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December 3, 2019

Via Overnight Mail

Ms. Rosemary Chiavetta, Secretary
Pennsylvania Public Utility Commission
Commonwealth Keystone Building, 2nd Floor
400 North Street
Harrisburg, PA 17120

Re: Duquesne Light Company – Revised Phase III Energy Efficiency and Conservation Plan – Program Year 10 Annual Report
Docket No. M-2015-2515375

Dear Secretary Chiavetta:

On November 15, 2019, Duquesne Light Company ("Duquesne Light" or the "Company") filed and served on all parties its Annual Report to the Pennsylvania Public Utility Commission for the period June 1, 2018 through May 31, 2019, Program Year 10, for its Revised Phase III Energy Efficiency and Conservation Plan. Pages of that Annual Report version erroneously included a watermark reading "Confidential and Proprietary." Therefore, enclosed for filing, please find an Annual Report version that omits this watermark. This Annual Report version is otherwise identical to the version filed November 15, 2019.

Should you have any questions, please do not hesitate to contact me or Dave Defide, Senior Manager of Customer Programs, at (412) 393-6107.

Respectfully Submitted,

Michael Zimmerman
Counsel, Regulatory

Enclosure
Cc: Certificate of Service *(cover letter only)*

CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the foregoing has been served upon the following persons, in the manner indicated, in accordance with the requirements of 52 Pa. Code § 1.54 (relating to service by a participant):

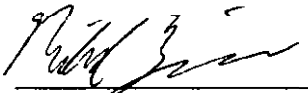
FIRST-CLASS MAIL

Bureau of Investigation & Enforcement
Pennsylvania Public Utility Commission
Commonwealth Keystone Building
400 North Street, 2nd Floor West
PO Box 3265
Harrisburg, PA 17105-3265

Office of Small Business Advocate
555 Walnut Street, 1st Floor
Harrisburg, PA 17101

Office of Consumer Advocate
555 Walnut Street
Forum Place, 5th Floor
Harrisburg, PA 17101-1923

Date: December 3, 2019



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NAVIGANT
A Guidehouse Company

Final Annual Report to the Pennsylvania Public Utility Commission

Phase III of Act 129
Program Year 10
(June 1, 2018 – May 31, 2019)
For Pennsylvania Act 129 of 2008
Energy Efficiency and Conservation Plan

Prepared for:

Duquesne Light Company

DLC
—DUQUESNE LIGHT CO.—

Prepared by:
Navigant, A Guidehouse Company
1200 19th Street NW, Suite 700
Washington, DC 20036

November 15, 2019

guidehouse.com

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DISCLAIMER

This report was prepared by Navigant Consulting, Inc., n/k/a Guidehouse Inc. ("Navigant"),[1] for Duquesne Light. The work presented in this report represents Navigant's professional judgment based on the information available at the time this report was prepared. Navigant is not responsible for the reader's use of, or reliance upon, the report, nor any decisions based on the report. NAVIGANT MAKES NO REPRESENTATIONS OR WARRANTIES, EXPRESSED OR IMPLIED. Readers of the report are advised that they assume all liabilities incurred by them, or third parties, as a result of their reliance on the report, or the data, information, findings and opinions contained in the report.

[1] On October 11, 2019, Guidehouse LLP completed its previously announced acquisition of Navigant Consulting Inc. In the months ahead, we will be working to integrate the Guidehouse and Navigant businesses. In furtherance of that effort, we recently renamed Navigant Consulting Inc. as Guidehouse Inc.

