lighting program, customer account numbers are not obtained. The method for determining low income participation in the upstream Lighting program is outlined in Appendix A.

[11] The estimated cost of low-income savings from non-low-income programs is $1.4 million.

Act 129 mandates that a minimum of 10% of the required energy and demand targets be obtained from units of federal, state and local governments, including municipalities, school districts, institutions of higher education and nonprofit entities. Herein, this group is referred to as the government, nonprofit and institutional (GNI) sector.

The energy savings compliance target for the GNI sector for Duquesne Light is 42,257 MWh/yr, which must be obtained by May 31, 2013. Based on CPITD verified gross energy savings[12], Duquesne Light achieved 118 percent of the target. These values are shown in Figure 1-3.

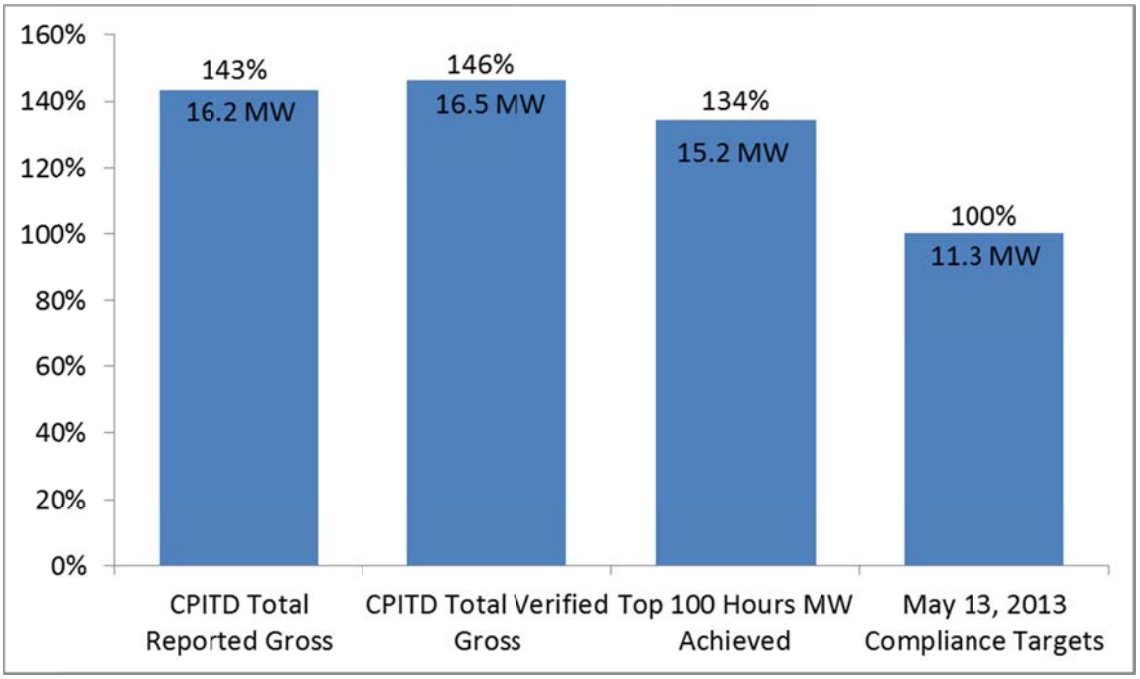
Figure 1-3: GNI CPITD Energy Savings



[12] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated.

The peak demand reduction compliance target for the GNI sector for Duquesne Light is 11.3 MW. Based on CPITD verified gross demand reduction[13], Duquesne Light achieved 134 percent of the target. These values are shown in Figure 1-4**.**

Figure 1-4: GNI CPITD Peak Demand Reduction



According to the Phase II Implementation Order, Duquesne Light is allowed by the PUC to "carry over" MWh savings into Phase 2 of Act 129. Table 1-2 below shows how many MWh of savings from PY4 Duquesne Light will be carrying over into Phase II.

Table 1-2: Savings from PY4 Carried into Phase II

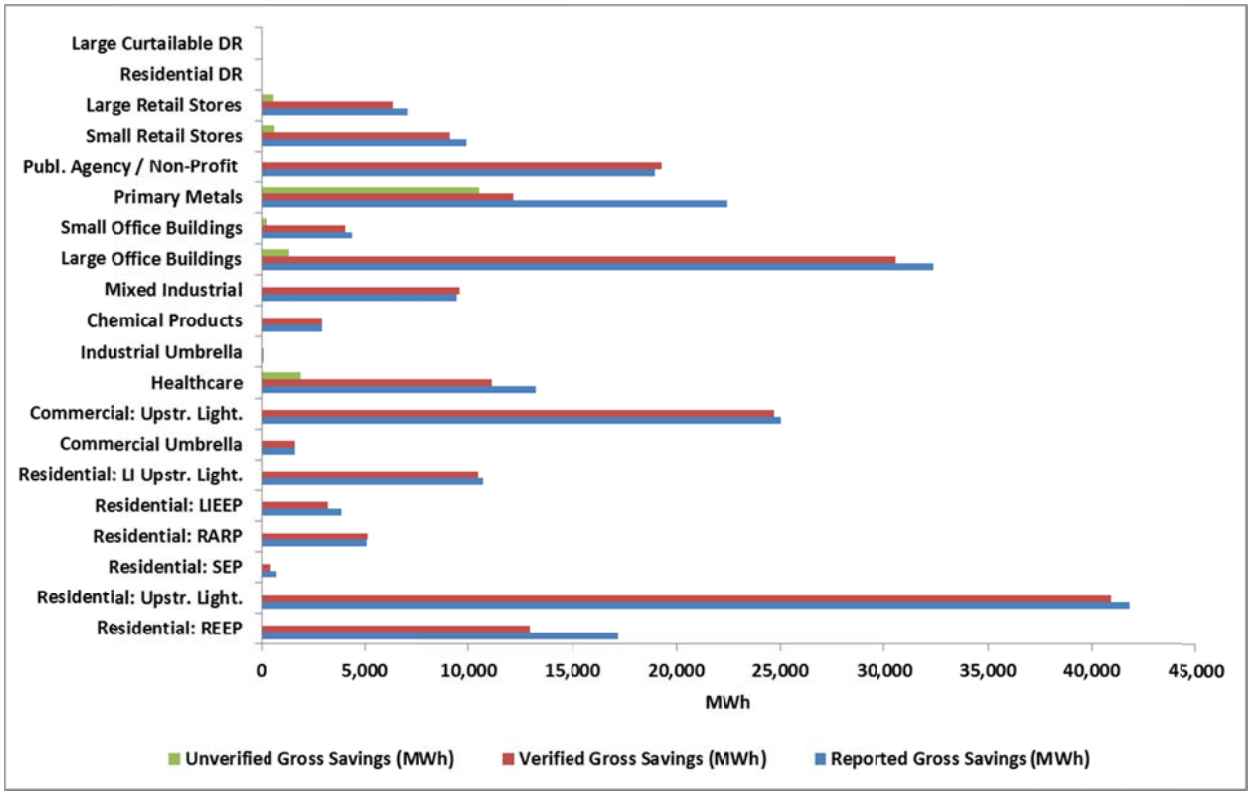
CPITD Verified Savings (MWh/yr)	CPITD Unverified Savings (MWh/yr)	Savings Carried into Phase II (MWh/yr)
556,282	15,436	133,717

[13] See the "Report Definitions" section for an explanation of how CPITD verified gross savings are calculated.

1.2 Summary of Energy Impacts

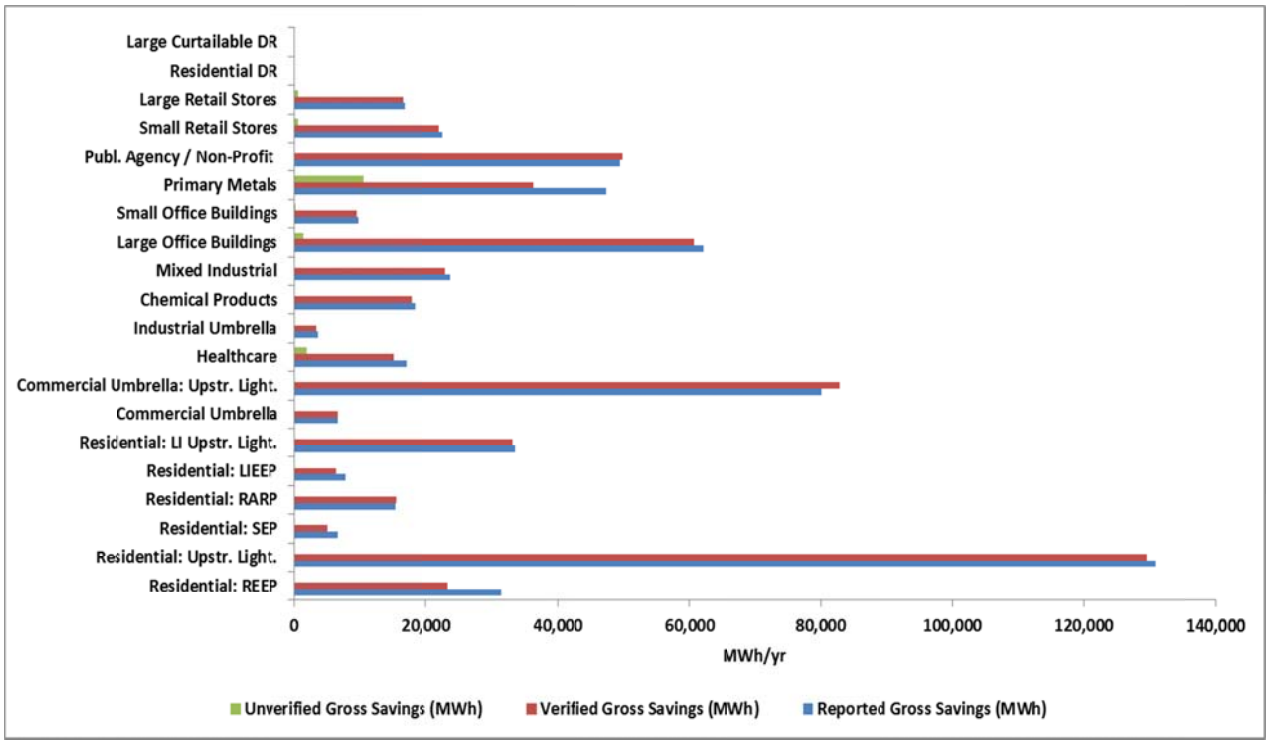
A summary of the reported, verified and unverified energy savings by program for Program Year 4 is presented in Figure 1-5. The "Unverified Gross Savings" values refer to projects that were reported in PY4, but have not been verified at the time of this report.

Figure 1-5: PYTD Gross Energy Savings by Program



A summary of the cumulative reported, verified and unverified energy savings by program is presented in Figure 1-6.

Figure 1-6: CPITD Gross Energy Savings by Program



A summary of energy impacts by program through the PY4Q4 is presented in Table 1-3 and Table 1-4.

Table 1-3: Duquesne Light Reported Participation and Gross Energy Savings by Program

Program	Participants			Reported Gross Impact (MWh)		
	IQ	PYTD	CPITD	IQ	PYTD	CPITD
Residential: EE Program (REEP): Rebate Program	8,564	29,796	65,729	8,601	17,225	31,427
Residential: EE Program (Upstream Lighting)	N/A	N/A	N/A	11,335	41,782	130,775
Residential: School Energy Pledge	1,947	1,947	16,275	756	756	6,620
Residential: Appliance Recycling	539	3,262	9,888	816	5,089	15,372
Residential: Low Income EE	2,350	6,396	14,393	1,621	3,891	7,842
Residential: Low Income EE (Upstream Lighting)	N/A	N/A	N/A	2,905	10,708	33,515
Commercial Sector Umbrella EE	26	55	211	890	1,665	6,552
Commercial Sector Umbrella EE (Upstream Lighting)	N/A	N/A	N/A	6,731	25,030	80,114
Healthcare EE	19	44	66	6,698	13,200	16,980
Industrial Sector Umbrella EE	1	26	34	79	79	3,581
Chemical Products EE	9	27	38	2,095	2,931	18,249
Mixed Industrial EE	39	138	224	4,236	9,453	23,727
Office Building – Large – EE	75	176	290	9,549	32,379	62,088
Office Building – Small EE	48	133	317	1,493	4,413	9,682
Primary Metals EE	18	55	86	12,342	22,491	47,472
Public Agency / Non-Profit	35	178	422	3,085	18,954	49,495
Retail Stores – Small EE	138	320	830	3,627	9,922	22,557
Retail Stores – Large EE	23	83	171	1,647	7,027	16,809
Residential Demand Response	0	1,474	1,474	0	0	0
Large Curtailable Demand Response	0	40	40	0	0	0
TOTAL PORTFOLIO	**13,831**	**44,150**	**110,488**	**78,505**	**226,994**	**582,858**

Table 1-4: Verified Gross Energy Savings by Program

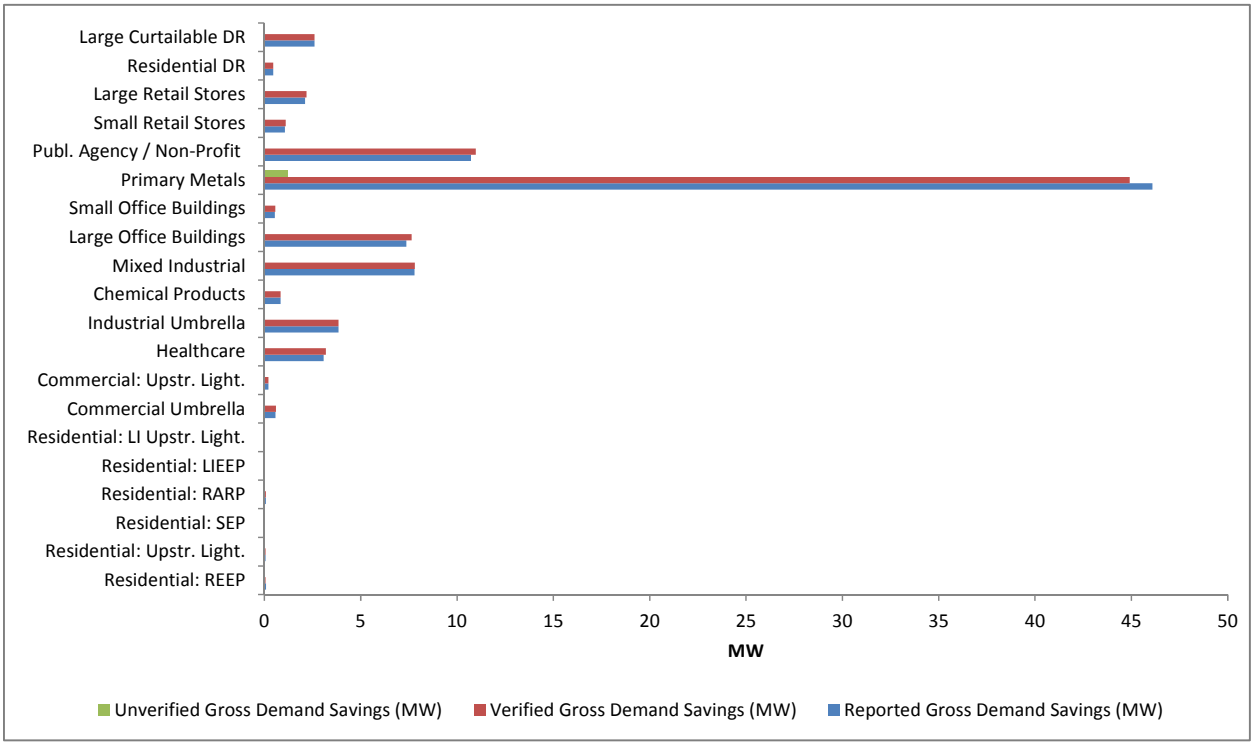
Program	PYTD Reported Gross Energy Savings (MWh/Yr)	PYTD Energy Realization Rate	PYTD Verified Gross Energy Savings (MWh/yr)	PYTD Unverified Gross Energy Savings (MWh/yr)	PYTD Achieved Precision [1]	CPITD Verified Gross Energy Savings (MWh/Year)	CPITD Unverified Gross Energy Savings (MWh/yr)	CPITD Achieved Precision [1]
Residential: EE Program (REEP): Rebate Program	17,225	0.75	12,914		1.6%	23,422		1.5%
Residential: EE Program (Upstream Lighting)	41,782	0.98	40,927			129,472		1.9%
Residential: School Energy Pledge	756	0.63	476		9.0%	5,004		3.8%
Residential: Appliance Recycling	5,089	1.01	5,141		5.4%	15,412		1.7%
Residential: Low Income EE	3,891	0.83	3,224		3.2%	6,408		1.8%
Residential: Low Income EE (Upstream Lighting)	10,708	0.98	10,489			33,181		2.1%
Commercial Sector Umbrella EE	1,665	0.99	1,643		9.3%	6,646		3.4%
Commercial Sector Umbrella EE (Upstream Lighting)	25,030	0.99	24,708		9.3%	82,733		3.6%
Healthcare EE	13,200	0.99	11,106	1,949	9.3%	15,012	1,949	5.0%
Industrial Sector Umbrella EE	79	1.02	81		7.1%	3,305		2.2%
Chemical Products EE	2,931	1.02	2,976		7.1%	17,845		2.7%
Mixed Industrial EE	9,453	1.02	9,598		7.1%	23,015		3.1%
Office Building – Large – EE	32,379	0.99	30,591	1,390	9.3%	60,650	1,390	4.5%
Office Building – Small EE	4,413	0.99	4,077	282	9.3%	9,501	282	3.9%
Primary Metals EE	22,491	1.02	12,150	10,524	7.1%	36,224	10,524	3.1%
Public Agency / Non-Profit	18,954	1.02	19,404	18	8.6%	49,979	18	4.6%
Retail Stores – Small EE	9,922	0.99	9,144	659	9.3%	22,020	659	4.1%
Retail Stores – Large EE	7,027	0.99	6,331	613	9.3%	16,454	613	3.6%
Residential Demand Response	0	N/A	0		N/A	0		N/A
Large Curtailable Demand Response	0	N/A	0		N/A	0		N/A
TOTAL PORTFOLIO	**226,994**	**0.97**	**204,981** [2]	**15,436**	**4.1%**	**556,282**	**15,436**	**1.5%**

[1] At the 90% Confidence Level
[2] Total verified savings sums program verified savings. Realization rate applied to reported values excluding unverified 15,436 MWh.

1.3 Summary of Demand Impacts

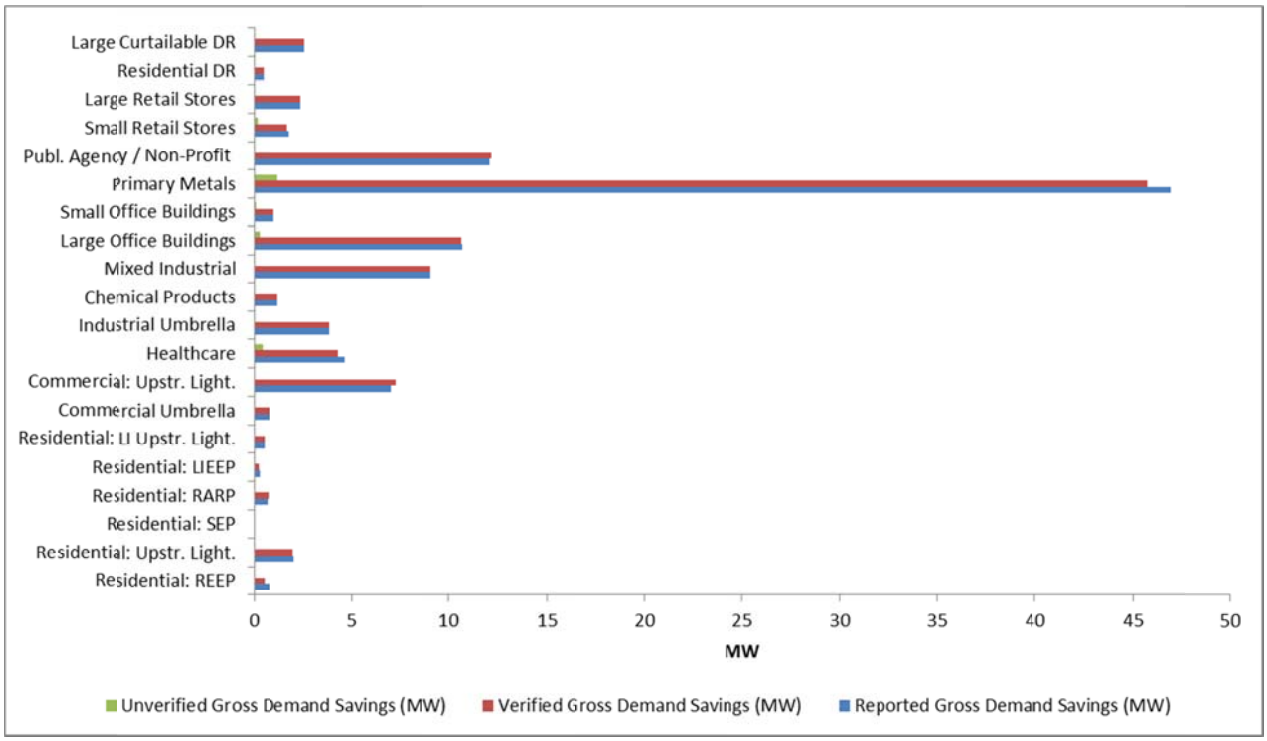
A summary of the reported and verified demand reduction by program within the top 100 hours for the program year is presented in Figure 1-7.