ACRONYMS

BDR	Behavioral Demand Response
CBL	Customer Baseline
C&I	Commercial and Industrial
CDH	Cooling Degree Hours
CEEP	Community Education Energy Efficiency Program
CEP	Commercial Efficiency Program
CSP	Conservation Service Provider or Curtailment Service Provider
DLC	Duquesne Light Company
DR	Demand Response
EDC	Electric Distribution Company
EDT	Eastern Daylight Time
EE&C	Energy Efficiency and Conservation
EM&V	Evaluation, Measurement, and Verification
EUL	Effective Useful Life
GNI	Government, Nonprofit, Institutional
HER	Home Energy Report
HIM	High Impact Measure
HOT	Hold-Out Test
HOU	Hours of Use
HVAC	Heating, Ventilating, and Air Conditioning
ICSP	Implementation Conservation Service Provider
IEP	Industrial Efficiency Program
IMP	Interim Measure Program
ISR	In-Service Rate
kW	Kilowatt
kWh	Kilowatt-hour
LCL	Large Curtailable Load
LDV	Lagged Dependent Variable
LED	Light-Emitting Diode
LFER	Linear Fixed-Effects Regression
LIEEP	Low-Income Energy Efficiency Program
LLF	Line Loss Factors
LMP	Locational Marginal Price
M&V	Measurement and Verification
MFHR	Multifamily Housing Retrofit
MOU	Memorandum of Understanding
MW	Megawatt
MWh	Megawatt-hour
NPV	Net Present Value

NTG	Net-to-Gross
P3TD	Phase III to Date
PA PUC	Pennsylvania Public Utility Commission
PAPP	Public Agency Partnership Program
PSA	Phase III to Date Preliminary Savings Achieved; equal to VTD + PYRTD
PSA+CO	PSA savings plus Carryover from Phase II
PY	Program Year: e.g. PY8, from June 1, 2016, to May 31, 2017
PYRTD	Program Year Reported to Date
PYVTD	Program Year Verified to Date
RARP	Residential Appliance Recycling Program
RCT	Randomized Control Trial
REEP	Residential Energy Efficiency Program
RTD	Phase III to Date Reported Gross Savings
RUL	Remaining Useful Lifetime
SCDI	Small Commercial Direct Install
SWE	Statewide Evaluator
TRC	Total Resource Cost
TRM	Technical Reference Manual
UEC	Unit Energy Consumption
VTD	Phase III to Date Verified Gross Savings
W	Watt
WHRP	Whole House Retrofit Program
WSA	Weather Sensitivity Adjustment

TYPES OF SAVINGS

Gross Savings: The change in energy consumption and/or peak demand that results directly from program-related actions taken by participants in an Energy Efficiency and Conservation (EE&C) program, regardless of why they participated.

Net Savings: The total change in energy consumption and/or peak demand that is attributable to an EE&C program. Depending on the program delivery model and evaluation methodology, the net savings estimates may differ from the gross savings estimate due to adjustments for the effects of free riders, changes in codes and standards, market effects, participant and nonparticipant spillover, and other causes of changes in energy consumption or demand not directly attributable to the EE&C program.

Reported Gross: Also referred to as ex ante (Latin for beforehand) savings. The energy and peak demand savings values calculated by the electric distribution company (EDC) or its program Implementation Conservation Service Providers (ICSP) and stored in the program tracking system.

Unverified Reported Gross: The Phase III Evaluation Framework allows EDCs and the evaluation contractors the flexibility to not evaluate each program every year. If an EE&C program is being evaluated over a multi-year cycle, the reported savings for a program year where evaluated results are not available are characterized as unverified reported gross until the impact evaluation is completed and verified savings can be calculated and reported.

Verified Gross: Also referred to as ex post (Latin for from something done afterward) gross savings. The energy and peak demand savings estimates reported by the independent evaluation contractor after the gross impact evaluation and associated M&V efforts have been completed.

Verified Net: Also referred to as ex post net savings. The energy and peak demand savings estimates *reported by the independent evaluation contractor after application of the results of the net impact* evaluation. Typically calculated by multiplying the verified gross savings by a net-to-gross (NTG) ratio.

Annual Savings: Energy and demand savings expressed on an annual basis, or the amount of energy and/or peak demand an EE&C measure or program can be expected to save over the course of a typical year. Annualized savings are noted as MWh/yr or MW/yr. The Pennsylvania Technical Reference Manual provides algorithms and assumptions to calculate annual savings, and Act 129 compliance targets for consumption reduction are based on the sum of the annual savings estimates of installed measures or behavior change.

Lifetime Savings: Energy and demand savings expressed in terms of the total expected savings over the useful life of the measure. Typically calculated by multiplying the annual savings of a measure by its effective useful life. The Total Resource Cost (TRC) test uses savings from the full lifetime of a measure to calculate the cost-effectiveness of EE&C programs.

Program Year Reported to Date (PYRTD): The reported gross energy and peak demand savings achieved by an EE&C program or portfolio within the current program year. PYTD values for energy efficiency will always be reported gross savings in a semi-annual or preliminary annual report.

Program Year Verified to Date (PYVTD): The verified gross energy and peak demand savings achieved by an EE&C program or portfolio within the current program year as determined by the impact evaluation findings of the independent evaluation contractor.

Phase III to Date (P3TD): The energy and peak demand savings achieved by an EE&C program or portfolio within Phase III of Act 129. Reported in several permutations described below.

Phase III to Date Reported (RTD): The sum of the reported gross savings recorded to date in Phase III of Act 129 for an EE&C program or portfolio.

Phase III to Date Verified (VTD): The sum of the verified gross savings recorded to date in Phase III of Act 129 for an EE&C program or portfolio, as determined by the impact evaluation finding of the independent evaluation contractor.

Phase III to Date Preliminary Savings Achieved (PSA): The sum of the verified gross savings (VTD) from previous program years in Phase III where the impact evaluation is complete plus the reported gross savings from the current program year (PYTD).

Phase III to Date Preliminary Savings Achieved + Carryover (PSA+CO): The sum of the verified gross savings from previous program years in Phase III plus the reported gross savings from the current program year plus any verified gross carryover savings from Phase II of Act 129. This is the best estimate of an EDC's progress toward the Phase III compliance targets.

Phase III to Date Verified + Carryover (VTD + CO): The sum of the verified gross savings recorded to date in Phase III plus any verified gross carryover savings from Phase II of Act 129.

1. INTRODUCTION

Pennsylvania Act 129 of 2008, signed on October 15, 2008, mandated energy savings and demand reduction goals for the largest electric distribution companies (EDCs) in Pennsylvania for Phase I (2008 through 2013). Phase II of Act 129 began in 2013 and concluded in 2016. In late 2015, each EDC filed a new energy efficiency and conservation (EE&C) plan with the Pennsylvania Public Utilities Commission (PA PUC) detailing the proposed design of its portfolio for Phase III. These plans were updated based on stakeholder input and subsequently approved by the PUC in 2016.

Phase III of the Act 129 programs began implementation on June 1, 2016. This report documents the progress and effectiveness of the Phase III EE&C accomplishments for Duquesne Light Company (Duquesne Light, DLC) in Program Year 10 (PY10), and the cumulative accomplishments of the Phase III programs since inception. It also documents the energy savings carried over from Phase II. The Phase II carryover savings count toward EDC savings compliance targets for Phase III.

This report details the participation, spending, reported gross, verified gross, and verified net impacts of the energy efficiency programs in PY10. Compliance with Act 129 savings goals are ultimately based on verified gross savings. This report also includes estimates of cost-effectiveness according to the Total Resource Cost test (TRC).[2] Duquesne Light retained Navigant Consulting Inc., n/k/a Guidehouse Inc. (Navigant) as an independent evaluation contractor for Phase III of Act 129. Navigant is responsible for the measurement and verification of the savings and calculation of gross verified and net verified savings.

Navigant also performed a process evaluation to examine the design, administration, implementation, and market response to the EE&C programs. This report presents the key findings and recommendations identified by the process evaluation and documents any changes to EE&C program delivery considered based on the recommendations.