Figure 1-7: PYTD Reported Demand Reduction by Program (Top 100 Hours)



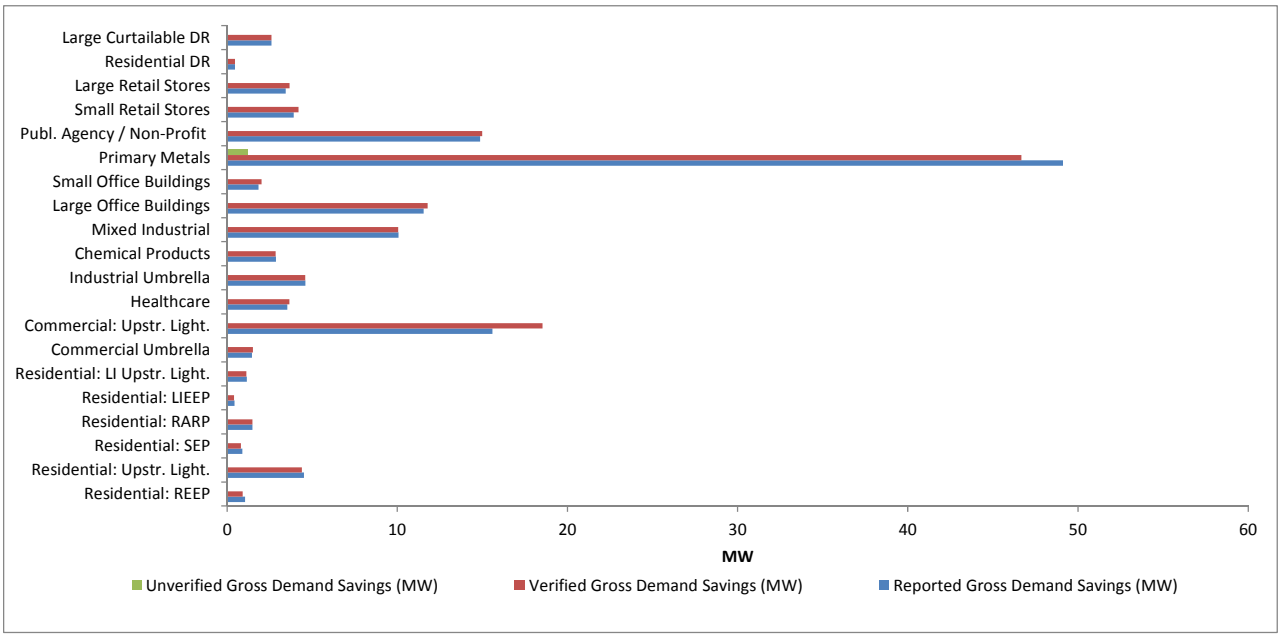
A summary of the reported, verified and unverified demand reduction by program including all MW savings for the program year is presented in Figure 1-8. The impacts below reflect a line loss factor of 1.074.

Figure 1-8: PYTD Reported Demand Reduction by Program (All MW Savings)



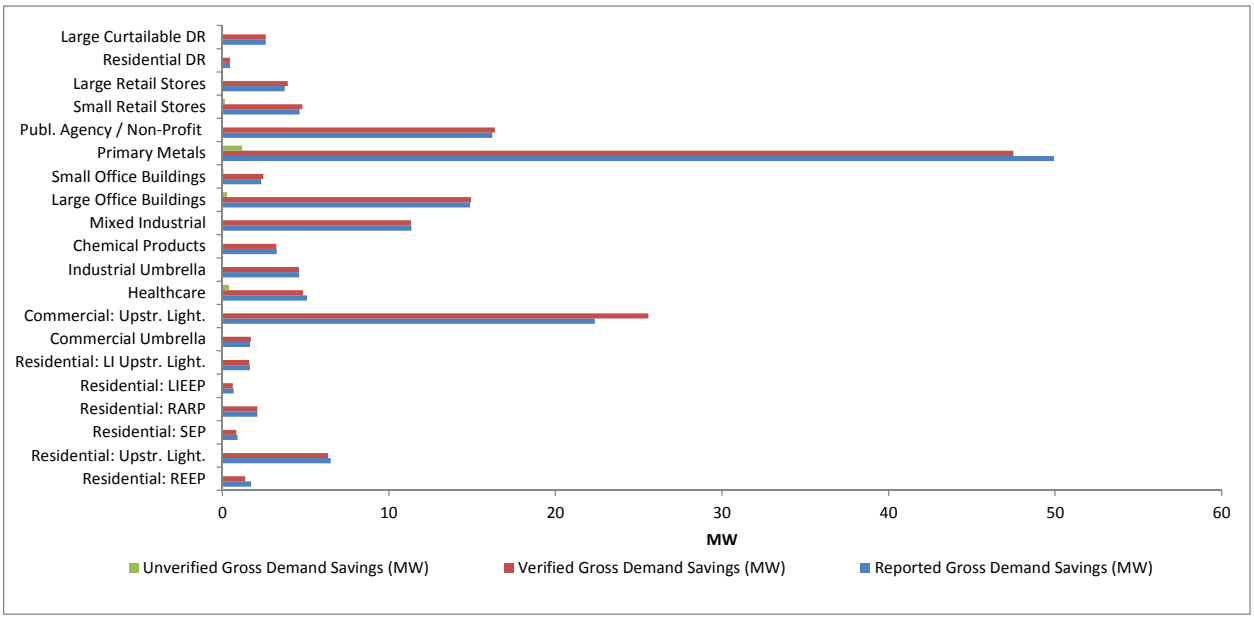
A summary of the cumulative reported and verified demand reduction by program within the top 100 hours is presented in Figure 1-9.

Figure 1-9: CPITD Reported Demand Reduction by Program (Top 100 Hours)



A summary of the cumulative reported, verified and unverified demand reduction by program including all MW savings for the program year is presented in Figure 1-10.

Figure 1-10: CPITD Reported Demand Reduction by Program (All MW Savings)



A summary of demand reduction impacts by program through PY4Q4 is presented in Table 1-5, Table 1-6 and Table 1-7.

Table 1-5: EDC Reported Participation and Gross Demand Reduction by Program

Program	Participants			Reported Gross Impact (MW)		
	IQ	PYTD	CPITD	IQ	PYTD	CPITD
Residential: EE Program (REEP): Rebate Program	8,564	29,796	65,729	0.217	0.751	1.729
Residential: EE Program (Upstream Lighting)	N/A	N/A	N/A	0.556	2.049	6.505
Residential: School Energy Pledge	1,947	1,947	16,275	0.022	0.022	0.916
Residential: Appliance Recycling	539	3,262	9,888	0.109	0.684	2.107
Residential: Low Income EE	2,350	6,396	14,393	0.072	0.274	0.678
Residential: Low Income EE (Upstream Lighting)	N/A	N/A	N/A	0.142	0.525	1.667
Commercial Sector Umbrella EE	26	55	211	0.111	0.767	1.660
Commercial Sector Umbrella EE (Upstream Lighting)	N/A	N/A	N/A	1.880	6.991	22.376
Healthcare EE	19	44	66	1.331	4.623	5.088
Industrial Sector Umbrella EE	1	26	34	0.012	3.857	4.615
Chemical Products EE	9	27	38	0.300	1.231	3.270
Mixed Industrial EE	39	138	224	0.843	9.069	11.351
Office Building – Large – EE	75	176	290	2.200	10.687	14.879
Office Building – Small EE	48	133	317	0.405	1.030	2.337
Primary Metals EE	18	55	86	1.504	46.912	49.932
Public Agency / Non-Profit	35	178	422	1.202	12.071	16.205
Retail Stores – Small EE	138	320	830	0.828	1.792	4.642
Retail Stores – Large EE	23	83	171	0.255	2.405	3.750
Residential Demand Response	0	1,474	1,474	0.000	0.465	0.465
Large Curtailable Demand Response	0	40	40	0.000	2.602	2.602
TOTAL PORTFOLIO	**13,831**	**44,150**	**110,488**	**11.990**	**108.805**	**156.774**

Table 1-6: PYTD Verified Gross Demand Reduction in the Top 100 Hours by Program

Program	PYTD Reported Gross Demand Savings (MW)	PYTD Demand Realization Rate	PYTD Verified Gross Demand Savings (MW)	PYTD Achieved Precision [1]	CPITD Verified Gross Demand Savings (MW/Year)	CPITD Achieved Precision [1]
Residential: EE Program (REEP): Rebate Program	0.077	0.68	0.053	0.7%	0.918	1.4%
Residential: EE Program (Upstream Lighting)	0.060	0.98	0.059	0.7%	4.403	1.5%
Residential: School Energy Pledge	0.000	0.67	0.000	10.3%	0.821	2.4%
Residential: Appliance Recycling	0.064	1.01	0.065	4.9%	1.489	1.4%
Residential: Low Income EE	0.025	0.87	0.022	3.8%	0.406	1.8%
Residential: Low Income EE (Upstream Lighting)	0.015	0.98	0.015	3.8%	1.128	2.1%
Commercial Sector Umbrella EE	0.576	1.04	0.599	7.9%	1.538	4.9%
Commercial Sector Umbrella EE (Upstream Lighting)	0.205	1.04	0.213	7.9%	18.533	4.8%
Healthcare EE	3.074	1.04	3.194	7.9%	3.720	4.8%
Industrial Sector Umbrella EE	3.845	1.00	3.847	0.1%	4.596	2.0%
Chemical Products EE	0.831	1.00	0.832	0.1%	2.846	2.6%
Mixed Industrial EE	7.795	1.00	7.798	0.1%	10.056	1.3%
Office Building – Large – EE	7.360	1.04	7.646	7.9%	11.946	4.7%
Office Building – Small EE	0.538	1.04	0.559	7.9%	2.020	4.6%
Primary Metals EE	46.097	1.00	44.995	0.1%	47.980	1.4%
Public Agency / Non-Profit	10.727	1.02	10.989	1.7%	15.174	2.7%
Retail Stores – Small EE	1.061	1.04	1.102	7.9%	4.200	4.8%
Retail Stores – Large EE	2.106	1.04	2.188	7.9%	3.715	4.4%
Residential Demand Response	0.465	1.00	0.465	0.0%	0.465	0.0%
Large Curtailable Demand Response	2.602	1.00	2.602	0.0%	2.602	0.0%
TOTAL PORTFOLIO	**87.526**	**1.01**	**87.242**	**2.1%**	**138.556**	**2.9%**
[1] At 90% Confidence Level						

Table 1-7: PYTD Total Verified Gross Demand Reduction by Program

Program	PYTD Reported Gross Demand Savings (MW)	PYTD Demand Realization Rate	PYTD Verified Gross Demand Savings (MW)	PYTD Unverified Gross Demand Savings (MW)	PYTD Achieved Precision [1]	CPITD Verified Gross Demand Savings (MW/Year)	CPITD Unverified Gross Demand Savings (MW/Year)	CPITD Achieved Precision [1]
Residential: EE Program (REEP): Rebate Program	0.751	0.68	0.512		0.7%	1.378		1.4%
Residential: EE Program (Upstream Lighting)	2.049	0.98	2.007		0.7%	6.351		1.5%
Residential: School Energy Pledge	0.022	0.67	0.014		10.3%	0.835		2.4%
Residential: Appliance Recycling	0.684	1.01	0.691		4.9%	2.116		1.4%
Residential: Low Income EE	0.274	0.87	0.238		3.8%	0.622		1.8%
Residential: Low Income EE (Upstream Lighting)	0.525	0.98	0.514		3.8%	1.628		2.1%
Commercial Sector Umbrella EE	0.767	1.04	0.797		7.9%	1.736		4.9%
Commercial Sector Umbrella EE (Upstream Lighting)	6.991	1.04	7.262		7.9%	25.582		4.8%
Healthcare EE	4.623	1.04	4.383	0.403	7.9%	4.910	0.403	4.8%
Industrial Sector Umbrella EE	3.857	1.00	3.858		0.1%	4.607		2.0%
Chemical Products EE	1.231	1.00	1.231		0.1%	3.246		2.6%
Mixed Industrial EE	9.069	1.00	9.072		0.1%	11.330		1.3%
Office Building – Large – EE	10.687	1.04	10.794	0.297	7.9%	15.094	0.297	4.7%
Office Building – Small EE	1.030	1.04	1.007	0.060	7.9%	2.467	0.060	4.6%
Primary Metals EE	46.912	1.00	45.639	1.290	0.1%	48.623	1.290	1.4%
Public Agency / Non-Profit	12.071	1.02	12.359	0.007	1.7%	16.544	0.007	2.7%
Retail Stores – Small EE	1.792	1.04	1.705	0.150	7.9%	4.804	0.150	4.8%
Retail Stores – Large EE	2.405	1.04	2.447	0.050	7.9%	3.975	0.050	4.4%
Residential Demand Response	0.465	1.00	0.465		0.0%	0.465		0.0%
Large Curtailable Demand Response	2.602	1.00	2.602		0.0%	2.602		0.0%
TOTAL PORTFOLIO	**108.805**	**1.01**	**107.599**	**2.257**	**2.1%**	**158.914**	**2.257**	**2.9%**

[1] At 90% Confidence Level
[2] Total verified savings sums program verified savings. Realization rate applied to Primary Metals value excluding the 1.290 MW in unverified savings.

1.4 Summary of PY4 Net to Gross Ratios

Per the 2011 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 future program planning purposes. Table 1-8 presents a summary of NTG ratios by program.

Table 1-8: PY4 NTG Ratios by Program

Program Name	NTG Ratio PY4	NTG Categories Included[14]
Residential: EE Program (REEP)	62%	Free Ridership, Participant Spillover
Residential School Energy Pledge (SEP)[15]	86%	Free Ridership
Residential: Low Income EE (LIEEP)	56%	Free Ridership, Participant Spillover
Residential: Appliance Recycling (RARP)	76%	Free Ridership, Participant Spillover
Commercial	50%	Free Ridership
Industrial	72%	Free Ridership
PORTFOLIO	**57%**	

[14] For example, free ridership, non-participant spillover, participant spillover.

[15] For PY4, a NTG factor of 86% was used, based on the NTG factor estimated for PY3. Additional field research was not undertaken for PY4 because: (1) surveys were not already being completed for verification purposes in PY4, (2) there were no program changes which might lead to changes in the program NTG factor; and (3) the very small savings and budgets for this program. Based on these considerations, the value of the information did not justify additional field work for PY4.

1.5 Summary of Portfolio Finances and Cost-Effectiveness

A breakdown of the portfolio finances is presented in Table 1-9.

Table 1-9: Summary of Portfolio Finances

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$1,235	$8,801	$23,614
EDC Incentives to Trade Allies	0	0	92
Subtotal EDC Incentive Costs	**1,235**	**8,801**	**23,706**
Design & Development	0	0	3,481
Administration[1]	0	0	0
Management[2]	3,753	12,795	31,551
Marketing	279	866	2,516
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**4,032**	**13,661**	**37,548**
EDC Evaluation Costs	383	1,187	2,516
SWE Audit Costs	226	536	2,178
Total EDC Costs[3]	5,876	24,261	67,049
Participant Costs[4]	0	21,343	59,608
Total TRC Costs[5]	**0**	**46,874**	**110,617**
Total Lifetime Energy & Capacity Benefits		**139,767**	**345,847**
Total TRC Benefits[6]	**N/A**	**139,767**	**345,847**
TRC Ratio[7]	**N/A**	**3.0**	**3.1**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

1.6 Summary of Cost-Effectiveness by Program

TRC ratios are calculated by comparing the total TRC benefits and the total TRC costs. Table 1-10 shows the TRC ratios by program and other factors used in the TRC ratio calculation. Almost all programs are very cost effective. The most cost effective – Commercial Sector Umbrella Program with a benefit/cost ratio of 15.7 – benefitted greatly from the allocation of a portion of the upstream lighting program component savings and costs to this program. The Industrial Sector Umbrella Program was marginally cost effective, though this is a program that allows projects that do not fit neatly into another program to be part of the Act 129 initiative. The Residential Demand Response and Large Curtailable Demand Response Program were clearly not cost effective. However, these programs are not continuing into Phase II.

Table 1-10: PYTD TRC Ratios by Program

Program	TRC Benefits ($1000)	TRC Costs ($1000)	TRC Ratio	Discount Rate	Line Loss Factor
Residential Energy Efficiency (REEP)	21,686	6,473	3.4	6.9%	6.9%
Residential School Energy Pledge Program (SEP)	276	90	3.1	6.9%	6.9%
Residential Appliance Recycling Program (RARP)	2,835	1,276	2.2	6.9%	6.9%
Residential Low-Income Energy Efficiency Program (LIEEP)	5,846	2,209	2.6	6.9%	6.9%
Residential Demand Response	6	79	0.1	6.9%	6.9%
Commercial Sector Umbrella Program (CSUP)	14,344	913	15.7	6.9%	6.9%
Office Buildings – Small	3,603	1,549	2.3	6.9%	6.9%
Office Buildings - Large	26,992	7,861	3.4	6.9%	6.9%
Retail Stores	13,559	5,705	2.4	6.9%	6.9%
Public Agency/Non-profit/Education	18,263	8,383	2.2	6.9%	6.9%
Healthcare	9,358	3,308	2.8	6.9%	6.9%
Industrial Sector Umbrella Program	50	55	0.9	6.9%	6.9%
Mixed Industrial	9,257	2,703	3.4	6.9%	6.9%
Chemicals	2,816	1,031	2.7	6.9%	6.9%
Primary Metals	10,726	4,606	2.3	6.9%	6.9%
Large Curtailable Demand Response	149	633	0.2	6.9%	6.9%
Portfolio	**139,767**	**46,874**	**3.0**	**6.9%**	**6.9%**

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 some cases Smart Strips and Limelight nightlights.

In addition to the equipment rebate and efficiency kit program components, a third REEP program component – an upstream CFL program – was initiated July 2010 with several targeted area retail establishments. This program 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. The evaluation approach and analysis results for the Upstream Lighting program can be found in Appendix A.

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

In PY4, the O-Power component described above was added to the REEP program.

2.2 Impact Evaluation Gross Savings

The Residential Energy Efficiency Program is achieving its goals. By the end of PY4, Duquesne has reported cumulative gross (CPITD) savings totaling 143% of the 113,738 MWh cumulative estimate

projected for Phase I in the Duquesne Light Energy Efficiency and Conservation (EE&C) Plan.[16] Table 2-1 shows REEP savings by quarter for PY4 and the resulting total CPITD.

Table 2-1: CPITD REEP Reported Results by Quarter

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
PY4 Q1	5,727	7,602	0.137	0.407	$409
PY4 Q2	1,008	12,232	0.000	0.625	$886
PY4 Q3	14,467	19,237	0.000	0.995	$967
PY4 Q4	8,564	19,936	0.000	0.773	$778
PY4 Total	**29,796**	**59,007**	**0.137**	**2.800**	**$3,040**
CPITD Total	**65,729**	**162,202**	**5.572**	**8.235**	**$6,103**

Table 2-2: PY4 REEP Program Reported Results by Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	**29,796**	**59,007**	**0.137**	**2.800**	**$3,040**

Measurement and Verification Methodology

Consistent with Duquesne Light's EM&V Plan Sections 2.5 and 2.5.1, 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.

[16] Duquesne Light, Energy Efficiency & Conservation Plan, July 1, 2009 (EE&C Plan). Note that the total Duquesne Act 129 energy savings estimate shown in this plan exceeds Duquesne's total energy savings compliance target by 35%.

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

Step 1. The verification checklist for deemed savings measures includes data downloaded from PMRS and/or taken from hardcopy documentation for each participant installation or can be obtained by telephone or on-site visit. The verification checklist for deemed savings measures includes:

1. Participant has valid utility account number
1. Measure(s) is on approved list and all parameters necessary for calculating savings are present.
2. Proof of purchase identifies qualifying measure and is dated within the period being verified.
3. Rebate payment date is in the current program period being verified (for residential rebates).
4. Unit kWh and kW are correct for each listed measure.
5. Measure was actually installed at the customer site (telephone survey for basic level of rigor).

Step 2. A simple random sample of participants is selected from the PMRS database.

Step 3. Relevant documentation for item #1 through #5 from PMRS or other hardcopy documentation is then obtained for a sample of participants to check against the PMRS records.

Step 4. Because all participants sampled met the criterion of having incentive payments less than $2,000, telephone interviews are 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 5. Using the data collected from program files and telephone surveys, a verification rate (VR) is calculated. The VR 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, the verification rate is calculated for each stratum.