Phase III of Act 129 includes a demand response (DR) goal for Duquesne Light. DR events are limited to the months of June through September, which are the first 4 months of the Act 129 program year. Because the DR season is completed early in the program year, it is possible to complete the independent evaluation of verified gross savings for DR sooner than is possible for energy efficiency programs. Duquesne Light initiated its DR program in PY9 and continued activities into PY10. Verified gross savings results from the EDC's PY10 DR season, which ran from June through September 2018, were originally reported in the PY10 Semi-Annual Report submitted in January 2019.

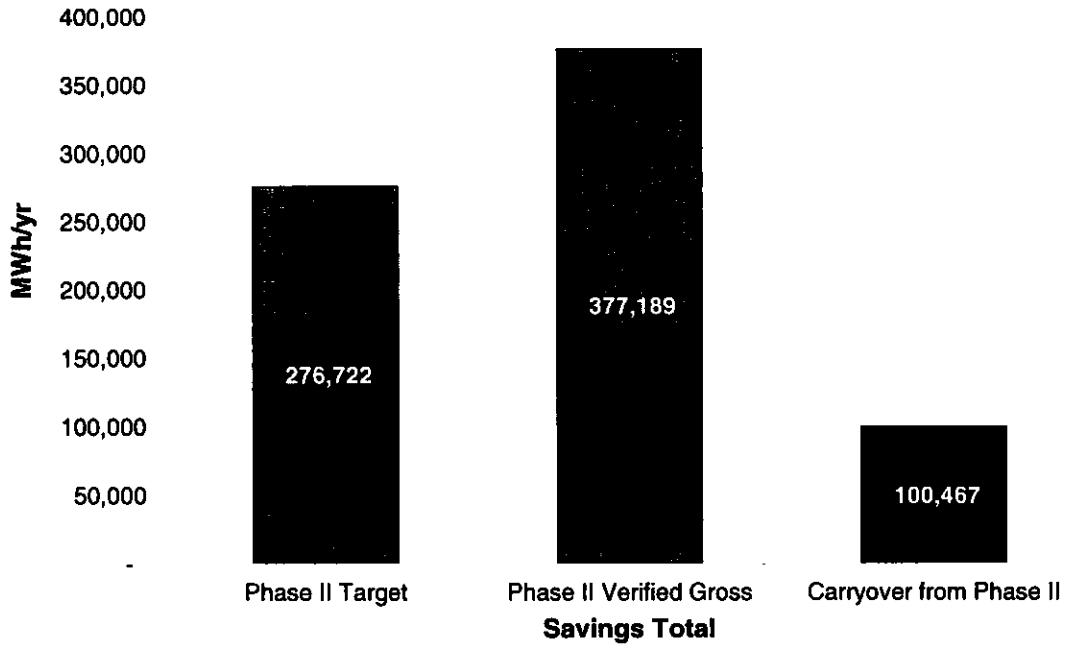
[2] The Pennsylvania TRC Test for Phase I was adopted by PUC order at Docket No. M-2009-2108601 on June 23, 2009 (*2009 PA TRC Test Order*). The TRC Test Order for Phase I later was refined in the same docket on August 2, 2011 (2011 PA TRC Test Order). The 2013 TRC Order for Phase II of Act 129 was issued on August 30, 2012. The 2016 TRC Test Order for Phase III of Act 129 was adopted by PUC order at Docket No. M-2015-2468992 on June 11, 2015.

2. SUMMARY OF ACHIEVEMENTS

2.1 Carryover Savings from Phase II of Act 129

Duquesne Light achieved a total of 100,467 MWh/yr of portfolio-level carryover savings from Phase II. Figure 1 illustrates the carryover calculation by comparing Duquesne Light's Phase II verified gross savings total to the Phase II compliance target.