Step 6. The final step involves multiplying each program's verification rate by the total reported savings in the program tracking system for that program, 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 verification rate.

REEP program-specific variances from the six-step approach and program-specific information are outlined below.

REEP Measurement and Verification

Step 1 – Verification Checklist: Performed as described above.

Step 2 – 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

involved 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 verification 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 and O-Power 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 database, i.e., verification of a census of the records. Navigant verified O-Power program impacts using linear fixed effects regression (LFER) analysis applied to monthly billing data for participants and control customers during the pre- and post-program period.

In Duquesne's PY4 Sampling Plan, the annual sample size target for REEP was 70 – including 40 kit participants and 30 rebate participants – with a targeted level of confidence and precision of 9.6%. Table 2-3, below, presents the targeted and achieved sample sizes for the program.

Table 2-3: REEP Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
REEP Kits	Kits	26,844	0.5	85/12	40	40	Telephone verification
REEP Rebates	Rebates	2,896	0.5	85/14	30	70	Telephone verification
Program Total		**29,740**	**n/a**	**85/11**	**70**	**110**	

Step 3 – Measure/Project Qualification: The evaluation team reviewed and confirmed relevant documentation for check list criteria item 1 through 4 described under Step 1 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 PY4 sampled rebate applications and supporting proof or purchase data were requested and reviewed to ensure proof of purchase supported the rebate request. In PY4 no exceptions were noted.

Step 4 – Deemed Savings Verification: The evaluation team compared kWh and kW savings in PMRS against estimates based on the 2012 PA TRM for the REEP program.

Savings for the measures listed below were adjusted in PMRS to be consistent with deemed values and algorithms from the 2012 PA TRM and then became the reported values.

- All Kits
- Energy Star Dehumidifiers
- Energy Star Outdoor Fixtures
- Energy Star Freezers
- Energy Star Refrigerators
- Energy Star Room Air Conditioners
- High Efficiency Showerheads
- Programmable Thermostat
- Whole House Fans (CAC HP Cooling)

Step 5 – 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 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 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 6 – Program Realization Rate: The program realization rate was 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 above) were calculated using the stratified ratio estimation approach,

following the method outline in Lohr (1999)[17]. Aggregation of the variance of each stratum (calculated depending on the assumed distribution type) is also calculated per Lohr (1999).

Navigant verified O-Power program impacts using linear fixed effects regression (LFER) analysis applied to monthly billing data for participants and control customers during the pre- and post-program period. The realization rate is the ratio of the verified program impacts to those reported by Duquesne.

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. 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. Cross-sector sales to non-residential customers were determined through in-store intercept surveys as described in Appendix A. 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*[18] for these strata. 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 2-4 and Table 2-5.

Table 2-4: PY4 REEP Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings (MWh)	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision (at 85% confidence)	Verified Gross Energy Savings (MWh)
Rebates	712	85%	0.21	20.2%	603
Kits	11,722	66%	0.48	3.4%	7,759
O-Power	4,791	95%	0.12	17%	4,551
Upstream Lighting	41,782	98%	0.00	0.0%	40,927
Program Total	**59,007**	**91%**		**1.5%**	**53,841**

[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 2-5: PY4 REEP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision(at 85% confidence)	Verified Gross Demand Savings
Rebates	0.117	97%	0.21	5.7%	0.113
Kits	0.634	63%	0.58	3.7%	0.399
O-Power	0.000	N/A	0.00	0.0%	0.000
Upstream Lighting	2.049	98%	0.00	0.0%	2.007
Program Total	**2.800**	**90%**		**0.7%**	**2.519**

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 (45%) and Limelights (33%). The Smart strips have a significant impact of the realization rate due to their high reported savings as compared to that of the Limelights.

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."[19] The free ridership assessment presented below provide 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 rebate, efficiency kit and upstream lighting program component participants. Equipment Rebate and Efficiency Kit free ridership estimation follow the same basic approach applied in PY3. The OPower program verified savings estimates are already net of free riders.

Equipment Rebate Free Ridership

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

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. Did the respondent have previous plans to purchase the rebated product?
    b. How much of the product was the respondent previously planning to purchase?
    c. Likelihood that respondent would have purchased the rebated item in the absence of the program?
    d. What would respondents have purchased in the absence of the program?
    e. When would the respondents have made the purchase in absence of the program?
    f. What does the respondent say was the influence of the program in his or her decision to purchase the rebated item?

2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
    a. Respondents who indicated that they (1) did not have plans to purchase the rebated item prior to participation in the REEP rebate program, (2) were not very or not at all likely to purchase without the program, (3) would have purchased less efficient products, (4) reported a program influence of 9 or 10, or (5) would have purchased the item more than a year later were assumed to be 0% free riders.
    b. Individuals who indicated that they (1) had previous plans to purchase the same rebated item, (2) would have purchased the same equipment at the same time without the program, and (3) would have been extremely likely to do so in absence of the program were assigned a 100% free ridership.
    c. All other respondents were assigned a free ridership between 0 and 100 percent depending on the amount of equipment they planned to purchase, the likelihood that they would have made those purchases in the absence of the program, the timing of such purchases, and the influence of the program on their decision to make the purchase.

Using the type of judgmental Free Rider Probability Assessment approach described in the National Action Plan for Energy Efficiency,[20] Navigant developed an algorithm for determining a free ridership fraction/percentage for each surveyed respondent. The calculated free ridership values were scaled based on the savings achieved by each item individuals indicated they would have been likely to purchase and install without the program. Note that some individuals purchased more than 1 item. The

[20] National Action Plan for Energy Efficiency (2007). Model Energy Efficiency Program Impact Evaluation Guide. Prepared by Steven R. Schiller, Schiller Consulting, Inc. <www.epa.gov/eeactionplan>

counts reflect the number of items respondents were asked about. This algorithm and the results for Equipment Rebate component of the REEP program are shown below in Table 2-6.

Table 2-6: REEP Equipment Rebate Free Ridership Methodology and Results

FR	Previous Plan to Purchase?	How much of product?	Likelihood of purchasing in absence of program	What would be purchased without program	Timing of Purchase	Influence of Program Rating (1-10)	Count
100%	Y	More or the Same	Extremely	Same Products	Same Time or Within 1 month	1 to 4	14
80%	Y	More or the Same	Extremely	Same Products	Same Time or Within 1 month	Greater than 4	13
80%	Y	More or the Same	Very	Same Products	Same Time or Within 1 month	1 to 3	2
60%	Y	More or the Same	Very	Same Products	Any Answer	5 to 8	8
50%	Y	Less	Very	Same Products	Any Answer	5 to 8	1
25%	Y	More or the Same	Somewhat Likely	Same Products	or 7-12 months*	7 to 8	8
0%	N	N/A	or Not very or Not at all	or Less Efficient Products	or greater than 1 year	or 9-10	46
						Total	92
						FR	***39%***

* Individuals who indicated they would have purchased the rebated item 7-12 months later than they did were assigned a 25% FR regardless of their responses to other questions; that is, a delay of that long was seen as evidence that such a purchase would not be likely to occur.

The REEP Equipment Rebate component free ridership is estimated to be 39%, which indicates that, while the program influenced most participant decisions regarding the rebated equipment, it does not seem to have been influential for more than one third of participants. Participants were asked free ridership questions about each measure that they purchased. The counts in Table 2-6 indicate the total number of measures the 70 respondents were asked about (92). The total free ridership was weighted based on the verified savings associated with each measure.

Efficiency Kit Free Ridership

The steps taken to evaluate the free ridership for the installation of items received in the efficiency kits through the REEP program 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. Did the respondent have previous plans to purchase and install any of the items provided in the efficiency kits?
    b. What would the respondent have purchased and installed in the absence of the program?
    c. What is the likelihood that the respondent would have purchased and installed these items in the absence of the program?

d. How many of the item would the respondent have installed in absence of the program?
e. When would the respondent have installed the measure if there had been no program?

2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
    a. Respondents who (1) indicated that they did not have plans to purchase/install any of the equipment prior to participation, (2) indicated that they would have been not very or not at all likely to purchase/install the equipment without the program, or (3) indicated they would have purchased/installed kit items more than a year later in the absence of the program were assumed to be 0% free riders.
    b. Individuals who indicated that they (1) had previous plans to purchase/install all of the equipment, (2) would have purchased/installed the same equipment at the same time without the program and (3) would have been extremely likely to do so in absence of the program were assigned a 100% free ridership.
    c. All other respondents were assigned a free ridership between 0 and 100 percent depending on the amount of equipment they planned to purchase/install and the likelihood that they would have made those purchases in the absence of the program.

The calculated free ridership values were scaled based on the savings achieved by each item individuals indicated they would have been likely to purchase and install without the program.

Table 2-7 below shows the methodology applied in the derivation of the free ridership percentages for each respondent who received an efficiency kit.

Table 2-7 : REEP Efficiency Kit Free Ridership Methodology

Free Ridership	Previous Plans to purchase any of the items received?	What would you have purchased in absence of program?	Likelihood of purchasing each item in absence of program	How many would you have purchased without program?	When would you have purchased the item?
100%	Y	Same Items	Extremely	More Than or Equal To	Same time or 1 month later
90%	Y	Same Items	Extremely	More Than or Equal To	Don't Know
80%	Y	Same Items	Extremely or Very	More Than or Equal To	2-6 months Later
80%	Y	Same Items	Very	More Than or Equal To	Same time or 1 month later
50%	Y	Some of the items (fewer)	Very	Fewer	Same time or 1 month later
50%	Y	Some of the items (fewer)	Extremely or Very	Fewer	2-6 months Later
50%	Y	Same Items	Somewhat Likely	More Than or Equal To	Same time or 1 month later
25%	Y	Some of the items (fewer)	Somewhat Likely	Any Answer	2-6 months Later
25%	Y	Any Answer	Any Answer	Any Answer	7-12 month later
0%	N	Or None of the items	Or Not very or not at all likely	Any Answer	Or More than a year

The overall free ridership was estimated to be 11%, by taking the average free ridership for each product in the kits, weighted by the savings associated with each kit item. The free ridership results by product are illustrated below in Table 2-8. These results indicate that, of all efficiency kit products, participants would be most likely to purchase the CFLs in the absence of the program.

Table 2-8: PY4 REEP Efficiency Kit Free Ridership Results

FR	CFL	Smart Strip	LED Nightlight	Overall
100%	1	0	0	
90%	1	0	0	
80%	6	0	2	
50%	3	0	0	
25%	1	0	0	
0%	28	36	34	
Total	**40**	**36**	**36**	
FR	***21%***	***0%***	***4%***	***11%***

Free ridership is quite low for the REEP kits. All respondents who received a Smart Strip and the majority of respondents who received Night Lights indicated they did not have prior plans to purchase or install these products, resulting in 0% free ridership. However, many of these respondents also indicated that they have not installed these products, indicating a realization rate of 0% and therefore 0 verified gross savings.

Upstream Lighting Free Ridership

The free ridership for the Upstream Lighting Program 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 for the purchase of CFLs and LEDs through the upstream lighting program component were 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. Did the respondent have previous plans to purchase CFLs/LEDs?
    b. What was the main reason for purchasing CFLs/LEDs?
    c. What was the influence of bulb price/program advertisements on the respondent's decision to purchase the bulbs?
    d. How many program bulbs would the respondent have purchased if the bulbs were <average incentive amount> more expensive?

2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:

    a. Respondents who indicated that (1) they did not have plans to purchase CFLs/LEDs before entering the store, and (2) who identified the program bulb pricing, program advertising or program events as the main reason for purchasing CFLs/LEDs and (3) indicated that the maximum rating of the program bulb prices and program advertising was 9 or 10 on a 10 point scale and (4) indicated they would not have purchased any program bulbs if the bulbs were <average incentive amount> more expensive were assumed to be 0% free riders.

    b. Respondents who indicated that (1) they had prior plans to purchase CFLs/LEDs, and (2) did not list the program bulb pricing, program advertising or program events as the main reason for purchasing, and (3) regarding the program bulb prices and program advertising gave a maximum program influence rating of 1 or 2 on a 10 point scale, and (4) indicated they would have purchased the same number or more bulbs if the bulbs had been <average incentive amount> more expensive were assumed to be 100% free riders.

    c. All other respondents were assigned a free ridership between 0 and 100 percent depending on their responses to each question. These free ridership percentages were assigned by averaging two different free ridership estimates. The first free ridership estimate was assigned based on participant responses to (1) their prior purchasing plans, (2) the reason for purchasing the bulbs (Program or Non-Program Reason) and (3) the maximum influence of the bulb price and program advertisements on their purchase decisions. The second free ridership estimate was determined by evaluating the respondents responses to the percentage of the purchased bulbs that they would have purchased if the bulbs were <average incentive amount> higher.

The free ridership algorithm associated with the first of the two free ridership estimates for the Upstream Lighting program is shown below in Table 2-9.

Table 2-9: Upstream Lighting Free Ridership Methodology

Free Ridership Percentage	Prior Plans to purchase CFLs or LEDs	Reason for Purchasing CFLs or LEDs - Program Factor	Influence of price of bulbs and program advertisements (Maximum influence of both)
100%	Y	N	1, 2
80%	Y	Y	1, 2
65%	N	N	1, 2
50%	N	Y	1, 2
80%	Y	N	3 , 4, 5
65%	Y	Y	3, 4, 5
35%	N	N	3, 4, 5
25%	N	Y	3, 4, 5
50%	Y	N	6, 7, 8
25%	Y	Y	6, 7, 8
10%	N	-	6, 7, 8
10%	Y	N	9, 10
0%	Y	Y	9, 10
0%	N	-	9, 10

This second upstream lighting free ridership was estimated based on the following equation:

$$FR = \frac{Number\ of\ Bulbs\ which\ would\ have\ been\ purchased\ if\ price\ was < average\ incentive > higher}{Number\ of\ Bulbs\ purchased}$$

The free ridership calculated through the equation above was averaged with that estimated based on the methodology presented in Table 2-9 to determine a free ridership percentage for each respondent.

The calculated free ridership percentage for standard CFLs, specialty CFLs and LEDs is presented below in Table 2-10. The total upstream lighting free ridership is determined by weighting Standard CFL, Specialty CFL and LED free ridership percentages by the savings associated with each.

Table 2-10: Upstream Lighting Free Ridership Results

	Standard CFLs (n=426)	Specialty CFLs (n=58)	LEDs (n=24)	Total Upstream Lighting
Average FR	55%	69%	47%	**57%**

In order to determine the overall FR ratio for the REEP program, the FRs of each sub-program (kits, rebates and upstream lighting) were weighted by the savings achieved by each measure type. The results are presented in Table 2-11 below.

Table 2-11: REEP Total Free Ridership Ratio

REEP Sub-program	MWh Savings	Percent of Savings	Individual FR
Kits	7,759	16%	11%
Rebates	603	1%	39%
Upstream Lighting	40,927	83%	57%
REEP Total FR ratio:			**50%**

Spillover

In the NTG surveys administered to REEP customers, Navigant also asked whether or not the customer had taken any additional energy saving actions after participating in the Duquesne program and if these actions were influenced by their participation in the program. If the respondent had made additional energy efficiency improvements as a result of the program, these would be spillover savings. These questions were asked of respondents who participated in the REEP Equipment Rebate program component, those who participated in the REEP Kit program component and those who participated in the upstream lighting program. Of the 70 REEP Equipment Rebate customers surveyed, 46 (or 66 percent of respondents) said they had taken additional energy saving actions. Of the 40 REEP Kit customers surveyed, 24 (60 percent of respondents) said they had taken additional energy saving actions. Navigant used deemed savings values for the top 5 reported actions for both the REEP Rebate and REEP Kit participants. In addition, the survey asked the respondent how influential the Duquesne program was on their decision to take that additional energy saving action and how likely the participant would have been to do so if they had not participated in the program. The resulting savings per action was then discounted by the results from these questions.[21] The top reported actions for the REEP Equipment Rebate and REEP Kit program components are listed in Table 2-12 and Table 2-13 below, along with their average influence rate, and savings attributed to the program.

[21] Respondents were asked on a 1 to 10 scale, how influential their participation in the program was on their decision to take additional energy-saving actions, where 10 is extremely influential. To be conservative, any rating 1-5 was considered to be "no program influence." Ratings above 5 were given influence percentages on the following scale: rating of 6-7 = 30%, rating of 7-8 = 60%, rating of 9 = 80%, and rating of 10 = 100%. Respondents were also asked on a 1 to 10 scale, how likely they would have been to take the spillover action if there had been no program, where 10 is extremely likely. The likelihood was converted to a program effect (10-reported likelihood)/100 and averaged with the program influence score to determine the average program Influence.

Table 2-12: Top 5 REEP Rebate Spillover Actions

Action	Number of Respondents	Average Influence	Savings per Respondent who took action (kWh)	Savings Attributed to Program per respondent who took action (kWh)	Deemed Savings Reference
Purchased Energy Star Refrigerator	8	35.6%	85.7	30.53	PA TRM Average
Turned off / reduced use of lights	11	30.0%	262.8	78.84	OPA Summer Sweepstakes
Installed compact fluorescent lights	19	30.0%	101.4	30.43	OPA Summer Sweepstakes
Turned off / reduced use of power to electronics	11	49.6%	21.29	10.57	OPA Summer Sweepstakes
Unplugged devices usually plugged into outlet	7	49.6%	70.19	34.84	OPA Summer Sweepstakes
Total	**70**			**2,050**	
Total Savings per Respondent				**29**	

Table 2-13: Top 5 REEP Kit Spillover Actions

Action	Number of Respondents	Average Influence	Savings per Respondent who took action (kWh)	Savings Attributed to Program per respondent who took action (kWh)	Deemed Savings Reference
Purchased Energy Star Refrigerator	5	52.4%	85.7	44.93	PA TRM Average
Replaced my old central air conditioner with a high efficiency central air conditioner	4	15.5%	431	66.81	PA TRM - Calcs from PECO average of various sizes
Replaced my old furnace with a high efficiency furnace	4	15.5%	446	69.13	PA TRM - Calcs from PECO average of various sizes
Installed a programmable thermostat	6	15.5%	614.27	95.21	Average from Duquesne Program Savings
Turned off / reduced use of lights	10	48.7%	262.8	127.96	OPA Summer Sweepstakes
Total	**40**			**2,619**	
Total Savings per Respondent				**65**	

Participants surveyed through the telephone survey for the Upstream Lighting program were also asked if they had taken any additional energy savings actions as a result of purchasing CFL bulbs through the Duquesne Light program. Half of the respondents indicated that they had taken additional energy savings actions. The top reported actions for the REEP Upstream Lighting component are listed in Table 2-14, along with their average influence rate, and savings attributed to the program.

Table 2-14: Top 5 Upstream Lighting Spillover Actions

Action	Number of Respondents	Average Influence	Savings per Respondent who took action (kWh)	Savings Attributed to Program per respondent who took action (kWh)	Deemed Savings Reference
Refrigerator	12	38.8%	85.70	33.21	PA TRM Average
Replaced windows	10	40.0%	450.00	180.00	Energy Starwebsite - average of single and double pane windows
Replaced my old central air conditioner with a high efficiency central air	12	40.4%	431.00	174.20	PA TRM - Calcs from PECO average of various sizes
Turned off / reduced use of	45	34.3%	262.80	90.23	OPA Summer
Turned off / reduced use of power to electronics	43	36.7%	21.29	7.82	OPA Summer Sweepstakes
Total	**301**			**8,685**	
Total Savings per Respondent				**29**	

For several behavioral actions, the deemed savings values have been drawn from the 2008 Ontario Power Authority (OPA) Summer Sweepstakes program. Navigant completed an evaluation of the OPA Summer Sweepstakes program which involved surveys with participants aimed at understanding actions taken when a participant indicated they had performed certain spillover behavior such as turned off / reduced use of lights or unplugging electronic devices from outlets. Information collected through the surveys included number of measures installed, type of measures installed, and number of hours behavior changes were made. This information allowed the estimation of savings associated with each reported action. We have assumed, for the purposes of this spillover estimate, that the Duquesne population behaves similarly to the OPA population when taking spillover actions, allowing spillover estimates to be approximated (accepting the uncertainties surrounding using values established in one territory and applying them in another) and giving the program an understanding of the *potential magnitude* of any spillover savings. The savings values taken from the OPA Summer Sweepstakes program are not for weather-dependent measures.

The total spillover savings estimate for surveyed REEP Equipment Rebate participants is 2,050 kWh for the top 5 spillover actions, or 29 kWh per REEP Equipment Rebate program component respondent. The total spillover savings for surveyed REEP Kit participants is 2,619 kWh for the top 5 spillover actions, or 65 kWh per REEP kit program respondent. The total spillover for the Upstream Lighting program is 8,686, or 29 kWh per REEP Upstream Lighting program component respondent.

In order to determine a spillover factor for each component of the REEP program the savings per participant were multiplied by the number of PY4 participants for each program component. This leads to a total spillover savings for each program component. The total spillover savings is then divided by the gross program energy savings to determine a spillover factor.