Figure 1: Carryover Savings from Phase II of Act 129



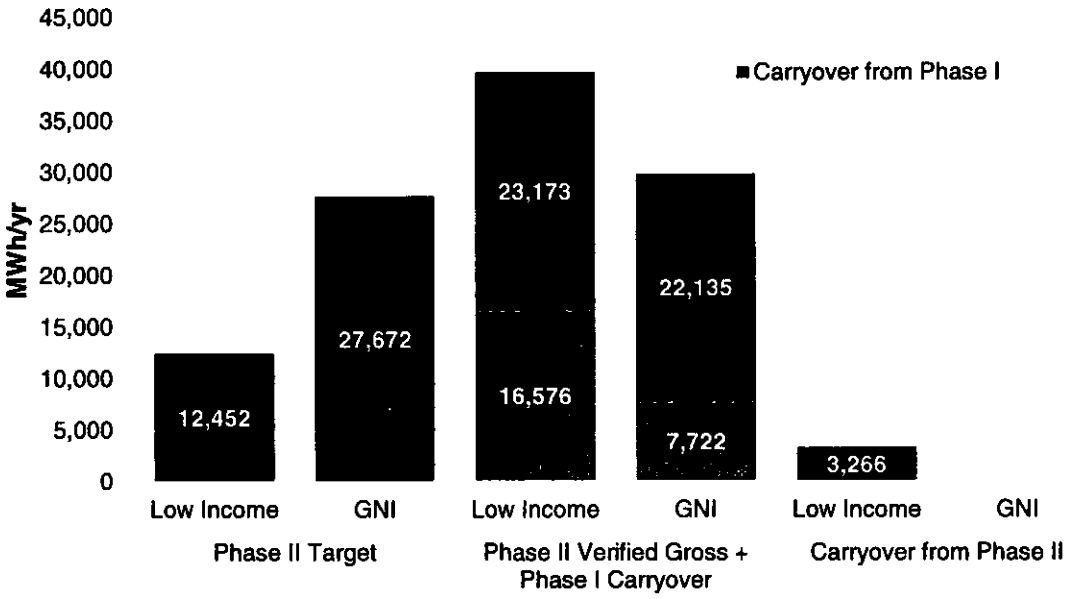
Source: Navigant analysis.

The Commission's Phase III Implementation Order[3] allowed EDCs to carry over savings in excess of the Phase II Government, Nonprofit, and Institutional (GNI) savings goal and excess savings from the low income (LI) customer segment.[4] Figure 2 shows the calculation of carryover savings for the low income and GNI targets.

[3] Pennsylvania Public Utility Commission, *Energy Efficiency and Conservation Program* Implementation Order, at Docket No. M-2014-2424864, (*Phase III Implementation Order*), entered June 11, 2015.

[4] Proportionate to those savings achieved by dedicated low income programs in Phase II.

Figure 2: Customer Segment-Specific Carryover from Phase II



Source: Navigant analysis.

2.2 Phase III Energy Efficiency Achievements to Date

Since the beginning of Program Year 10 on June 1, 2018, Duquesne Light has claimed:

- 98,208 MWh/yr of reported gross electric energy savings (program year reported to date [PYRTD])
- 12.58 MW/yr of reported gross peak demand savings (PYRTD) from energy efficiency programs
- 97,427 MWh/yr of verified gross electric energy savings (program year verified to date [PYVTD])
- 12.17 MW/yr of verified gross peak demand savings (PYVTD) from energy efficiency programs

Since the beginning of Phase III of Act 129 on June 1, 2016, Duquesne Light has achieved:

- 264,767 MWh/yr of reported gross electric energy savings (RTD)
- 31.31 MW/yr of reported gross peak demand savings (RTD) from energy efficiency programs
- 268,196 MWh/yr of verified gross electric energy savings (VTD)
- 31.78 MW/yr of verified gross peak demand savings (VTD) from energy efficiency programs

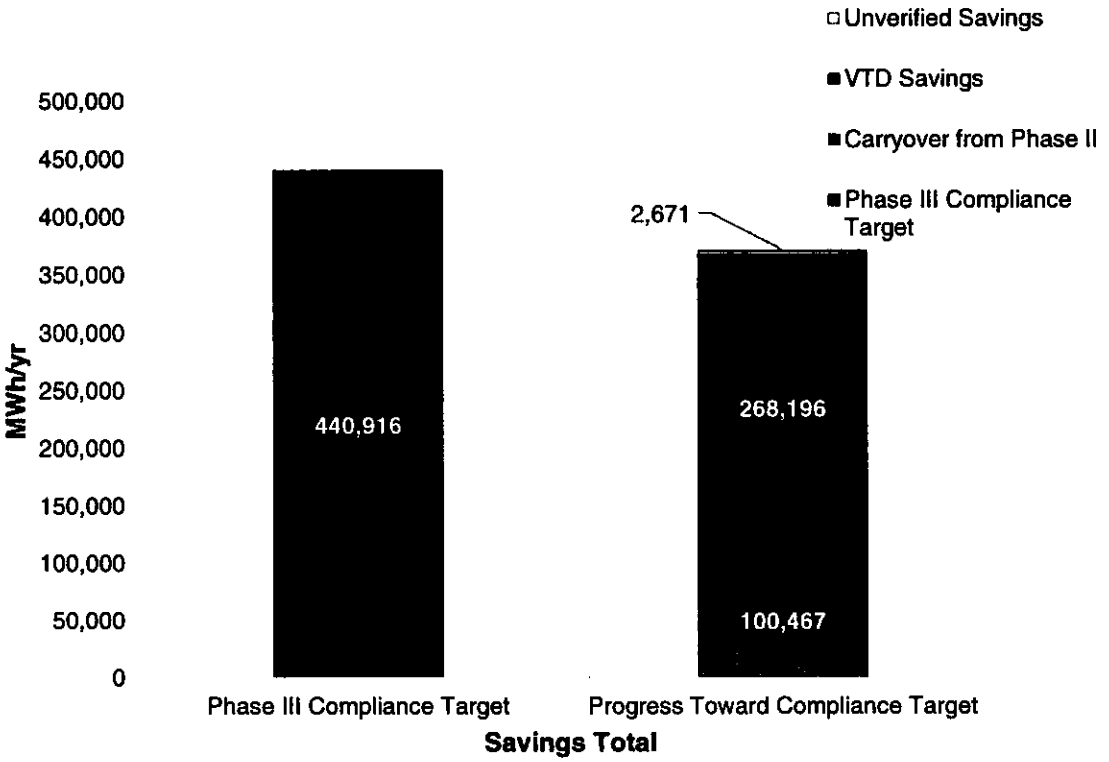
Including carryover savings from Phase II, Duquesne Light has achieved:

- 368,662 MWh/yr of VTD + portfolio-level CO energy savings.

- This represents 83.6% of the May 31, 2021, energy savings compliance target of 440,916 MWh/yr.

Figure 3 summarizes Duquesne Light's progress toward the Phase III portfolio compliance target. It also includes unverified savings for Small/Medium and Large Non-Residential Midstream Lighting programs. Navigant verified the first 4 months of PY10 activities for these programs; the latter 8 months of PY10 activities will be verified and reported in the PY11 Final Annual Report. Unverified savings total 2,671 MWh/yr and 0.47 MW/yr. Throughout this report, these unverified savings are included in realization rate denominators and no corresponding verified savings are included in the numerators. Small/Medium and Large Non-Residential Midstream Lighting program PY10 realization rates will appear lower than what historical program performance suggests. Reference Section 3.7 for additional and stratum-specific performance details.

Figure 3: EE&C Plan Performance Toward Phase III Portfolio Compliance Target[5]



Source: Navigant analysis.