Table 2-15: REEP Spillover Factors

REEP Component	Spillover Savings per Participant (kWh)	Total PY4 Participants	Total Spillover Savings (kWh)	Total Gross Savings (kWh)	Spillover %
REEP Rebate	29	2,896	84,802	603,241	14.1%
REEP Kits	65	26,844	1,757,781	7,759,365	22.7%
Upstream Lighting	29	148,894	4,296,424	40,927,321	10.5%
Total REEP Spillover Factor					**12.5%**

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

NTG = 1-FR+Spillover

Table 2-16 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 associated with the upstream lighting component, the high free ridership of this component drives the net-to-gross ratio down to less than 65%.

Table 2-16: REEP NTG Factors

REEP Component	FR (%)	Spillover (%)	NTG (%)
REEP Rebate	39%	14%	75%
REEP Kits	11%	23%	112%
Upstream Lighting	57%	11%	54%
Total REEP NTG Ratio			**62%**

2.4 Process Evaluation

The process evaluation for the REEP program group in PY4 included the following activities:

- Review of the 2012 Pennsylvania TRM
- Interviews with Duquesne program staff
- Conduct of surveys with 30 REEP Rebate and 40 REEP Kits participants sampled randomly from the entire PY4 population for each program segment (Rebates and Kits) between August 19 and September 9, 2013. These surveys included both verification questions and selected process evaluation questions.

- Review of program performance as reported in Duquesne's PMRS (DSM Tracking) system, including review of the tracking system, itself.

The process evaluation found the following:

- The program has been very successful at meeting its goal as evidenced by the fact that 142% of cumulative Phase I planned energy savings have been achieved. The upstream lighting program has contributed significantly to the success of the program.

- REEP participants reported high levels of satisfaction with both the rebate and kit programs and with all program aspects.

- When asked how likely they would be to recommend the program to others, REEP rebate participants reported an average likelihood of 9.6 (on a 1 to 10 scale where 10 is extremely likely) and REEP kit participants reported an average likelihood of 8.5.

- According to participants, the most common source of program awareness for the *rebate* program was through bill inserts and the most common source of program awareness for the *kit* program was through family or friends.

- Very few recommendations were made for program improvement. REEP rebate participants who did make recommendations most commonly recommended advertising the program more and REEP kit participants most commonly recommended providing more background information and more energy savings tips with the kits.

- Only 14% of rebate and 20% of kit participants had heard of other Duquesne Light programs. Only 3% of participants from both the rebate and kit programs have participated in other Duquesne Light programs. Increased cross promotion of programs could contribute to Duquesne continued ability to meet portfolio targets.

- Realization rates for the Energy efficiency kits were relatively low (66%). A significant portion (45%) of smart strips and limelights (33%) provided in kits were not installed by participants.

- The free ridership for the upstream lighting program is relatively high (57%). Since this component of the REEP program represents the most savings, the overall free ridership is 50%.

Recommendation	Duquesne Light Report For Process Evaluations
Consider providing more information about kit products, specifically about the Smart Strips which have a low installation rate that is impacting the realization rate	Being Considered
Enhance efforts to cross-promote other Duquesne Light programs to REEP participants. Very few participants had heard of other programs. Cross promoting other programs could help Duquesne continue to reach its savings goals in the future.	Being Considered
Investigate CFL free ridership more thoroughly in future evaluations. The estimated CFL free ridership is high and, while any free ridership analysis is subject to question, the results suggest that a significant percentage of CFL purchases might have occurred even in the absence of the program. A more thorough free ridership and process evaluation assessment may be warranted in future years' program evaluation to better determine the extent of the problem and investigate ways in which the program might be modified to have a higher net impact on energy consumption.	Being Considered

2.5 Financial Reporting

Table 2-17: Summary of REEP Finances

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$521	$2,051	$5,133
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**521**	**2,051**	**5,133**
Design & Development	0	0	541
Administration[1]	0	0	0
Management[2]	1,370	4,826	9,931
Marketing	275	632	964
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**1,645**	**5,458**	**11,436**
EDC Evaluation Costs	83	256	562
SWE Audit Costs	49	116	443
Total EDC Costs[3]	2,298	7,881	17,574
Participant Costs[4]	0	1,710	7,974
Total TRC Costs[5]		**6,473**	**19,021**
Total Lifetime Energy & Capacity Benefits		**21,686**	**86,651**
Total TRC Benefits[6]	**N/A**	**21,686**	**86,651**
TRC Ratio[7]	**N/A**	**3.4**	**4.6**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.

[2] EDC costs other than those identified explicitly.

[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.

[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.

[5] Total TRC Costs includes EDC Evaluation Costs, 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.

[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

3 School Energy Pledge (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, 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.

3.1 Program Updates

No changes were made to the SEP program in PY4.

3.2 Impact Evaluation Gross Savings

The School Energy Pledge Program is achieving its goals. By the end of PY4, Duquesne has reported gross savings totaling 141% of its 4,725 MWh cumulative estimate projected for Phase I in the EE&C Plan.

Table 3-1: SEP Reported Results by Quarter

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
PY4 Q1	0	0	0.000	0.000	$0
PY4 Q2	0	0	0.000	0.000	$0
PY4 Q3	0	0	0.000	0.000	$0
PY4 Q4	1,947	756	0.000	0.022	$0
PY4 Total	**1,947**	**756**	**0.000**	**0.022**	**$0**
CPITD Total	**16,275**	**6,620**	**0.895**	**0.916**	**$0**

Table 3-2: PY4 SEP Program Reported Results by Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	**1,947**	**756**	**0.000**	**0.022**	**$0**

Measurement and Verification Methodology

Measurement and Verification of the SEP program was not completed for PY4. As noted earlier, the evaluation relied on PY3 verification results for this program.[22] These results indicated a 63% realization rate for energy savings and a 67% realization rate for demand reductions.

Table 3-3: PY4 SEP Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings
Program Total	756	63%	0.52	9.0%	476

Table 3-4: PY4 SEP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision(at 85% confidence)	Verified Gross Demand Savings
Program Total	**0.022**	**67%**	**0.56**	**8.0%**	**0.014**

[22] For PY4, verification rates of 63% for energy savings and 67% for demand reduction were used for the School Energy Pledge program (SEP), based on the verification rates for PY3. Additional field verification of PY4 was not undertaken because: (1) verification rates for PY2 and PY3 are essentially the same; (2) there were no program changes which might lead to changes in installation of distributed measures; and (3) the very small savings and budgets for this program. Based on these considerations, the value of the information did not justify additional field work for PY4.

3.3 Impact Evaluation Net Savings

For PY4, a NTG factor of 86% was used, based on the NTG factor estimated for PY3. Additional field research was not undertaken for PY4 because: (1) surveys were not already being completed for verification purposes in PY4, (2) there were no program changes which might lead to changes in the program NTG factor; and (3) the very small savings and budgets for this program. Based on these considerations, the value of the information did not justify additional field work for PY4.

3.4 Process Evaluation

No additional process analysis was done in PY4, because there were no significant issues found in PY3, there were no significant program changes and the programs budget and savings are minimal.

3.5 Financial Reporting

Table 3-5: Summary of SEP Finances

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$0	$0	$164
EDC Incentives to Trade Allies	0	0	92
Subtotal EDC Incentive Costs	**0**	0	256
Design & Development	0	0	372
Administration[1]	0	0	0
Management[2]	130	309	1,191
Marketing	0	6	51
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**130**	**315**	**1,614**
EDC Evaluation Costs	10	31	74
SWE Audit Costs	6	14	60
Total EDC Costs[3]	146	360	2,004
Participant Costs[4]	0	36	382
Total TRC Costs[5]	**0**	**90**	**1,778**
Total Lifetime Energy & Capacity Benefits		**276**	**2,791**
Total TRC Benefits[6]	**N/A**	**276**	**2,791**
TRC Ratio[7]	**N/A**	**3.1**	**1.6**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.

[2] EDC costs other than those identified explicitly.

[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.

[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.

[5] Total TRC Costs includes EDC Evaluation Costs, 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.

[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

4 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).

4.1 Program Updates

No changes occurred for the RARP program in PY4.

4.2 Impact Evaluation Gross Savings

The Residential Appliance Recycling Program is achieving its goals. By the end of PY4, Duquesne has reported gross savings totaling 132% of its 11,668 MWh cumulative estimate projected for Phase I in the EE&C Plan. Quarter 2 had the largest participation for the RARP program in the program year, accounting for 40% of PY4 RARP energy savings. Participation by quarter is shown in Table 4-1.

Table 4-1: CPITD RARP Reported Results by Quarter

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
PY4 Q1	948	1,468	0.064	0.195	$34
PY4 Q2	1,242	2,039	0.000	0.272	$46
PY4 Q3	533	767	0.000	0.109	$20
PY4 Q4	539	816	0.000	0.109	$20
PY4 Total	**3,262**	**5,089**	**0.064**	**0.684**	**$120**
CPITD Total	**9,888**	**15,372**	**1.487**	**2.107**	**$359**

Table 4-2: PY4 RARP Program Reported Results by Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	**3,262**	**5,089**	**0.064**	**0.684**	**$120**

Measurement and Verification Methodology

Consistent with Duquesne Light's EM&V Plan Sections 2.5 and 2.5.1, the basic level of verification rigor will be used for TRM deemed savings measures and measures with rebates less than $2,000. The basic level of verification rigor methods for TRM deemed measures involves two basic steps:

- Survey a random sample of participants to verify appliance removals 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 the six-step process, described in Section 2.2. RARP program-specific variances from the six-step approach and program-specific information are outlined below.

RARP Measurement and Verification

Step 1 – Verification Checklist: Performed as described in Section 2.2.

Step 2 – 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 involved 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 verification 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's PY4 Sampling Plan, the annual sample size target for RARP was 25 participants, with a targeted level of precision of 15%. Table 4-3 below, presents the actual sample sizes and the precision of the estimate at 85% confidence for the program.

Table 4-3: RARP Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
RARP	n/a		0.5	85/15	25	100	Telephone verification
Program Total			0.50	85/15	25	100	

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.

Step 3 – Measure/Project Qualification: The evaluation team reviewed and confirmed relevant documentation for check list criteria item 1 through 4 described under Step 1 from PMRS, or other electronic or hardcopy documentation obtained for a sample of PMRS records.

- 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).
- Proof of Participation: Select PY4 sampled RARP detailed data were requested from JACO and reviewed as a check on the accuracy of the participant database. In PY4 no exceptions were noted.

Step 4 – Deemed Savings Verification: All energy efficiency measures delivered by the RARP have deemed savings specified in the 2012 TRM. The TRM provides a value of 1,659 kWh for refrigerators/freezers that have been retired and a value of 1,205 kWh for refrigerators/freezers that have been retired and replaced with ENERGY STAR appliances.[23] A separate Interim Measure Resolution specified that the savings to be deemed for recycled refrigerators/freezers replaced with standard (non-Energy Star) refrigerators/freezers should be 1,091 kWh and 0.1353 kW. Under the TRM Refrigerator/Freezer Recycling is treated as the one measure where the number of units is multiplied by specified savings per unit, depending on the type of replacement appliance, if any. Unit savings are defined as below:

Table 4-4: Refrigerator/Freezer Recycling – References

Component	kWh Savings	kW Savings	Coincidence Factor
Retirement	1,659	0.2057	0.62
Replaced with Energy Star	1,205	0.1494	0.62
Replaced with Non-Energy Star	1,091	0.1353	0.62

When the refrigerator or freezer is picked up, 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 in late summer 2012 were used to estimate the percentage of refrigerator/freezer replacement participants who replaced their refrigerator/freezer with an Energy Star refrigerator/freezer (87%) versus a non-Energy Star refrigerator/freezer. For replacement refrigerators, Navigant used the weighted average energy savings of replacing with an Energy Star unit or a Standard

[23] See pages 91-95 of the 2011 Technical Reference Manual at Commission Docket No. M-00051865, entered February 28, 2011.

unit, or (87% x 1,205 + 13% x 1,091) = 1,190 kWh. Table 4-5 shows the energy savings assigned to each participant based on the type of unit recycled and the replacement action.

Table 4-5: Refrigerator/Freezer Recycling – References

Unit	Action	Replacement Type	kWh Savings per unit	kW Savings per Unit
Primary Unit	Replace	Energy Star (87%)	(0.87 * 1,205) + (0.13 * 1,091) = 1,190	(0.87 *0.1494) + (0.13 * 0.1353) = 0.1476
		Standard (13%)		
Secondary Unit	Replace	Energy Star (87%)	1,190	0.1476
		Standard (13%)		
	Retire		1,659	0.2057

If a participant recycled a primary unit, their energy savings is 1,190 kWh and 0.1476 kW. If a participant recycled a secondary unit and said that they replaced it, their energy savings is also 1,190 kWh and 0.1476 kW. If a participant recycled a secondary unit and said that they retired it (did not replace it), their energy savings is 1,659 kWh and 0.2057 kW.

Step 5 – Participation and Installation Verification: Telephone surveys are employed for impact verification of measures receiving basic level of rigor verification (i.e., deemed savings measures with rebates less than $2000). 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).

Step 6 – Program Realization Rate: As related in M&V methodology in Section 2.2, the program realization rate is calculated using the verified energy and demand savings from telephone interviews, as summarized below:

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 4-6 and Table 4-7.

Table 4-6: PY4 RARP Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings (MWh)	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision (at 85% confidence)	Verified Gross Energy Savings (MWh)
RARP	5,089	101%*	0.10	4.7%	5,141
Program Total	**5,089**	**101%**	**0.10**	**4.7%**	**5,141**

*One surveyed respondent reported recycling two refrigerators but only one appeared in the program tracking system.

Table 4-7: PY4 RARP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction (MW)	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision (at 85% confidence)	Verified Gross Demand Reduction (MW)
RARP	0.684	101%*	0.10	4.3%	0.691
Program Total	**0.684**	**101%**	**0.10**	**4.3%**	**0.691**

*One surveyed respondent reported recycling two refrigerators but only one appeared in the program tracking system.

4.3 Impact Evaluation Net Savings

Free Ridership

The free ridership for the RARP program was determined by evaluating participant's responses to several questions relating to their motivation in participating in the RARP. The steps taken to evaluate the free ridership for the recycling of a fridge or freezer through the RARP were as follows:

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. Did the respondent have previous plans to dispose of the appliance?
    b. What was the main reason for disposing of the fridge or freezer?
    c. What would have been done with the appliance in the absence of the program?
    d. Were plans for disposal seriously considered (i.e., were there detailed plans)?
2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
    a. Respondents who indicated that they did not have plans to recycling the appliance prior to participation in the program (no action in absence of program),, or who said they would have otherwise recycled their appliance more than one year later (time delay reflects inertia and low likelihood of taking action), or who said they would have sold the appliance or given it away for free (whether they succeed or not, appliance stays on the grid) were assumed to be 0% free riders.
    b. Respondents who indicated that they had prior plans to recycle their appliance, did not list the program rebate as a reason for recycling, and said they would have recycled at the same time, and had actually planned the disposal details were assumed to be 100% free riders.
    c. All other respondents were assigned a free ridership between 0 and 100 percent depending on the indication of program influence and practical likelihood in their responses to the other questions. Disposing of a refrigerator or freezer is not a simple task. Respondents' reported intentions to dispose of the appliance in the absence of the program were discounted if their intentions relied on the participation of another party (e.g., did not have a vehicle to take the appliance to the dump). Relying on a dealer to come collect the appliance was considered 100% free ridership unless the

respondent had not replaced the appliance (i.e., no dealer was involved), in which case the response was steeply discounted.

Table 4-8 below shows the algorithm (methodology) applied in the derivation of the free ridership percentages for each respondent and the calculated overall free ridership for the program.

Table 4-8: RARP Free Ridership Algorithm

FR	Previous Plans to get rid of fridge/freezer?	Main Reason = Program Reason?	Planned Method of Disposal	Disposal Details Planned	Refrigerator Count	Freezer Count
0%	No/DK/Ref		or Kept it plugged in or Given it away for free or Sold it		53*	24*
50%	Yes	Program Reason	Taken it to the Dump / Hired someone to take it to the dump	Yes	0	0
100%	Yes	Non-Program Reason		Yes	6	0
0%	Yes	Program Reason		No/DK	0	0
50%	Yes	Non-Program Reason		No/DK	6	1
50%	Yes	Program Reason	Removed by dealer	Yes	0	0
100%	Yes	Non-Program Reason		Yes	12	1
0%	Yes	Program Reason		No/DK	0	0
20%	Yes	Non-Program Reason		No/DK	1	0
Total					25	2
FR					**29%**	**6%**

*Of the 77 respondent-units that fell into this category, there were no disposals plans or such plans were more than a year into the future for 44 units (33 refrigerators, 11 freezers); 26 units (14 refrigerators, 12 freezers) reportedly would have been given away for free; and 5 units (4 refrigerators, 1 freezer) reportedly would have been sold in the absence of the program.

The free ridership percentages for refrigerators and freezers were weighted by the savings associated with each appliance type for the program. The overall RARP free ridership was found to be 25% as seen below in Table 4-9.

Table 4-9: RARP Total FR Ratio

RARP Sub-program	MWh Savings	Percent of Savings	Individual FR ratios
Refrigerators	4,222	82%	29%
Freezers	918	18%	6%
RARP Total FR ratio:			**25%**

Spillover

In the NTG surveys administered to RARP customers, Navigant also asked whether or not the customer had taken any additional energy saving actions after participating in the Duquesne program and if the program was influential in their decision to do so. If the respondent had made additional energy efficiency improvements as a result of the program, these would be spillover savings. Of the 100 customers surveyed, 21 had taken any additional energy saving actions, or 21 percent of respondents. The top 5 reported actions for the RARP program are listed in Table 4-10 below, along with their influence rate, and savings attributed to the program.

Table 4-10: Top 5 RARP Rebate Spillover Actions

Action	Number of Respondents	Average Influence	Savings per Respondent (kWh)	Savings Attributed to Program per Respondent (kWh)	Deemed Savings Reference
Purchased Energy Star Refrigerator	5	3.90	85.70	33.42	PA TRM
Purchased Energy Star Dishwasher	2	5.00	107.00	53.50	PA TRM
Turned off / reduced use of lights	1	5.00	262.80	131.40	OPA Summer Sweepstakes
Installed compact fluorescent lights	10	5.15	101.42	52.23	OPA Summer Sweepstakes
Turned off / reduced use of power to electronics	2	4.50	21.29	9.58	OPA Summer Sweepstakes
Total	**100**			**947**	
Total Savings per Respondent				**9.5**	

The total spillover savings for surveyed RARP participants is 947 kWh for the top 5 spillover actions, or 9.5 kWh per program respondent. These results indicate that the RARP program somewhat raises awareness about energy efficiency and encourages customers to make additional efficiency upgrades.

In order to determine a spillover factor for the RARP program the savings per participant were multiplied by the number of PY4 participants. This leads to a total spillover savings for the RARP program which is then divided by the gross program energy savings to determine a spillover factor.

Table 4-11: RARP Spillover Factor

	Spillover Savings per Participant (kWh)	Total Unique PY4 Participants	Total Spillover Savings (kWh)	Total Verified Gross Savings (kWh)	Spillover %
RARP Program	9.47	3,197	30,276	5,140,929	0.59%

The NTG ratio for the RARP program is then calculated to be 0.76 (*NTG=1-FR+Spillover*).

4.4 Process Evaluation

Process evaluations for the RARP program included the following activities:

- Review of 2012 TRM
- Interviews with Duquesne program staff
- Conduct of surveys with 100 randomly selected RARP PY4 participants between August 19 and September 9, 2013. These surveys included both verification questions and selected process evaluation questions,
- Review of program performance as reported in Duquesne's PMRS (DSM Tracking) system, including review of the tracking system, itself.

The process evaluation found the following:

- The program has been very successful at meeting its goal as evidenced by the fact that 141% of Duquesne's Phase I energy savings goal for this program have been achieved.

- Participants most commonly reported Bill inserts (36%) as their source of program awareness, followed by word-of-mouth through family, friends or neighbors (24%).

- Participants most commonly reported the convenience of the home pick up (44%) as the main reason for participating in the program, followed by the cash incentive (21%). This differs from PY3 findings where the cash incentive was reported to be the most common reason for participating (40%).

- Participants reported high levels of satisfaction for all program aspects. The highest satisfaction was reported for the courtesy of the team which picked up the appliance (average rating 9.44) and for the sign up process for the program (average rating 9.35), and the lowest satisfaction was reported for the incentive amount (average rating 8.48) and the energy savings resulting from removing appliances (average rating 8.22).

- About a third (30%) of RARP participants have heard of other Duquesne Light programs and only 4% of RARP participants have participated in another program. The RARP program offers a touch point with customers which could be leveraged to cross promote other Duquesne Light programs. This could contribute to Duquesne Light's ability to reach program targets in the future.

- Sixty six percent of RARP participants reported having purchased a refrigerator to replace the unit recycled through the Duquesne Light program. Eight-six percent of RARP participants reported they would have purchased their replacement appliance regardless of the program. Only 11% indicated they would not have purchased the replacement unit if there had been no program.

Recommendation	Duquesne Light Report For Process Evaluations
Consider cross-promoting other Duquesne Light programs to RARP participants. Very few participants had heard of other programs. Cross promoting other programs could help Duquesne continue to reach their goals in the future.	Being Considered

4.5 Financial Reporting

Table 4-12: Summary of RARP Finances

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	20	$120	$358
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**20**	**120**	**358**
Design & Development	0	0	97
Administration[1]	0	0	0
Management[2]	82	561	1,532
Marketing	0	6	47
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**82**	**567**	**1,676**
EDC Evaluation Costs	9	29	66
SWE Audit Costs	6	14	54
Total EDC Costs[3]	117	730	2,154
Participant Costs[4]	0	560	1,259
Total TRC Costs[5]	**0**	**1,276**	**3,359**
Total Lifetime Energy & Capacity Benefits		**2,835**	**9,064**
Total TRC Benefits[6]	**N/A**	**2,835**	**9,064**
TRC Ratio[7]	**N/A**	**2.2**	**2.7**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.

[2] EDC costs other than those identified explicitly.

[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.

[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.

[5] Total TRC Costs includes EDC Evaluation Costs, 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.

[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

5 Residential 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 PY4, 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.

Additionally, a portion of the Upstream Lighting program is allocated to the Low Income sector based on the findings from the general population survey which found that 20.4% of bulbs purchased were installed in Low Income households. Additionally details about the upstream lighting evaluation can be found in Appendix A.

A new component, O-Power, was offered to Low Income customers in PY4. The O-Power program provides Home Energy Reports which deliver personalized information about customer energy usage and easy to follow tips which lead to energy savings.

5.1 Program Updates

The O-Power component, described above, was added to the LIEEP program in PY4.

5.2 Impact Evaluation Gross Savings

The Low Income Energy Efficiency Program has achieved its Phase I goal. By the end of PY4, Duquesne has reported gross savings totaling 138% of its 30,055 MWh estimate for Phase I in the EE&C Plan. Upstream Lighting savings assigned to the Low Income program represent a significant portion (81%) of the PY4 LIEEP reported gross savings.

Table 5-1: PY4 LIEEP Reported Results by Quarter

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
PY4 Q1	1,271	2,260	0.040	0.163	$254
PY4 Q2	428	3,403	0.000	0.192	$187
PY4 Q3	2,347	4,410	0.000	0.228	$147
PY4 Q4	2,350	4,526	0.000	0.215	$121
PY4 Total	**6,396**	**14,599**	**0.04**	**0.799**	**$710**
CPITD Total	**14,393**	**41,358**	**1.587**	**2.345**	**$1,383**

Table 5-2: PY4 LIEEP Reported Results by Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential Low Income	**6,396**	**14,599**	**0.040**	**0.799**	**$710**

Measurement and Verification Methodology

Consistent with Duquesne Light's EM&V Plan Sections 2.5 and 2.5.1, the basic level of verification rigor was to be used for TRM deemed savings measures and measures with rebates less than $2,000. 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 the six-step process, described in Section 2.2. LIEEP specific variances from the six-step approach and program specific information are outlined below.

LIEEP Measurement and Verification

Step 1 – Verification Checklist: Performed as described in Section 2.2.

Step 2 – Random Sampling: Because Duquesne's LIEEP was partially defined as low-income participation in the other Act 129 programs, stratification was needed by program type within LIEEP (e.g., low-income

REEP rebate participants, low-income REEP kit participants, low-income RARP participants, and low-income refrigerator replacement participants). The annual sample size target for LIEEP was 60 participants. Table 5-3, below, presents the actual sample sizes and the targeted precision of the estimate at 85% confidence for the program.

Upstream Lighting and O-Power 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 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 as described in Appendix A. Navigant verified O-Power program impacts using linear fixed effects regression (LFER) analysis applied to monthly billing data for participants and control customers during the pre- and post-program period.

Measurement and Verification of the LIEEP SEP component was not completed for PY4.[24] As a result, we have assumed that the program achieved approximately the same realization rate in PY4 as it did in PY3.

Table 5-3: LIEEP Sampling Strategy for PY4

Stratum	Strata Boundaries	Sample Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
LI REEP Kits	Kits	5,122	0.5	85/14	30	30	Telephone verification
LI REEP Rebates	Rebates	69	0.5	85/24	10	10	Telephone verification
LI RARP	RARP	220	0.5	85/25	10	10	Telephone verification
LI Refrigerator Replacement	LI Refrig Replace	630	0.5	85/25	10	10	Telephone verification
Program Total		6,041	n/a	85/13	60	60	

Step 3 – Measure/Project Qualification: The evaluation team reviewed and confirmed relevant documentation for check list criteria item 1 through 4 described under Step 1 from PMRS, or other hardcopy documentation obtained for a sample of PMRS records. This was done for LIEEP participants in the Rebate and RARP programs.

[24] As with other SEP evaluation activities, evaluation resources were determined to be of higher value in reducing uncertainty if used for other purposes (e.g., with respect to programs having a more substantial impact on overall portfolio performance). Also, the realization rates for this program were in the same general range (identical, statistically) for the two previous years.

- 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).
- Proof of Participation: Select PY4 sampled applications were requested and reviewed to ensure inclusion in the participant database. In PY4 no exceptions were noted.

Step 4 – Deemed Savings Verification: The evaluation team compared kWh and kW savings in PMRS against estimates based on the 2012 PA TRM for the LIEEP program.

Savings for the measures listed below were adjusted in PMRS to be consistent with deemed values and algorithms from the 2012 PA TRM and then became the reported values:

- All Kits
- Energy Star Dehumidifiers
- Energy Star Refrigerators
- Energy Star Room Air Conditioners
- Programmable Thermostat
- Refrigerator Replacement

Step 5 – 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) or removal of an appliance (RARP) ore removal of an appliance and replacement with an Energy Star model (Refrigerator Replacement). 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 tailored to the product promotion and included questions designed to verify 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 6 – Program Realization Rate: As related in above in the M&V methodology, the program realization rate is calculated using the verified energy and demand savings from telephone interviews, 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 and residential portfolio level (which aggregate the strata) were calculated using the stratified ratio

estimation approach, following the method outline in Lohr (1999)[25]. Aggregation of the variance of each stratum (calculated depending on the assumed distribution type) is also calculated per Lohr (1999).

Navigant verified O-Power program impacts using linear fixed effects regression (LFER) analysis applied to monthly billing data for low income participants and control customers during the pre- and post-program period. The realization rate is the ratio of the verified program impacts to those reported by Duquesne.

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. 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. 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*[26] for this stratum. As upstream lighting accounts for a large fraction of total LIEEP savings, the result of this approach is such that the relative precision calculated for the residential sector was found to be very low (i.e., very precise). These results are shown in Table 5-4 and Table 5-5.

The realization rates for the LIEEP REEP kits was found to be higher than that of the REEP kits among non-low-income participants for both energy and demand (Non-low-income realization rates were 66% for energy and 63% for demand). This indicates that a higher portion of LIEEP participants installed products received in the kits than did REEP participants.

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

[26] 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 5-4: PY4 LIEEP Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings (MWh)	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision (at 85% confidence)	Verified Gross Energy Savings (MWh)
LI REEP Kits	2,164	76%	0.36	17.9%	1,641
LI REEP Rebate	18	100%	0.00	0.0%	18
LI RARP	350	100%	0.00	0.0%	350
LI Refrigerator Replacement	759	100%	0.00	0.0%	759
LI SEP	134	55%	0.29	9.6%	74
O-Power	466	82%	0.12	17.0%	382
LI Upstream Lighting	10,708	98%	0.00	0.0%	10,489
Program Total	**14,599**	**94%**		**2.1%**	**13,713**

Table 5-5: PY4 LIEEP Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision (at 85% confidence)	Verified Gross Demand Reduction
LI REEP Kits	0.118	71%	0.46	22.2%	0.084
LI REEP Rebate	0.004	100%	0.00	0.0%	0.004
LI RARP	0.047	100%	0.00	0.0%	0.047
LI Refrigerator Replacement	0.101	100%	0.00	0.0%	0.101
LI SEP	0.004	67%	0.35	11.2%	0.003
O-Power	0.000	N/A	N/A	0.0%	0.000
LI Upstream Lighting	0.525	98%	0.00	0.0%	0.514
Program Total	**0.799**	**94%**		**2.7%**	**0.752**

5.3 Impact Evaluation Net Savings

Free Ridership

The free ridership ratios for each part of the LIEEP 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 those programs, and were based on the same surveys but conducted of low-income participants in those programs.[27]

In order to determine the total FR ratio for the LIEEP program, Navigant weighted the individual component FR ratios by the total savings achieved by each component. This result is presented in Table 5-6 below.

Table 5-6: LIEEP Total FR Ratio

LIEEP Sub-program	MWh Savings	Percent of Savings	Individual FR ratios
Kits	1,641	13%	13%
Rebates	18	0%	18%
RARP	350	3%	24%
SEP	74	1%	13%
Upstream Lighting	10,489	83%	57%
LIEEP Total FR ratio:			**50%**

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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.

Spillover

In the NTG surveys administered to LIEEP customers, Navigant also asked whether or not the customer had taken any additional energy saving actions after participating in the Duquesne program. If the respondent had made additional energy efficiency improvements as a result of the program, these would be spillover savings. LIEEP customers were surveyed for the RARP, Rebate, Kit and upstream lighting programs. The number of individuals who indicated they had taken additional actions as a result of the program for each LIEEP component is summarized below in Table 5-7.

[27] As with gross savings verification, NTG results for the SEP component of LIEEP were assumed to be the same as obtained through the PY3 evaluation.

Table 5-7: Number of LIEEP Participants Taking Spillover Actions

LIEEP Program Component	Number of Surveyed Participants	Number of Surveyed Participants Who Indicated They Took Additional Actions	% of Respondents who Took Additional Actions
Kit	20	16	80%
Rebate	10	9	90%
RARP	10	3	30%
Upstream Lighting	301	152	50%

Navigant used deemed savings values for the top reported actions for each LIEEP component. The top reported actions for the LIEEP REEP Kit program, LIEEP REEP Rebate and LIEEP RARP programs are listed in Table 5-8, Table 5-9, and Table 5-10 below, along with their influence rate, and savings attributed to the program.

Table 5-8: Top 5 LI REEP Kit Spillover Actions

	Number of Respondents	Average Influence	Savings per Respondent (kWh)	Savings Attributed to Program per Respondent (kWh)	Deemed Savings Reference
Clothes washing machine	1	1.5	142.00	21.30	PA TRM
Weatherproofed home	2	2.5	18.00	4.50	Ohio TRM
Turned off / reduced use of lights	6	1.75	262.80	45.99	OPA Summer Sweepstakes
Installed compact fluorescent lights	2	1.75	101.42	17.75	OPA Summer Sweepstakes
Installed motion sensors or light timers	2	1.75	274.00	47.95	PA TRM
Total	**20**			**438**	
Total Savings per Respondent				**22**	

Table 5-9: Top 4 LI REEP Rebate Spillover Actions

	Number of Respondents	Average Influence	Savings per Respondent (kWh)	Savings Attributed to Program per Respondent (kWh)	Deemed Savings Reference
Turned off / reduced use of lights	5	6.71	262.80	176.45	OPA Summer Sweepstakes
Installed compact fluorescent lights	3	6.71	101.42	68.10	OPA Summer Sweepstakes
Installed motion sensors or light timers	1	6.71	274.00	183.97	PA TRM
Installed LED lights	3	6.71	38.83	26.07	OPA Summer Sweepstakes
Total	**10**			**1,349**	
Total Savings per Respondent				**135**	

Table 5-10: Top 2 LI RARP Spillover Actions

	Number of Respondents	Average Influence	Savings per Respondent (kWh)	Savings Attributed to Program per Respondent (kWh)	Deemed Savings Reference
Installed compact fluorescent lights	2	7.25	101.42	73.53	OPA Summer Sweepstakes
Turned off / reduced use of power to electronics	1	9.00	21.29	19.16	OPA Summer Sweepstakes
Total	**10**			**166**	
Total Savings per Respondent				**17**	

Table 5-11: Top 5 Upstream Lighting Spillover Actions

	Number of Respondents	Average Influence	Savings per Respondent who took action (kWh)	Savings Attributed to Program per respondent who took action (kWh)	Deemed Savings Reference
Refrigerator	12	3.88	85.70	33.21	PA TRM Average
Replaced windows	10	4.00	450.00	180.00	Estar website - average of single and double pane windows
Replaced my old central air conditioner with a high efficiency central air conditioner	12	4.04	431.00	174.20	PA TRM - Calcs from PECO average of various sizes
Turned off / reduced use of	45	3.43	262.80	90.23	OPA Summer Sweepstakes
Turned off / reduced use of power to electronics	43	3.67	21.29	7.82	OPA Summer Sweepstakes
Total	**301**			**8,685**	
Total Savings per Respondent				**29**	

The total spillover savings from the top actions for surveyed LIEEP Kits, LIEEP Rebate, LIEEP RARP and upstream lighting surveyed participants are 438 kWh, 1,349 kWh, 166 kWh and 8,685 kWh respectively. The savings per respondent for the LIEEP Kits, LIEEP Rebate, LIEEP RARP and Upstream Lighting programs are 22 kWh/respondent, 135 kWh/respondent, 17 kWh/respondent and 29 kWh/respondent respectively. These results indicate that these programs successfully raise awareness about energy efficiency for Low Income customers, and encourage customers to make additional efficiency upgrades. Most notably, LI Rebate customers reported a higher spillover savings than RARP, Kit or Upstream Lighting participants, although the sample size for each program is low.

Spillover factors for each component of the program and for the overall LIEPP Program are presented below in Table 5-12.

Table 5-12: LIEEP Spillover Factors

LI Program Component	Spillover Savings per Participant (kWh)	Total PY4 Participants	Total Spillover Savings (kWh)	Total Gross Savings (kWh)	Spillover %
LI Kit	22	5,122	112,079	1,640,953	6.8%
LI Rebate	66	69	4,554	18,041	25.2%
LI RARP	17	220	3,657	349,783	1.0%
LI SEP	0	344	0	73,485	0.0%
Upstream Lighting	29	20,250	587,238	10,488,911	5.6%
Total Spillover Factor					**5.6%**

The resulting NTG ratio (1-FR+Spillover) for the LI program is 56% (1-0.50+0.056).

5.4 Process Evaluation

The process evaluation for the LIEEP program group in PY4 included the following activities:

- Review of the 2012 Pennsylvania TRM
- Interviews with Duquesne program staff
- Conduct of surveys with 20 LI REEP Kit, 10 LI REEP Rebate and 10 LI RARP randomly selected PY4 participants between August 19 and September 9, 2013. These surveys included both verification questions and selected process evaluation questions.
- Review of program performance as reported in Duquesne's PMRS (DSM Tracking) system, including review of the tracking system, itself.

The process evaluation found the following:

- The program has been successful at meeting its goal as evidenced by the fact that 138% of Duquesne Light's cumulative Phase I planned energy savings have been achieved. The upstream lighting program has contributed significantly to the success of the program.

- According to participants, program awareness is being driven mostly by bill Inserts (40%), friends, family and neighbors (25%) and through television advertisements for the REEP Rebate, REEP Kit and RARP components, respectively.

- LIEEP RARP customers most commonly reported the cash incentive (40%) as the main reason for participating in the program. This differs from residential (non-low-income) RARP customers who most commonly reported the convenience of the home pick up (44%)

- 35% of LIEEP REEP Kit participants, 22% of LIEEP REEP Rebate participants and 10% of LIEEP RARP participants reported having heard of other Duquesne Light programs. Only 10% of LIEEP REEP Kit participants, and no LIEEP REEP Rebate nor LIEEP RARP participants reported having participated in another Duquesne Light program. This suggests there may be opportunities to cross promote programs, though low participation by income-qualified customers in programs where purchasing energy efficiency equipment is a requirement.

- Participants reported high overall satisfaction for each LIEEP program component. The highest average satisfaction (on a scale of 1 to 10 where 10 is extremely satisfaction) was reported for the LIEEP Refrigerator Replacement program (10), followed by the LIEEP RARP (9.40), LIEEP REEP Kits (8.93) and LIEEP REEP Rebate (8.50).

- When asked about the likelihood of recommending the program to others, on a scale of 1 to 10 where 1 – "not very likely" and 10 – "extremely likely", LIEEP REEP Rebate participants reported an average likelihood of 9.6, LIEEP REEP Kit participants reported an average likelihood of 9.5 and LIEEP RARP participants reported an average likelihood of 9.9.

Recommendation	Duquesne Light Report For Process Evaluations
Consider cross-promoting other Duquesne Light programs to RARP participants. Very few participants had heard of other programs. Cross promoting other programs could help Duquesne continue to reach their goals in the future.	Being Considered
Investigate CFL free ridership more thoroughly in future evaluations. The estimated CFL free ridership is high and, while any free ridership analysis is subject to question, the results suggest that a significant percentage of CFL purchases might have occurred even in the absence of the program. A more thorough free ridership and process evaluation assessment may be warranted in future years' program evaluation to better determine the extent of the problem and investigate ways in which the program might be modified to have a higher net impact on energy consumption.	Being Considered
Consider conducting process-evaluation surveys early in Phase II of the program with more robust samples of participants. The very small sample sizes for the findings reported above indicate that these results are generally anecdotal rather than statistically significant.	Being Considered

5.5 Financial Reporting

Table 5-13: Summary of LIEEP Finances

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$3	$256	$915
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**3**	**256**	**915**
Design & Development	0	0	153
Administration[1]	0	0	0
Management[2]	53	266	856
Marketing	0	17	120
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**53**	**283**	**1,119**
EDC Evaluation Costs	24	75	170
SWE Audit Costs	14	34	137
Total EDC Costs[3]	94	648	2,351
Participant Costs[4]	0	832	2,054
Total TRC Costs[5]	**0**	**2,209**	**4,372**
Total Lifetime Energy & Capacity Benefits		5,846	18,501
Total TRC Benefits[6]	**N/A**	**5,846**	**18,501**
TRC Ratio[7]	**N/A**	**2.6**	**4.2**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

6 Watt Choices Direct Load Control (DLC) Program

The DLC program is offered to residential customers. The program installs digital control units (switches) on qualified central air conditioners. Participants are incented at the rate of $32 per year per air conditioner. The program sought to achieve load reductions within the anticipated top 100 hours of system peak load. In PY4 there were 1,474 customers enrolled in the DLC program.

6.1 Program Updates

The summer of PY4 was the first summer during which Duquesne offered the DLC program.

6.2 Impact Evaluation Gross Savings

This section describes the methodology and results of the impact evaluation. Navigant analyzed hourly interval data for a sample of program participants.

6.2.1 Evaluation Methodology

Navigant employed baseline calculations and regression analysis to quantify program impacts during event hours. Navigant used hourly interval data for a sample of 100 M&V participating units to quantify program impacts during program event hours. Navigant followed the protocols specified in sections 3.3A.2, 3.3A.2.01, and 3.3A.3 of the *Amended and Restated Operating Agreement of PJM Interconnection, L.L.C.,* dated May 8, 2012, to calculate the program impacts during these hours. Navigant estimated a regression model to predict how the event impacts vary with hour of the day and with the WTHI. Program impacts were calculated based on the PJM-specified WTHI value of 80.7 and the hour from 4-5 pm.[28]

6.2.2 Reported and Verified Savings

Table 6-1 and Table 6-2 summarize the PY4 reported savings for the DLC program. Table 6-3 describes the sampling strategy. Table 6-4 and Table 6-5 show the research-verified energy and demand savings. The Watt Choices DLC Program generated 0.465 MW[29] of demand reductions during the Top 100 hours in PY4.

[28] PJM Manual 18 section 4.3.7 states: *"The nominated value for a Direct Load Control (DLC) program will be based on load research and customer subscription. The value of the program is equal to the PJM-approved per-participant load reduction (evaluated at average peak day weather conditions and adjusted for the switch operability rate) multiplied by the number of active participants, adjusted for system losses."*

[29] Reported and verified demand reductions include line losses.

Table 6-1: PY4 DLC Program Reported Results by Quarter

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
PY4 Q1	1,474	0	0.465	0.465	$54
PY4 Q2	0	0	0	0	$0
PY4 Q3	0	0	0	0	$0
PY4 Q4	0	0	0	0	$0
PY4 Total	**1,474**	**0**	**0.465**	**0.465**	**$54**
CPITD Total	**1,474**	**0**	**0.465**	**0.465**	**$80**

Table 6-2: PY4 DLC Program Reported Results by Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential	1,474	0	0.465	0.465	$54
PY4 Total	**1,474**	**0**	**0.465**	**0.465**	**$54**
CPITD Total	**1,474**	**0**	**0.465**	**0.465**	**$80**

Table 6-3: DLC Program Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
M&V Sample	N/A	1,474	1	85/15	100	100	Impact Analysis
Program Total		**1,474**		**85/15**	**100**	**100**	

Table 6-4: PY4 DLC Program Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings (MWh)	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision at 85% Confidence	Verified Gross Energy Savings (MWh)	Unverified Gross Energy Savings (MWh)
All Participants	0	N/A	0	0	0	0
Program Total	**0**	**N/A**	**0**	**0**	**0**	**0**

Table 6-5: PY4 DLC Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction (MW)	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision at 85% Confidence	Verified Gross Demand Reduction Savings (MW)	Unverified Gross Demand Reduction (MW)
All Participants	0.465	1	0.45	6.2%	0.465	0
Program Total	**0.465**	**1**	**0.45**	**6.2%**	**0.465**	**0**

6.3 Impact Evaluation Net Savings

Navigant assumed that program participants would not have reduced their air conditioning usage at the times Duquesne called events without the program incentives and therefore applied a net-to-gross ratio of 1.0.

6.4 Process Evaluation

Navigant did not conduct a process evaluation for this program.

6.5 Financial Reporting

Table 6-6: Summary of Residential DR Finances

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$0	$54	$80
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**0**	**54**	**80**
Design & Development	0	0	0
Administration[1]	0	0	0
Management[2]	0	22	1,021
Marketing	0	0	0
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**0**	**22**	**1,021**
EDC Evaluation Costs	0	0	0
SWE Audit Costs	0	0	0
Total EDC Costs[3]	0	76	1,101
Participant Costs[4]	0	0	0
Total TRC Costs[5]	**0**	**76**	**1,101**
Total Lifetime Energy Benefits		**6**	**6**
Total Lifetime Capacity Benefits			
Total TRC Benefits[6]	**N/A**	**6**	**6**
TRC Ratio[7]	**N/A**	**0.1**	**0.0**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

7 Commercial Program Group Programs

Duquesne's Act 129 Commercial Program Group includes an overall umbrella program and five 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, 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:

- Large Office: Roth Bros, Inc. and Enerlogics Networks, Inc.
- Small Office: AllFacilities Energy Group
- Retail: AllFacilities Energy Group
- Healthcare: Duquesne Light
- Education: Duquesne Light
- Governmental and Non-Profit Programs: Duquesne Light and Governmental Partners
- Commercial Umbrella: Duquesne Light

7.1 Program Updates

The only change to the Commercial programs in PY4 was an emphasis on peak period energy management, through the application of custom commissioning projects, and communication strategies to assist in achieving demand reduction goals.

7.2 Impact Evaluation Gross Savings

The programs within the Commercial Program Group have come close to achieving their Phase I target (note that the portfolio target was set above the mandated goal). At the end of PY4, Duquesne reported cumulative (CPITD) gross savings totaling 89% of the 298,025 MWh cumulative estimate projected for Phase I in the utility's EE&C Plan.

Table 7-1: CPITD Commercial Sector Reported Results by Quarter

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
PY4 Q1	326	18,827	25.648	19.388	$1,398
PY4 Q2	135	29,532	0.000	5.214	$1,372
PY4 Q3	164	30,511	0.000	7.551	$987
PY4 Q4	364	33,719	0.000	8.212	$2,204
PY4 Total	**989**	**112,589**	**25.648**	**40.364**	**$5,961**
CPITD Total	**2,307**	**264,277**	**56.220**	**70.937**	**$12,830**

Table 7-2: Commercial Reported Results by Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Small Commercial EE*	1,358	118,905	22.817	31.015	$2,963
Large Commercial EE	527	95,877	18.542	23.717	$5,616
Government & Non-Profit EE	422	49,495	14.862	16.205	$4,251
Total	**2,307**	**264,277**	**56.220**	**70.937**	**$12,830**

***** Savings associated with the Upstream Lighting program which were assigned to the commercial sector based on the approach described in Appendix A are shown in the Small Commercial EE sector

The sample design for the Commercial Program Group used the stratified ratio estimator (Lohr 1999)[30]. 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

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

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

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

Per the utility's EM&V Plan and PY4 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 retail, healthcare, and large 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 PY4, impact evaluation verification work was completed in three phases: in spring of 2013 for projects reported in the first two quarters of PY4, in summer of 2013 for projects completed in the third quarter of PY4, and in fall of 2013 for projects completed in the fourth quarter of PY4. Commercial Evaluation Group projects completed between 6/1/2012 and 11/30/2012 (Q1 and Q2), between 12/1/2012 and 2/28/2013 (Q3) and between 3/1/2013 and 5/31/2013 (Q4), were extracted from Duquesne Light's program tracking system and placed into strata based on each project's reported kWh savings.

Two projects in the commercial large stratum were moved to the idiosyncratic commercial stratum because they were not representative of the rest of the population. For one of the projects the contractor had been fired after the project had been submitted, due to issues with reported savings for that project and others the contractor had been working on but not completed. The second project was a large sporting arena and this project was moved to the idiosyncratic stratum due to its unique building type and usage patterns that are not representative of the other projects in that stratum. Navigant removed one commercial project from the sample, but it still remains in the population, because it was impossible to accurately quantify the savings with the available data.

The strata used in calculating the overall realization rate and relative precision are described below in Table 7-3.

Table 7-3: Commercial Sector Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Large Commercial	> 2,000 MWh	2	0.50	85/0	2	1	Onsite Verification
Medium Commercial	< 2,000 MWh, > 500 MWh	14	0.50	85/28	6	6	Onsite Verification
Small Commercial	< 500 MWh, > 150 MWh	66	0.50	85/39	5	5	Onsite Verification
Very Small Commercial	< 150 MWh	561	0.82	85/47	8	8	Onsite and Telephone Verification
Idiosyncratic Commercial	N/A	2	0.50	85/0	2	2	Onsite Verification
Commercial Total		645		85/13	23	22	
Large GNI	> 2,000 MWh	3	0.50	85/0	3	3	Onsite Verification
Medium GNI	< 2,000 MWh, > 300 MWh	9	0.50	85/22	6	6	Onsite Verification
Small GNI	< 300 MWh	78	0.50	85/25	9	9	Onsite and Telephone Verification
GNI Total		90		85/12	18	18	

Per the utility's EM&V Plan[31], 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

[31] 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.

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

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

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 A. The overall realization rate of the commercial program was applied to the upstream lighting savings that were assigned to the commercial sector.[32]

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

[32] The energy realization rate, 99%, was used for both energy and demand with respect to the upstream lighting savings allocated to the commercial sector. The sector's demand realization rate of 1.06 exceeds 100%, which is not a logical possibility in this situation.

Table 7-4: PY4 Commercial Summary of Evaluation Results for Energy*

Stratum	Reported Gross Energy Savings (kWh)	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings (kWh)	Unverified Gross Energy Savings (kWh)
Large Commercial	12,417,490	0.80	0.00	0.0%	9,986,680	0
Medium Commercial	16,259,703	0.98	0.27	14.3%	13,341,256	2,598,498
Small Commercial	18,075,505	0.91	0.26	20.1%	15,172,439	1,390,893
Very Small Commercial	17,123,396	1.31	0.68	38.7%	21,186,032	904,394
Idiosyncratic Commercial	4,725,682	0.68	0.25	0.0%	3,204,876	0
Commercial Upstream Lighting	25,029,748	0.99	N/A	N/A	24,707,147	0
Commercial SEP	3,496	0.63	N/A	N/A	2,202	0
Commercial Total	93,635,020	0.99		9.3%	87,600,632	4,893,785
Large GNI	8,295,477	0.97	0.08	0.0%	8,005,514	0
Medium GNI	6,125,184	0.89	0.20	7.8%	5,475,725	0
Small GNI	4,533,706	1.31	0.61	28.2%	5,922,318	18,232
GNI Total	18,954,367	1.02		8.4%	19,403,557	18,232

*Note that no energy savings are being claimed from demand response programs.

Table 7-5: PY4 Commercial Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (kW)	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Demand Savings (kW)	Unverified Gross Demand Savings (kW)
Large Commercial	1,126	2.00	0.00	0.0%	2,255	0
Medium Commercial	2,787	1.17	0.38	20.1%	2,785	403
Small Commercial	3,535	1.07	0.27	20.5%	3,376	386
Very Small Commercial	3,527	1.43	0.88	49.6%	4,803	171
Idiosyncratic Commercial	2,665	0.10	1.49	0.0%	257	0
Commercial Upstream Lighting	6,991	1.04	N/A	N/A	7,262	0
Commercial SEP	0	0.67	N/A	N/A	0	0
Commercial Commissioning Demand Response	7,659	1.00	0.00	0.0%	7,659	0
Commercial Total	28,294	1.04		7.9%	28,397	960
Large GNI	1,082	0.88	0.28	0.0%	949	0
Medium GNI	1,901	1.04	0.07	2.8%	1,971	0
Small GNI	1,568	1.22	0.25	12.0%	1,920	0
GNI Commissioning Demand Response	7,518	1.00	0.00	0.0%	7,518	7
GNI Total	12,071	1.02		1.7%	12,359	7

7.3 Impact Evaluation Net Savings

Free Ridership

The free ridership for the Commercial program group was determined by evaluating participant responses to several questions relating to their motivation in participating in the Commercial program. Free ridership was evaluated based on 2 data sets: (1) interviews with the project decision makers associated with projects included in the verification sample and (2) telephone interviews with project decision makers for projects not included in the verification sample for which surveys also included a battery of process evaluation questions. The two approaches used somewhat different question batteries and free ridership algorithms, to try to explore the extent to which free ridership approach impacted the results. The steps taken to evaluate the free ridership for the Commercial program determined through interviews with decision-makers associated with projects included in the verification sample were as follows:

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. Did the respondent have previous plans to purchase the rebated measures?
    b. Did the respondent have funding available to purchase the measures before learning about the rebate?
    c. What type of measure would have been purchased without the program?
    d. When would the measure have been purchased if there had not been a program?
2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
    a. Respondents who indicated that they did not have prior plans to purchase the rebated measures, or who said they would have purchased a less efficient model were assumed to be 0% free riders.
    b. Respondents who indicated that they had prior plans to purchase the rebated measures, had sufficient funding available to purchase the measures, and would have purchased the same measure at the same time or within 3 months were assumed to be 100% free riders.
    c. All other respondents were assigned a free ridership between 0 and 100 percent depending on the indication of program influence in their responses to the other questions.

Table 7-6 below shows the algorithm (methodology) applied in the derivation of the free ridership percentages for each respondent and the calculated overall free ridership for the program.

Table 7-6: Commercial Program Verification Sample Free Ridership Algorithm

FR	Existing Plans?	Sufficient Funding?	Same Efficiency?	Same Timing?	Counts
0%	No	Any Response	or Standard Efficiency	Any Response	7
15%	Yes	No	Same High-Efficiency, Later-Date	>3 Months	2
25%	Yes	No	Same High-Efficiency	Any Response	1
50%	Yes	Yes	Same High-Efficiency, Later-Date	>12 Months	2
Customer Reported % Without Program	Yes	No	Fewer Efficient	Any Response	4
75%	Yes	Yes	Same High-Efficiency, Later-Date	Between 6 and 12 Months	2
100%	Yes	Yes	Same High-Efficiency, or Same But Later Date	Within 3 months	11
0%	No	Any Response	or Standard Efficiency	Any Response	7

Respondent free-ridership assigned based on the methodology outlined above were weighted by the verified savings for their projects. The resulting free ridership based on the on-site interviews was **59%.**

The steps taken to evaluate the free ridership associated with projects not included in the verification sample were as follows:

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. What would the respondent have purchased with the program?
    b. When would the measure have been purchased if there had not been a program?
    c. How likely would the respondent have been to purchase the measure in absence of the program?
    d. Was the incentive a reason the participant purchased the rebated equipment?
2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
    a. Respondents who indicated that they would have been not very or not at all likely to purchase the equipment with the program, **or** who said they would have purchased a standard efficiency equipment were assumed to be 0% free riders.
    b. Respondents who indicated that they would have been very or extremely likely to purchase the same equipment at the same time or within 3 months **and** who indicated the incentive was not a reason for purchasing the equipment were assumed to be 100% free riders.

c. All other respondents were assigned a free ridership between 0 and 100 percent depending on the indication of program influence in their responses to the other questions.

Table 7-7 below shows the algorithm (methodology) applied in the derivation of the free ridership percentages for each respondent and the calculated overall free ridership for the program.

Table 7-7: Commercial Program Non-Verification Sample Free Ridership Algorithm

FR	Likelihood of Purchasing without program?	Incentive reason for participating?	Same Efficiency?	Same Timing?	Counts
0%	Not Very Likely or Not At All Likely	Any Response	or Standard Efficiency	Any Response	36
50%	>Not Very Likely	Any Response	Same High-Efficiency, Later-Date	>12 Months	14
50%	Somewhat Likely	Any Response	Same High-Efficiency, Later-Date	<6 months	10
65%	Somewhat or Very Likely	Any Response	Same High-Efficiency, Later-Date	Between 6 and 12 Months	7
75%	Extremely or Very Likely	Any Response	Same High-Efficiency, Later-Date	Between 3 and 6 Months	1
75%	Extremely Likely	Yes	Same High-Efficiency, or Same But Later Date	Within 3 months	17
100%	Very Likely or Extremely Likely	No	Same High-Efficiency, or Same But Later Date	Within 3 months	11

The free ridership assigned to each respondent is weighted by the verified savings associated with their project. The resulting free ridership determined through telephone surveys with commercial customers is **40%.**

Navigant estimates the free ridership rate to be approximately **50%**, an average of the two free ridership estimates. While some spillover questions were asked as part of the net-to-gross interviews, it was not possible to quantify the results. Therefore, net-to-gross is estimated at 50%.

7.4 Process Evaluation

Navigant evaluated the Commercial & Industrial programs[33] based on the following information:

- Program documentation available from public utility commission filings

[33] The number of PY4 unique participants not included in the commercial and industrial verification samples was very small. Therefore, a census was attempted of all remaining commercial and industrial participants and the analysis of results was combined for these two sectors. The results appear here and also in the next section addressing the Industrial Program Group.

- Program specific information on Duquesne's website
- Interview with Duquesne program staff and Conservation Services Provider staff
- Program logic model supplied in Duquesne's EM&V Plan
- On-site and telephone customer surveys conducted with participants selected as part of the verification sample (included a question regarding ways to improve the program)
- Telephone surveys completed with 115 C&I participants not included in the verification sample
- Program performance as reported in Duquesne's PMRS (DSM tracking) system

Process Evaluation Findings for the C&I programs in PY4 Include:

- The C&I programs are quite successful and at an aggregate level have reached 120% of their goal for PY4, with the Commercial programs achieving 95% of Duquesne Light's Commercial program energy savings goal (the sum of the utility's individual program goals exceed its Act 129 compliance target).
- Participants most commonly report contractors as the method of hearing about the program and as the most influential source in their decision to participate in the program.
- Surveyed customers reported that program awareness would improve if the program was also advertised through mail, radio and television advertisements.
- Twenty-nine percent of respondents indicated some portion of the program participation took longer than expected. Fourteen percent specified that the time to receive the rebate took longer than expected. When asked to indicate how long it took to receive the rebate, 29% of this group indicated it took longer than 8 weeks.
- While only 20% of participants reported barriers to participation, the most commonly reported barrier was that paperwork was too burdensome (10%). A significant percentage of respondents (48%) indicated lack of awareness as the reason why similar companies do not participate.
- Participants reported a high level of satisfaction with all program aspects and a reasonable high level of ease in completing each program aspect**.**
- The most commonly reported decision criteria for participation was the time that the new equipment will take to pay for itself in cost savings (Payback period) which was reported by 57% of respondents. This was followed by the lowest operating cost (17%) and the lowest first cost (13%).
- Just over half of the participants, 51%, indicated they would have purchased the same measure in the absence of the program. Twenty-six percent of these respondents indicated they would have purchased the measure at the same time.
- When asked to indicate why they decided to install the rebated equipment, over half (56%) of all respondents indicated reducing energy costs as one main reason for installing the rebated equipment. Only 25% of respondents reported receiving the rebate from Duquesne Light as a main reason for installing the rebated equipment.

- A total of 42 respondents (36%) indicated they made additional efficiency improvements for which they did not receive a rebate. This may be representative of spillover savings which can be attributed to the program.
- There are significant differences in the deemed savings values between versions of the TRM, which is why it is crucial that the correct version of the TRM be used. Navigant found instances where the CSP had applied the wrong TRM, which had a significant impact on the verified savings, particularly for motor and VFD measures. In Phase II the TRM should be applied based on the installation date. Significant updates were made to the deemed savings values for lighting measures between the 2012 TRM and the 2013 TRM, which is why it will be important to use the correct version of the TRM.
- It appears as though the CSPs default to constant volume as the baseline for motor and VFD measures but this often did not align with what Navigant found on-site.

Recommendation	Duquesne Light Report For Process Evaluations
While contractors are a good source of program marketing, Duquesne Light should consider other marketing options such as newsletters that provide energy efficiency case studies of Duquesne Light customers, to improve program awareness of non-participants.	Being Considered
Duquesne Light should consider emphasizing payback period in its promotion of the C/I programs. This is the most common decision criteria reported by participants. Providing this information may contribute to higher participation levels in the future.	Being Considered
Duquesne Light should make additional 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
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.	Being considered
Choosing the correct baseline has a significant impact on overall measure and project savings, due to the high fluctuation in the deemed savings values depending on which baseline is selected. Navigant recommends that the CSPs ask the customer about how the motors were controlled prior to the project and clearly document the findings in the project documentation.	Being considered
In light of the reported importance of trade ally contractors in informing participants about the program and in influencing their decisions to participate, Phase II program efforts should emphasize broader and more significant outreach to the contractor community. Bringing additional contractors into the program could extend the program to new participants and potentially help to drive down free ridership.	Being Considered
In light of the reported importance of trade ally contractors in informing participants about the program and in influencing their decisions to participate, PY5 evaluation efforts should include a substantive	Included in Phase II evaluation plan

Recommendation	Duquesne Light Report For Process Evaluations
contractor survey effort to explore ways to increase contractor promotion of the programs.	
In light of the participant reports that likely barriers to participation are the level of required paperwork and lack of awareness of the programs, the PY5 evaluation effort should include non-participant survey research.	Included in Phase II evaluation plan

7.5 Financial Reporting

Table 7-8. Summary of Program Finances – Commercial Umbrella

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$46	$127	$557
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**46**	**127**	**557**
Design & Development	0	0	91
Administration[1]	0	0	0
Management[2]	25	415	842
Marketing	0	23	73
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**25**	**438**	**1,006**
EDC Evaluation Costs	15	46	83
SWE Audit Costs	9	21	69
Total EDC Costs[3]	95	632	1,715
Participant Costs[4]	0	196	952
Total TRC Costs[5]	**0**	**913**	**2,274**
Total Lifetime Energy & Capacity Benefits		**14,343**	**18,334**
Total TRC Benefits[6]	**N/A**	**14,343**	**18,334**
TRC Ratio[7]	**N/A**	**5.4**	**8.1**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

Table 7-9. Summary of Program Finances – Small Office

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$11	$299	$642
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**11**	**299**	**642**
Design & Development	0	0	180
Administration[1]	0	0	0
Management[2]	27	185	583
Marketing	0	14	103
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**27**	**199**	**866**
EDC Evaluation Costs	19	59	130
SWE Audit Costs	11	26	114
Total EDC Costs[3]	68	583	1,752
Participant Costs[4]	0	893	1,858
Total TRC Costs[5]	**0**	**1,549**	**3,252**
Total Lifetime Energy & Capacity Benefits		**3,603**	**8,315**
Total TRC Benefits[6]	**N/A**	**3,603**	**8,315**
TRC Ratio[7]	**N/A**	**2.3**	**2.6**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

Table 7-10. Summary of Program Finances – Large Office

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$56	$1,065	$2,898
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**56**	**1,065**	**2,898**
Design & Development	0	0	343
Administration[1]	0	0	0
Management[2]	304	809	2,016
Marketing	0	29	195
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**304**	**838**	**2,554**
EDC Evaluation Costs	39	121	247
SWE Audit Costs	23	54	218
Total EDC Costs[3]	422	2,078	5,917
Participant Costs[4]	0	4,012	9,276
Total TRC Costs[5]	**0**	**7,861**	**14,967**
Total Lifetime Energy & Capacity Benefits		26,992	52,429
Total TRC Benefits[6]	**N/A**	**26,992**	**52,429**
TRC Ratio[7]	**N/A**	**3.4**	**3.5**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

Table 7-11. Summary of Program Finances – Retail – Large and Small

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$34	$657	$2,245
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**34**	**657**	**2,245**
Design & Development	0	0	210
Administration[1]	0	0	0
Management[2]	96	388	1,402
Marketing	0	17	117
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**96**	**405**	**1,729**
EDC Evaluation Costs	23	72	148
SWE Audit Costs	14	33	132
Total EDC Costs[3]	167	1,167	4,254
Participant Costs[4]	0	3,734	8,798
Total TRC Costs[5]	**0**	**5,705**	**12,169**
Total Lifetime Energy & Capacity Benefits		**13,559**	**32,811**
Total TRC Benefits[6]	**N/A**	**13,559**	**32,811**
TRC Ratio[7]	**N/A**	**2.4**	**2.7**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

Table 7-12. Summary of Program Finances – Public Agency/Non-Profit/Education

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$351	$1,423	$4,613
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**351**	**1,423**	**4,613**
Design & Development	0	0	579
Administration[1]	0	0	0
Management[2]	322	1,642	3,250
Marketing	1	48	324
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**323**	**1,690**	**4,153**
EDC Evaluation Costs	64	199	408
SWE Audit Costs	38	90	364
Total EDC Costs[3]	776	3,402	9,538
Participant Costs[4]	0	4,993	12,421
Total TRC Costs[5]	**0**	**8,383**	**18,483**
Total Lifetime Energy & Capacity Benefits		**18,280**	**41,867**
Total TRC Benefits[6]	**N/A**	**18,263**	**41,850**
TRC Ratio[7]	**N/A**	**2.2**	**2.3**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

Table 7-13. Summary of Program Finances – Healthcare

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$187	$804	$1,026
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**187**	**804**	**1,026**
Design & Development	0	0	93
Administration[1]	0	0	0
Management[2]	371	633	1,341
Marketing	0	15	107
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**371**	**648**	**1,541**
EDC Evaluation Costs	22	67	137
SWE Audit Costs	13	30	122
Total EDC Costs[3]	593	1,549	2,826
Participant Costs[4]	0	1,571	3,461
Total TRC Costs[5]	**0**	**3,308**	**6,381**
Total Lifetime Energy & Capacity Benefits		**9,358**	**12,901**
Total TRC Benefits[6]	**N/A**	**9,358**	**12,901**
TRC Ratio[7]	**N/A**	**2.8**	**2.0**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

8 Industrial Program Group Programs

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

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

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

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

- Primary Metals Program: Roth Bros, Inc. and Enerlogics Networks, Inc.
- Chemical Products: Global Energy Partners, LLC
- Mixed Industrial: Global Energy Partners, LLC
- Industrial Umbrella: Duquesne Light

8.1 Program Updates

The only change to the Industrial programs in PY4 was an emphasis on peak period energy management, through the application of custom commissioning projects, and communication strategies to assist in achieving demand reduction goals.

8.2 Impact Evaluation Gross Savings

The programs within the Industrial Program Group are close to achieving their goals (note that the portfolio target was set above the mandated goal). At the end of PY4, Duquesne reported cumulative (CPITD) gross savings totaling 85% of the 110,040 MWh cumulative estimate projected for Phase I in the utility's EE&C Plan.

Table 8-1: Industrial Sector Reported Results by Quarter

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
PY4 Q1	137	4,653	58.569[34]	56.812	$265
PY4 Q2	23	7,604	0.000	1.014	$1,500
PY4 Q3	19	3,945	0.000	0.583	$289
PY4 Q4	67	18,752	0.000	2.659	$956
PY4 Total	**246**	**34,955**	**58.569**	**61.069**	**$3,009**
CPITD Total	**382**	**93,029**	**66.668**	**69.167**	**$5,844**

Table 8-2: CPITD Industrial Reported Results by Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Small Industrial EE	258	27,308	14.680	15.966	$1,848
Large Industrial EE	124	65,721	51.987	53.202	$3,996
Total	**382**	**93,029**	**66.668**	**69.167**	**$5,844**

As with the Commercial Program Group, the sample design for the Industrial Program Group used the stratified ratio estimator (Lohr 1999)[35]. 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[36], rather

[34] While peak reduction projects may have appeared in the Duquesne tracking system in multiple quarters, those providing demand reduction during the top 100 hours are shown in this table as occurring in PY4Q1 when the majority of these top 100 hours occurred.

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

[36] 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.

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 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 PY4, impact evaluation verification work was completed in three phases: in spring of 2013 for projects reported in the first two quarters of PY4, in summer of 2013 for projects completed in the third quarter of PY4, and in fall of 2013 for projects completed in the fourth quarter of PY4. Industrial Program Group projects completed between 6/1/2012 and 11/30/2012 (Q1 and Q2), between 12/1/2012 and 2/28/2013 (Q3), and between 3/1/2013 and 5/31/2013 (Q4), were extracted from Duquesne Light's program tracking system and broken into strata based on each project measure's reported kWh savings.

Navigant removed two industrial projects from the sample, but kept them in the population, due to a lack of information available causing an inability to accurately evaluate the savings for those projects. One of the industrial projects that was removed was a lighting project completed all throughout a high-use, sensitive space and the documentation was not sufficient enough to verify the savings. The second industrial project was removed because the main contact for the project no longer worked for the company and therefore it was difficult to quantify the savings with the limited information available.

Three industrial projects from PY4 were deemed as unverified and removed from the population due to concerns about their evaluability. A large industrial customer completed parts of a custom project that is being implemented in phases. The nature of the project necessitates that all phases be complete before savings can be estimated effectively. One of these projects was selected in Navigant's sample in PY4 Q1-Q2 but was deemed unverifiable. All three of these projects were grouped into the unverified category and will be verified post PY4 after all phases of the project are complete.

Table 8-3: Industrial Sector Sampling Strategy for PY4

Stratum	Strata Boundaries	Population Size	Assumed Coefficient of Variation (C_v) or Proportion in Sample Design	Target Levels of Confidence & Precision	Target Sample Size	Achieved Sample Size	Evaluation Activity
Large Industrial	> 500 MWh	12	0.56	85/29	6	6	Onsite and Telephone Verification[37]
Medium Industrial	< 500 MWh, > 100 MWh	44	0.50	85/33	6	7	Onsite Verification
Small Industrial	< 100 MWh	411	0.88	85/50	8	47	Onsite and Telephone Verification
Program Total		**467**		**85/15**	**20**	**60**	

Per the utility's EM&V Plan[38], 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.

[37] Data were obtained electronically. Together with telephone discussions, an on-site visit was not required to perform the verification assessment.

[38] 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 8-4: PY4 Industrial Summary of Evaluation Results for Energy*

Stratum	Reported Gross Energy Savings (kWh)	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Energy Savings (kWh)	Unverified Gross Energy Savings (kWh)
Large Industrial	20,297,208	1.08	0.22	10.2%	10,525,964	10,523,889
Medium Industrial	10,009,261	0.94	0.29	16.5%	9,376,028	0
Small Industrial	4,648,229	1.05	0.66	13.2%	4,902,614	0
Program Total	**34,954,698**	**1.02**		**7.1%**	**24,804,606**	**10,523,889**

*Note that no energy savings are being claimed from demand response programs.

Table 8-5: PY4 Industrial Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Savings (kW)	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision	Verified Gross Demand Savings (kW)	Unverified Gross Demand Savings (kW)
Large Industrial	2,615	0.98	0.11	5.2%	1,294	1,290
Medium Industrial	1,446	1.02	0.06	3.7%	1,475	0
Small Industrial	822	1.03	0.24	4.9%	846	0
Industrial Commissioning Demand Response	56,186	1.00	0.00	0.0%	56,186	0
Program Total	**61,069**	**1.00**		**0.1%**	**59,800**	**1,290**

8.3 Impact Evaluation Net Savings

Free Ridership

The Free ridership for the Industrial program was determined through the same methodology as the commercial program and is described above in 7.3.

The free ridership determined through on-site interviews was 31% and that determined through telephone interviews was 26%. The respondent counts for each approach are shown below in Table 8-6 and Table 8-7.

Table 8-6: Industrial Program Verification Sample Free Ridership Algorithm

FR	Existing Plans?	Sufficient Funding?	Same Efficiency?	Same Timing?	Counts
0%	No	Any Response	Any Response	Any Response	6
0%	Yes	Any Response	Standard Efficiency	Any Response	1
15%	Yes	No	Same High-Efficiency, Later-Date	>3 Months	2
25%	Yes	No	Same High-Efficiency	Any Response	1
35%	Yes	Yes	Same High-Efficiency, Later-Date	>12 Months	2
50%	Yes	Yes	Same High-Efficiency, Later-Date	Between 6 and 12 Months	2
75%	Yes	Yes	Same High-Efficiency, Later-Date	Between 3 and 6 Months	0
100%	Yes	Yes	Same High-Efficiency	Between now and 3 months	11

Table 8-7: Industrial Program Non-Verification Sample Free Ridership Algorithm

FR	Likelihood of Purchasing without program?	Incentive reason for participating?	Same Efficiency?	Same Timing?	Counts
0%	Not at all Likely	Yes	Any Response	Any Response	1
0%	Any Response	Any Response	Standard Efficiency	Any Response	5
15%	Not at all Likely	No	Any Response	Any Response	0
25%	Not Very Likely	Any Response	Any Response	Any Response	2
50%	>Not Very Likely	Any Response	Same High-Efficiency, Later-Date	>12 Months	3
50%	Somewhat Likely	Any Response	Same High-Efficiency, Later-Date	<6 months	1
65%	Somewhat or Very Likely	Any Response	Same High-Efficiency, Later-Date	Between 6 and 12 Months	0
75%	Extremely or Very Likely	Any Response	Same High-Efficiency, Later-Date	Between 3 and 6 Months	0
75%	Extremely Likely	Yes	Same High-Efficiency	Between now and 3 months	1
85%	Very Likely	No	Same High-Efficiency	Between now and 3 months	0
100%	Extremely Likely	No	Same High-Efficiency	Between now and 3 months	3

Based on these results, Navigant estimates that free ridership is approximately 28%, an average of the two free ridership estimates. While some spillover questions were asked as part of the net-to-gross interviews, it was not possible to quantify the results. Therefore, net-to-gross is estimated at 72%.

8.4 Process Evaluation

Navigant evaluated the Commercial & Industrial programs[39] based on the following information:

- Program documentation available from public utility commission filings
- Program specific information on Duquesne's website
- Interview with Duquesne program staff and Conservation Services Provider staff
- Program logic model supplied in Duquesne's EM&V Plan
- On-site and telephone customer surveys conducted with participants selected as part of the verification sample (included a question regarding ways to improve the program)

[39] The number of PY4 unique participants not included in the commercial and industrial verification samples was very small. Therefore, a census was attempted of all remaining commercial and industrial participants and the analysis of results was combined for these two sectors. The results appear here and also in the next section addressing the Industrial Program Group.

- Telephone surveys completed with 115 C&I participants not included in the verification sample
- Program performance as reported in Duquesne's PMRS (DSM tracking) system

Process Evaluation Findings for the C&I programs in PY4 Include:

- The C&I programs are quite successful and at an aggregate level have reached 120% of their goal for PY4, with the Industrial programs achieving 84% of Duquesne Light's Commercial program energy savings goal (the sum of the utility's individual program goals exceed its Act 129 compliance target).
- Participants most commonly report contractors as the method of hearing about the program and as the most influential source in their decision to participate in the program.
- Surveyed customers reported that program awareness would improve if the program was also advertised through mail, radio and television advertisements.
- Twenty-nine percent of respondents indicated some portion of the program participation took longer than expected. Fourteen percent specified that the time to receive the rebate took longer than expected. When asked to indicate how long it took to receive the rebate, 29% of this group indicated it took longer than 8 weeks.
- While only 20% of participants reported barriers to participation, the most commonly reported barrier was that paperwork was too burdensome (10%). A significant percentage of respondents (48%) indicated lack of awareness as the reason why similar companies do not participate.
- Participants reported a high level of satisfaction with all program aspects and a reasonable high level of ease in completing each program aspect**.**
- The most commonly reported decision criteria for participation was the time that the new equipment will take to pay for itself in cost savings (Payback period) which was reported by 57% of respondents. This was followed by the lowest operating cost (17%) and the lowest first cost (13%).
- Just over half of the participants, 51%, indicated they would have purchased the same measure in the absence of the program. Twenty-six percent of these respondents indicated they would have purchased the measure at the same time.
- When asked to indicate why they decided to install the rebated equipment, over half (56%) of all respondents indicated reducing energy costs as one main reason for installing the rebated equipment. Only 25% of respondents reported receiving the rebate from Duquesne Light as a main reason for installating the rebated equipment.
- A total of 42 respondents (36%) indicated they made additional efficiency improvements for which they did not receive a rebate. This may be representative of spillover savings which can be attributed to the program.

Recommendation	Duquesne Light Report For Process Evaluations
While contractors are a good source of program marketing, Duquesne Light should consider other marketing options such as newsletters that provide energy efficiency case studies of Duquesne Light customers, to improve program awareness of non-participants.	Being Considered
Duquesne Light should consider emphasizing payback period in its promotion of the C/I programs. This is the most common decision criteria reported by participants. Providing this information may contribute to higher participation levels in the future.	Being Considered
Duquesne Light should make additional 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
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.	Being considered
Choosing the correct baseline has a significant impact on overall measure and project savings, due to the high fluctuation in the deemed savings values depending on which baseline is selected. Navigant recommends that the CSPs ask the customer about how the motors were controlled prior to the project and clearly document the findings in the project documentation.	Being considered
In light of the reported importance of trade ally contractors in informing participants about the program and in influencing their decisions to participate, PY5 evaluation efforts should include a substantive contractor survey effort to explore ways to increase contractor promotion of the programs.	Included in Phase II evaluation plan
In light of the participant reports that likely barriers to participation are the level of required paperwork and lack of awareness of the programs, the PY5 evaluation effort should include non-participant survey research.	Included in Phase II evaluation plan

8.5 Financial Reporting

Table 8-8. Summary of Program Finances – Industrial Umbrella

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$9	$65	$312
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**9**	**65**	**312**
Design & Development	0	0	39
Administration[1]	0	0	0
Management[2]	14	146	241
Marketing	0	4	31
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**14**	**150**	**311**
EDC Evaluation Costs	6	18	38
SWE Audit Costs	4	9	36
Total EDC Costs[3]	33	242	697
Participant Costs[4]	0	0	1,415
Total TRC Costs[5]	**0**	**55**	**1,651**
Total Lifetime Energy & Capacity Benefits		**50**	**2,589**
Total TRC Benefits[6]	**N/A**	**50**	**2,589**
TRC Ratio[7]	**N/A**	**0.9**	**1.6**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

Table 8-9. Summary of Program Finances – Mixed Industrial

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$139	$495	$1,475
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**139**	**495**	**1,475**
Design & Development	0	0	39
Administration[1]	0	0	0
Management[2]	209	411	1,611
Marketing	0	9	67
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**209**	**420**	**1,717**
EDC Evaluation Costs	13	40	82
SWE Audit Costs	8	18	77
Total EDC Costs[3]	369	973	3,351
Participant Costs[4]	0	870	2,927
Total TRC Costs[5]	**0**	**2,703**	**6,099**
Total Lifetime Energy & Capacity Benefits		**9,257**	**21,848**
Total TRC Benefits[6]	**N/A**	**9,257**	**21,848**
TRC Ratio[7]	**N/A**	**3.4**	**3.6**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

Table 8-10. Summary of Program Finances – Chemicals

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$89	$149	$822
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**89**	**149**	**822**
Design & Development	0	0	130
Administration[1]	0	0	0
Management[2]	136	260	1,353
Marketing	0	10	73
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**136**	**270**	**1,556**
EDC Evaluation Costs	14	44	91
SWE Audit Costs	8	20	81
Total EDC Costs[3]	247	483	2,550
Participant Costs[4]	0	523	2,911
Total TRC Costs[5]	**0**	**1,031**	**4,752**
Total Lifetime Energy & Capacity Benefits		**2,815**	**12,203**
Total TRC Benefits[6]	**N/A**	**2,815**	**12,203**
TRC Ratio[7]	**N/A**	**2.7**	**2.6**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

Table 8-11. Summary of Program Finances – Primary Metals

	PY4 Quarter 3 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$(232)	$1,233	$2,311
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**(232)**	**1,233**	**2,311**
Design & Development	0	0	430
Administration[1]	0	0	0
Management[2]	613	1,305	3,648
Marketing	1	30	205
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**614**	**1,335**	**4,283**
EDC Evaluation Costs	39	121	249
SWE Audit Costs	22	53	232
Total EDC Costs[3]	443	2,742	7,075
Participant Costs[4]	0	1,359	3,866
Total TRC Costs[5]	**0**	**4,606**	**10,189**
Total Lifetime Energy & Capacity Benefits		**10,725**	**29,249**
Total TRC Benefits[6]	**N/A**	**10,725**	**29,249**
TRC Ratio[7]	**N/A**	**2.3**	**2.9**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

9 Watt Choices Curtailable Load Program

The Curtailable Load program is a demand response program for large commercial and industrial customers. The program is based on demand response agreements between a conservation service provider and agents acting on behalf of Duquesne. The program sought to achieve load reductions within the anticipated top 100 hours of system peak load. In PY4, there were 40 customers enrolled in the Curtailable Load program.

9.1 Program Updates

The summer of PY4 was the first summer that Duquesne offered the Curtailable Load program.

9.2 Impact Evaluation Gross Savings

This section describes the methodology and results of the impact evaluation. Navigant analyzed hourly interval data for a census of program participants.

9.2.1 Evaluation Methodology

Sections 3.3A.2, 3.3A.2.01, and 3.3A.3 of the *Amended and Restated Operating Agreement of PJM Interconnection, L.L.C.* dated May 8, 2012 describe the methodology used to estimate the customer baseline. The baseline load for weekday events is calculated as the average of the highest 4 out of 5 eligible baseline days with an optional symmetric additive adjustment. Days are not eligible for inclusion in the baseline if the day is an event day, NERC holiday, or weekend. Otherwise eligible days are excluded if the average daily event period usage is less than 25% of the average event period for the five days; this criterion eliminates outlier days in which the load was extremely low. Navigant applied a Consecutive-Day baseline (weekends and holidays are eligible comparison days) for four participants with normal operations on weekends and holidays.

The baseline load for Saturday events is calculated as the average of the highest 2 out of 3 eligible baseline days with an optional symmetric additive adjustment. Days are not eligible for inclusion in the baseline if the day is an event day, NERC holiday, or Sunday. Otherwise eligible days are excluded if the average daily event period usage is less than 25% of the average event period for the three days.

The optional Symmetric Additive Adjustment (SAA) affects the level of the baseline load, but not the shape. The SAA shifts the baseline up or down so that the average baseline load during the three hours beginning four hours prior to the event period is equal to the average load during this same period. Use of the SAA was designated for each participant.

Program reductions may be either positive (the load is less than the baseline) or negative (the load is greater than the baseline). All negative load reductions were recorded as zero.

One program participant used a generator when reducing load in response to an Act 129 event. However, the generator was used in addition to Act 129 event hours. The generator data was multiplied by negative one to convert the data from supply to demand and the baseline was calculated following the protocol.

9.2.2 Reported and Verified Savings

Tables 9-1 and 9-2 summarize the PY4 reported savings for the Curtailable Load program. No sampling was done in the analysis. The impact analysis was conducted on a census of program participants. Table 9-3 and 9-4 show the verified energy and demand savings. The Watt Choices Curtailable Load Program generated 2.602 MW[40] of demand reductions during the Top 100 hours in PY4. However, the analysis of demand reductions was applied to all demand response projects, including those garnered under other Commercial/Industrial programs. In total, 73.966 MW of event-specific demand reductions were analyzed.

[40] Reported and verified demand reductions include line losses.

Table 9-1: PY4 Curtailable Load Program Reported Results by Quarter

Reporting Period	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
PY4 Q1	40	0	2.602	2.602	$0
PY4 Q2	0	0	0	0	$0
PY4 Q3	0	0	0	0	$0
PY4 Q4	0	0	0	0	$0
PY4 Total	**40**	**0**	**2.602**	**2.602**	**$0**
CPITD Total	**40**	**0**	**2.602**	**2.602**	**$0**

Table 9-2: PY4 Curtailable Load Program Reported Results by Sector

Sector	Participants	Reported Gross Energy Savings (MWh/yr)	Top 100 Hours Reported Gross Demand Reduction (MW)	Total Reported Gross Demand Reduction (MW)	Incentives ($1,000)
Residential					
Low-Income					
Small Commercial and Industrial					
Large Commercial and Industrial	40	0	2.602	2.602	0
Government and Non-Profit					
PY4 Total	**40**	**0**	**2.602**	**2.602**	**$0**
CPITD Total	**40**	**0**	**2.602**	**2.602**	**$0**

Table 9-3: PY4 Curtailable Load Program Summary of Evaluation Results for Energy

Stratum	Reported Gross Energy Savings (MWh)	Energy Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision (at 85% Confidence)	Verified Gross Energy Savings (MWh)	Unverified Gross Energy Savings (MWh)
All Participants	0	N/A	0	0	0	0
Program Total	0	N/A	0	0	0	0

Table 9-4: PY4 Curtailable Load Program Summary of Evaluation Results for Demand

Stratum	Reported Gross Demand Reduction (MW)	Demand Realization Rate	Observed Coefficient of Variation (C_v) or Proportion	Relative Precision (at 85% Confidence)	Verified Gross Demand Reduction Savings (MW)	Unverified Gross Demand Reduction (MW)
All Participants	2.602	1	0	0	2.602	0
Program Total	2.602	1	0	0	2.602	0

9.3 Impact Evaluation Net Savings

Navigant assumed that program participants would not have curtailed load at the times Duquesne dispatched the program without the program incentives and therefore applied a net-to-gross ratio of 1.0.

9.4 Process Evaluation

Navigant did not conduct a process evaluation for this program.

9.5 Financial Reporting

Table 9-5: Summary of Large Curtailable DR Finances

	PY4 Quarter 4 ($000)	PYTD ($000)	CPITD ($000)
EDC Incentives to Participants	$0	$0	$0
EDC Incentives to Trade Allies	0	0	0
Subtotal EDC Incentive Costs	**0**	**0**	**0**
Design & Development	0	0	0
Administration[1]	0	0	0
Management[2]	3	618	727
Marketing	0	2	9
Technical Assistance	0	0	0
Subtotal EDC Implementation Costs	**3**	**620**	**736**
EDC Evaluation Costs	3	9	16
SWE Audit Costs	2	4	11
Total EDC Costs[3]	8	633	763
Participant Costs[4]	0	0	0
Total TRC Costs[5]	**0**	**633**	**763**
Total Lifetime Energy & Capacity Benefits		**149**	**149**
Total TRC Benefits[6]	**N/A**	**149**	**149**
TRC Ratio[7]	**N/A**	**0.2**	**0.2**

NOTES

Per PUC direction, TRC inputs and calculations are required in the Annual Report only and should comply with the 2011 Total Resource Cost Test Order approved July 28, 2011.

[1] Implementation contractor costs.
[2] EDC costs other than those identified explicitly.
[3] Per the 2011 Total Resource Cost Test Order – Total EDC Costs, here, refer to EDC incurred expenses only.
[4] Per the 2011 Total Resource Cost Test Order –Net participant costs; in PA, the costs of the end-use customer.
[5] Total TRC Costs includes EDC Evaluation Costs, 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.
[7] TRC Ratio equals Total TRC Benefits divided by Total TRC Costs.

Appendix A – Upstream Lighting Evaluation Methodology

Introduction

Duquesne Light's Act 129 Upstream Lighting program works with retailers of residential lighting products to offer special discounts on efficient lighting – specifically CFLs and LEDs. Customers purchase the bulbs already discounted at the store; there is no coupon or rebate form to submit. Instead, participating retailers provide sales data regarding the discounted bulbs to Duquesne's Conservation Services Provider (CSP) for the program, ECOVA. These data identify sales of specific products, by SKU number. ECOVA then applies the relevant energy savings algorithm from the Pennsylvania Technical Reference Manual (TRM) to estimate savings for the program from each discounted bulb sold, and the results are entered into Duquesne's PMRS tracking database.

Duquesne's approved evaluation plan for this program specified that the savings from the discounted products would be calculated based solely on applying the gross energy and demand savings algorithms from the TRM to the sales data, including the assumption of an 84% in-service rate (installation rate) for the bulbs purchased. The evaluation each year verifies that the TRM has been applied correctly to the data obtained by ECOVA and makes corrections, as necessary. However, a number of questions have been raised regarding the savings algorithms themselves. In particular, it is likely that the algorithms undercount savings by ignoring cross sector sales.

In some other jurisdictions, both within Pennsylvania and outside of it, evaluation data suggests that a small but meaningful percentage of the discounted bulbs make their way into non-residential settings[41]. Installations in non-residential settings are more likely to be used more hours each year and to be used more during periods of peak electricity consumption. That is, they may be generating significantly more savings each year than if they were installed in a residential setting. Further, failure to consider cross-sector sales will result in savings and costs for one sector being accounted for in another, which would not be in accordance with requirements in Section 2.A.11 of Act 129 which requires no cross subsidization of measure incentives across customer classes.

There also is interest in determining two other factors with respect to this program:

- Net-to-gross. While the net-to-gross factor for all Act 129 programs is considered to be 100% for purposes of each utility's compliance with energy savings and demand reduction targets and reported savings, the net-to-gross factor is of interest and is to be used for program redesign efforts and for estimating cost effectiveness for modified programs. Duquesne had not previously estimated net-to-gross ratios for the Upstream Lighting program.

[41] See sources referenced in "CFL Cross Sector Sales and Leakage Issues" memorandum submitted by PECO Energy to the TUS and SWE on February 22, 2013.

- Low Income Percentage. Unlike other residential programs that require participating customers to complete rebate applications to receive a program incentive, the Upstream Lighting program incentives are built into a discounted price at the store. This feature, which facilitates program delivery and reduces potential participation barriers faced by customers (having to find a rebate application, remembering to submit it, etc.), also makes identification of program participants virtually impossible (especially given customer confidentiality concerns of the retailers). As a result, while data are collected on the number of discounted bulbs that are sold by the participating stores, it is not possible to determine what percentage of the bulbs (and therefore savings) should be attributed to low-income households in the territory.

Approach

Navigant planned to use the following research tools to evaluate the residential vs. non-residential ratio, complete the Free Ridership (FR) analysis, and estimate the low income percentage and determine the installation rate:

- In-Store Intercept Surveys
    - In-store intercept surveys were designed to collect information about customers planned installation location (residential vs. non-residential) and about upstream lighting free ridership. The surveys were completed across a number of store sizes and across weekday and weekend time periods. The surveys captured information about the different customer types who purchased program bulbs.
- Telephone Population Surveys
    - A telephone survey was designed to target a random sample of Duquesne Light residential customers. The survey collected information about NTG (Free ridership and spillover) as well as the percentage of customers who fall into the low-income category.
- Interviews of participating retailers and manufacturers and program implementers
    - Interview were completed with participating retailers and manufacturers and program implementers to collect information about sales patterns (weekday vs. weekend) and program effect on bulbs sales (FR).

Unfortunately, participating retailers and manufacturers were not forthcoming with information that could assist in the evaluation, citing confidentiality and competitiveness concerns. The program implementation contractor, while very helpful in facilitating the in-store intercept component of the research, was unable to provide any more detail than what had already been provided in the summary sales records they presented to Duquesne and the evaluation team. However, the other research approaches yielded important insights and findings.

In-Store Intercept Surveys

The Navigant team conducted in-store intercept surveys with 201 customers who purchased qualifying CFLs and LEDs between September 7th, 2013 and September 23rd, 2013. Interviews were completed at 12 store locations, three which fell into the large strata based on their PY4 bulb sales and nine which fell

into the medium strata based on their PY4 bulb sales. A total of five store locations fell into the large strata as defined in the sampling plan, but two of these locations would not allow the evaluation team to complete surveys. These interviews were conducted across weekday, evening and weekend time periods.

The in-store intercept survey was designed to collect information about installations in residential vs. non-residential locations, and free ridership information.

Telephone Survey

The team also conducted telephone surveys with a random sample of 301 Duquesne residential customers between June 4th 2013 and June 24th 2013. These surveys included questions to identify all respondents who had purchased CFLs in the previous three months, regardless of where the products were purchased. The assumption was that there were not significant differences between customers who bought at participating stores and those who bought at non-participating stores with respect to the key characteristics of interest.

The telephone survey was designed to collected information about low income installations as well as net to gross (NTG) information.

The survey sample was selected at random from a list of all residential Duquesne Light customers' who had telephone numbers included in their contact information.

Findings

Residential vs. Non-Residential Installations

Based on the in-store intercept surveys, Navigant estimates that 12.55% of bulbs purchased through the Duquesne Watts Choice program are installed in non-residential locations. This 12.55% was estimated based on a weighted average of responses received through in-store intercept surveys conducted on both weekdays and weekend days and assumes that all bulbs sold is small store locations were installed in residential locations. The percentage of CFLs reported by respondents as destined for non-residential installations was not the same on weekday vs. weekend days. The results indicated that the non-residential sales percentage during weekend days is lower than the percentage during weekdays, when one might expect business customers to make the majority of their purchases. Further, the Duquesne Light program implementer and a program implementer in a different, non-Pennsylvania service territory (DTE in Michigan) believe that the majority of CFL sales occur on weekend days. Navigant has interviewed a number of participating retailers and manufacturers but due to confidentiality concerns they would not share their estimates of the percentage of lighting sales which occur on weekdays vs. weekend days. Based on our professional judgment, we currently estimate the weekend sales percentage to be approximately 70% (i.e., of all CFL sales occurring during any given week, 70% occur on Saturday and Sunday).

The 12.55% is a conservative estimate of cross-sector sales in that (1) it assumes that all sales to participating stores in the small sales stratum were of CFLs that were installed only in residential settings; (2) its assumes that no less than 70% of every store's CFL sales occurs on Saturday or Sunday.

Applying the 70% weekend sales percentage estimate to our survey results, we estimate that 16% of CFL sales through large and medium store locations from Duquesne Light's Upstream Lighting program end up in non-residential installations as shown in Table 1, below:

Table 1: Estimation of Percentage of CFLs Being Installed in Non-Residential Settings, Based on Intercept Survey Results

	Number of Respondents*	Total Number of CFLs	Total residential	Total non-residential	% Non-Residential by Time Period	Estimated CFL Sales Weekday vs. Weekend	% Non-Residential CFLs Total
Weekday Intercept	*75*	626	472	154	25%	30%	
Weekend Intercept	*107*	829	728	101	12%	70%	
Intercept Total	**182**	**1455**	**1200**	**255**			**16%**

*While a total of 201 in-store intercept surveys were completed, only 182 of these respondents purchased CFLs. The remaining respondents purchased LEDs.

Navigant stratified PY4 retailers based on their total bulbs sales (kWh). Table 2 illustrates the stratum size/name, the total number of stores, total "sales" (kWh savings), and the kWh savings range (criterion for being included in the stratum) for each stratum.

Table 2: Retail Store Strata Criteria

Strata	Total Number of Stores	In-store intercept Number of Stores	Total PY4 Sales (Annual kWh Savings)	Strata Boundaries (Annual Savings from Store)
Large	5	3	23,316,589	>2,800,000 kWh
Medium	13	9	22,956,918	1,000,000 – 2,800,000 kWh
Small	89	-	12,383,529	<1,000,000 kWh
Total			**58,657,037**	

The majority of program bulb sales (approximately 80%) occurred in stores which fell into the large and medium stratum. Navigant believes the store brands which are part of the medium and large stratum represent the locations where non-residential bulbs are purchased. Stores falling into the small stratum are much less likely to be locations for non-residential purchases. To be conservative, Navigant is assuming that non-residential CFLs represents 0% of sales in stores which fall into the small stratum and has weighted the 16% non-residential bulb sales occurring through large and medium stores by the savings associated with these stores. Based on this approach, we estimate that 12.55% of Duquesne Light program bulbs are purchased by non-residential customers

To estimate the energy savings and demand reduction associated with these non-residential CFL installations, we must:

1. Identify the business types in which these CFLs were projected to be installed.

2. Identify the hours of use and coincidence factors specified in the Pennsylvania Technical Reference Manual (TRM) for those business types.

3. Weight the hours of use and coincidence factors for each identified business type by the number of CFLs projected to be installed in each business type, to obtain a weighted average hours of use and a weighted average coincidence factor to apply to the CFLs projected to be installed in non-residential settings.

   See Table 3 below, which shows these calculations.

Table 3: Calculation of Weighted Average Non-residential Hours of Use and Coincidence Factor

Location	Reported Bulb Count	Hours of Use from TRM	Coincidence Factor
Office	101	2,567	0.61
Retail	26	2,829	0.73
Full Service Restaurant	54	3,613	0.65
Medical	0	4,198	0.77
Manufacturing	8	4,730	0.57
Construction	48	2,316	0.54
Public Assembly (One Shift)	18	2,610	0.62
Average		**2,839**	**0.62**

4. Multiply the non-residential percentage (12.55%) by the total number of CFLs reported as sold through Duquesne Light's Upstream Lighting program for PY2, PY3 and PY4, to obtain the total number of reported CFLs estimated to have been installed in non-residential facilities.

5. Multiply the total number of non-residential CFLs by the per-unit energy savings calculated by the TRM's CFL energy savings algorithm when using the weighted non-residential average hours of use estimate. This yields the total energy savings resulting from Upstream Lighting program non-residential CFL installations.

6. Multiply the total number of non-residential CFLs by the per-unit demand reduction calculated by the TRM's CFL demand reduction algorithm when using the weighted non-residential coincidence factor estimate. This yields the total demand reduction resulting from Upstream Lighting program non-residential CFL installations. This demand reduction number is based on the full PY4 period and is included in the Non-Compliance demand reduction tables in the body of this report.

7. To calculate the demand reduction to use in the compliance reporting tables of the report, we must limit the demand reduction to the average demand reduction occurring during the top 100 hours of summer 2012. To accomplish this, as with all energy efficiency projects, we determine which CFLs were in place prior to or during the top 100 hours of summer 2012. These CFLs include all PY2 CFLs, all PY3 CFLs, and all PY4 CFLs that were reported in the Duquesne Light tracking system at some point prior to the last of the top 100 hours of summer 2012 (accounting for the percentage of the top 100 hours during which the bulbs were not in place). We then sum the total demand reduction occurring during each of the top 100 hours

and then divide that sum by 100. This yields the total demand reduction from Upstream Lighting program CFLs for compliance purposes.

Free Ridership

The free ridership for the Upstream Lighting Program was estimated by evaluating participant in-store intercept and telephone survey responses to several questions. The steps taken to evaluate the free ridership for the purchase of CFLs and LEDs through the upstream lighting program component were 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:
   - Did the respondent have previous plans to purchase CFLs/LEDs?
   - What was the main reason for purchasing CFLs/LEDs?
   - What was the influence of bulb price/program advertisements on the respondent's decision to purchase the bulbs?
   - How many program bulbs would the respondent have purchased if the bulbs were <average incentive amount> more expensive?
2. In estimating free ridership for this program, we made the following assumptions regarding survey responses and participant actions:
   - Respondents who indicated that (1) they did not have plans to purchase CFLs/LEDs before entering the store, and (2) who identified the program bulb pricing, program advertising or program events as the main reason for purchasing CFLs/LEDs and (3) indicated that the maximum influence rating of the program bulb prices and program advertising was 9 or 10 on a 10 point scale and (4) indicated they would not have purchased any program bulbs if the bulbs were <average incentive amount> more expensive were assumed to be 0% free riders.
   - Respondents who indicated that (1) they had prior plans to purchase CFLs/LEDs, and (2) did not list the program bulb pricing, program advertising or program events as the main reason for purchasing, and (3) gave a maximum program influence rating for the program bulb prices and program advertising of 1 or 2 on a 10 point scale, and (4) indicated they would have purchased the same number or more bulbs if the bulbs had been <average incentive amount> more expensive were assumed to be 100% free riders.
   - All other respondents were assigned a free ridership between 0 and 100 percent depending on their responses to each question. These free ridership percentages were assigned by averaging two different free ridership estimates. The first free ridership estimate was assigned based on participants responses to (1) their prior purchasing plans, (2) the reason for purchasing the bulbs (Program or Non-Program Reason) and (3) the maximum influence of the bulb price and program advertisements on their purchase decisions. The second free ridership estimate was determined by evaluating the respondents responses to the

percentage of the purchased bulbs that they would have purchased if the bulbs were <average incentive amount> higher.

The free ridership algorithm associated with the first free ridership estimate is shown below in Table 4.

Table 4: Upstream Lighting Free Ridership Methodology

Free Ridership Percentage	Prior Plans to purchase CFLs or LEDs	Reason for Purchasing CFLs - Program Factor	Influence of price of bulbs and program advertisements (Maximum influence of both)
100	Y	N	1, 2
80	Y	Y	1, 2
65	N	N	1, 2
50	N	Y	1, 2
80	Y	N	3 , 4, 5
65	Y	Y	3, 4, 5
35	N	N	3, 4, 5
25	N	Y	3, 4, 5
50	Y	N	6, 7, 8
25	Y	Y	6, 7, 8
10	N	-	6, 7, 8
10	Y	N	9, 10
0	Y	Y	9, 10
0	N	-	9, 10

This second free ridership was estimated based on the following equation:

$$FR = \frac{Number\ of\ Bulbs\ which\ would\ have\ been\ purchased\ if\ price\ was < average\ incentive > higher}{Number\ of\ Bulbs\ purchased}$$

The free ridership calculated through the equation above is averaged with that estimated based on the methodology presented in Table 4 to determine a free ridership percentage for each respondent.

The calculated free ridership percentage for standard CFLs, specialty CFLs and LEDs is presented below in Table 5. The total upstream lighting free ridership is determined by weighting Standard CFL, Specialty CFL and LED free ridership percentages by the savings associated with each.

Table 5: Upstream Lighting Free Ridership Results

	Standard CFLs (n=426)	Specialty CFLs (n=58)	LEDs (n=24)	Total Upstream Lighting
Average FR	55%	69%	47%	**57%**

Spillover

Participants surveyed through the telephone survey for the Upstream Lighting program were also asked if they had taken any additional energy savings actions as a result of purchasing CFL bulbs through the Duquesne Light program. Half of the respondents indicated that they had taken additional energy savings actions. The top reported actions for the REEP Upstream Lighting component are listed in Table 6, along with their average influence rate, and savings attributed to the program.

Table 6: Top 5 Upstream Lighting Spillover Actions

Action	Number of Respondents	Average Influence	Savings per Respondent who took action (kWh)	Savings Attributed to Program per respondent who took action (kWh)	Deemed Savings Reference
Refrigerator	12	3.88	85.70	33.21	PA TRM Average
Replaced windows	10	4.00	450.00	180.00	Energy Star website - average of single and double pane windows
Replaced my old central air conditioner with a high efficiency central air conditioner	12	4.04	431.00	174.20	PA TRM - Calcs from PECO average of various sizes
Turned off / reduced use of	45	3.43	262.80	90.23	OPA Summer
Turned off / reduced use of power to electronics	43	3.67	21.29	7.82	OPA Summer Sweepstakes
Total	**301**			**8,685**	
Total Savings per Respondent				**29**	

In order to determine a spillover factor for the Upstream Lighting program the savings per participant were multiplied by the number of PY4 participants. The number of Upstream Lighting participants was estimated by dividing the total number of bulbs sold by the average number of bulbs each participant reported purchasing through surveys. Multiplying the number of participants by the spillover savings per participant leads to total spillover savings for the program. The total spillover savings is then divided by the gross program energy savings to determine a spillover factor.

Table 7: REEP Spillover Factors

REEP Component	Spillover Savings per Participant (kWh)	Total PY4 Participants	Total Spillover Savings (kWh)	Total Gross Savings (kWh)	Spillover %
Upstream Lighting	29	148,894	4,296,424	44,423,625	9.7%

The NTG ratio for the Upstream Lighting program is then determined as follows:

NTG = 1-FR+Spillover

NTG = 1-0.57+0.097 = 0.53

The NTG ratio for the Upstream Lighting is estimated to be 0.53.

Low Income Percentage

In order to determine the percentage of program bulbs being purchased by and installed in low income households, respondents were asked to provide the number of individuals living in their household and their annual household income through the telephone survey. The telephone survey was used for this purpose since it targeted specifically residential Duquesne Light customers. The tables below shows the official low-income household definitions used by the federal government, as well as how they were slightly modified for implementation in the general population survey.

Table 8: Household Federal Government Income Level Definitions (Low Income defined as at or below 150% of the Federal Poverty Level)

	Percent of Federal Poverty Level					
Household Size	**100%**	**133%**	**150%**	**200%**	**300%**	**400%**
1	$11,490	$15,282	$17,235	$22,980	$34,470	$45,960
2	$15,510	$20,628	$23,265	$31,020	$46,530	$62,040
3	$19,530	$25,975	$29,295	$39,060	$58,590	$78,120
4	$23,550	$31,322	$35,325	$47,100	$70,650	$94,200
5	$27,570	$36,668	$41,355	$55,140	$82,710	$110,280
6	$31,590	$42,015	$47,385	$63,180	$94,770	$126,360
7	$35,610	$47,361	$53,415	$71,220	$106,830	$142,440
8	$39,630	$52,708	$59,445	$79,260	$118,890	$158,520
For each additional person, add	$4,020	$5,347	$6,030	$8,040	$12,060	$16,080

These guidelines were used to develop approximate income ranges associated with household size, to determine whether each respondent represented a low income household. The income ranges were defined such that household income information could be obtained from surveyed respondents,

balancing the need for accuracy with the respondents' need for some level of confidentiality. The categorizations are presented below in Table 9.

Table 9: Low-income Household Definitions Used in General Population Survey

Number in Household	One	Two	Three	Four	Five	Six+	Don't Know/ Refused	Total
Household Income:								
Under $20k	Low Income							
$20-$25k		Low Income						
$25-$30k			Low Income					
$30-$35k				Low Income				
$35-$40k					Low Income			
$40-$45K						Low Income		
$45-$50k								
More than $50k (D3=2)								
Don't Know/ Refused								
Total								

Applying these guidelines for defining a qualifying low-income household, the survey responses were used to determine the percentage of the residential bulbs installed in low income households. The survey found that 20.4% of residential bulbs were installed in low-income households. From the in-store intercept survey, Navigant found that 12.55% of bulbs were installed in non-residential locations. Of the remaining 87.45%, 20.4% were installed in low-income households. The percentage of total program bulbs installed in residential and low income residential locations is shown below:

Percentage of Program Bulbs installed in LI Households = 0.8745(0.204) = 0.178*

Percentage of Program Bulbs installed in Residential Households = 0.8745(1-0.204) = 0.696*