The Phase III Implementation Order directed EDCs to offer conservation measures to the low-income customer segment based on the proportion of electric sales attributable to low income households. The Phase III Implementation Order directed EDCs to offer conservation measures to the low income customer segment based on the proportion of electric sales attributable to low income households. The proportionate number of measures targeted for Duquesne Light is 8.4%. Duquesne Light offers a total of 102 EE&C measures to its residential and non-residential customer classes.[6] There are 20 measures

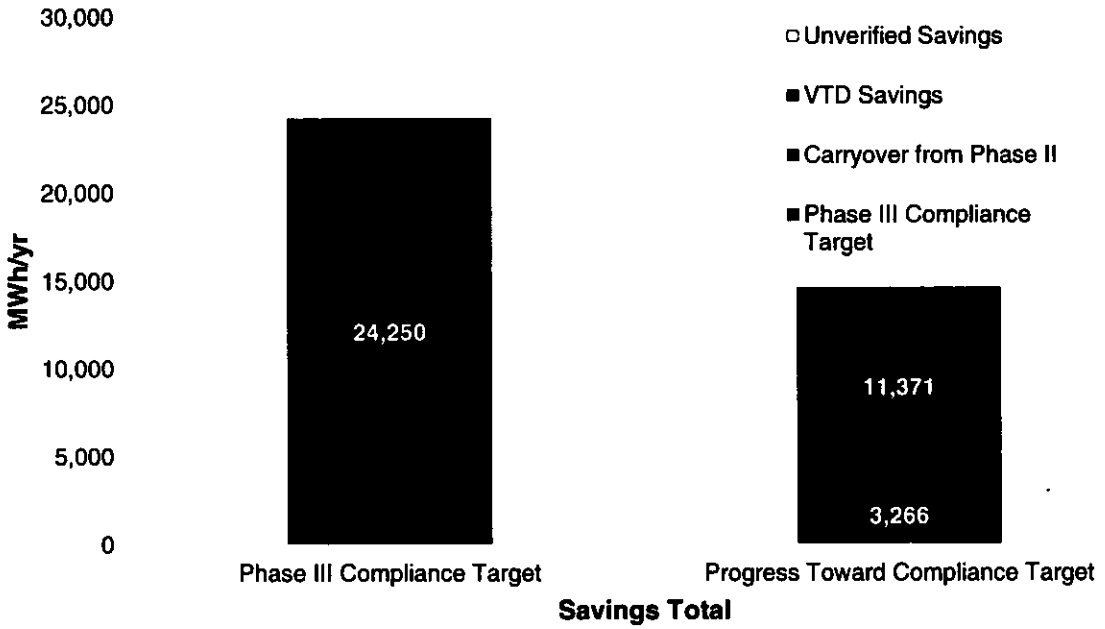
[5] This figure includes unverified savings associated with the Small/Medium Midstream Lighting program and the Large Midstream Lighting program. These savings will be verified during PY11.

[6] As noted in the July 15, 2019 Preliminary Annual Report, Duquesne Light made *minor* modifications to its plan during PY10. These measure counts reflect the plan with these minor modifications. Details can be found in the filing titled *Duquesne Light Company – Phase III Energy Efficiency and Conservation Plan Petition for Minor Modification Docket No. M-2015-2515375*, filed on December 17, 2018 and approved on January 23, 2019.

available to the low income customer segment at no cost to the customer. This represents 19.6% of the total measures offered in the EE&C Plan and exceeds the proportionate number of measures target.

The PA PUC also established a low income energy savings target of 5.5% of the portfolio savings goal. The low income savings target for Duquesne Light is 24,250 MWh/yr and is based on verified gross savings. Figure 4 compares the VTD performance for the low income customer segment to the Phase III savings target. Duquesne Light has achieved 60.4% of the Phase III low income energy savings target.

Figure 4: EE&C Plan Performance Toward Phase III Low Income Compliance Target[7]

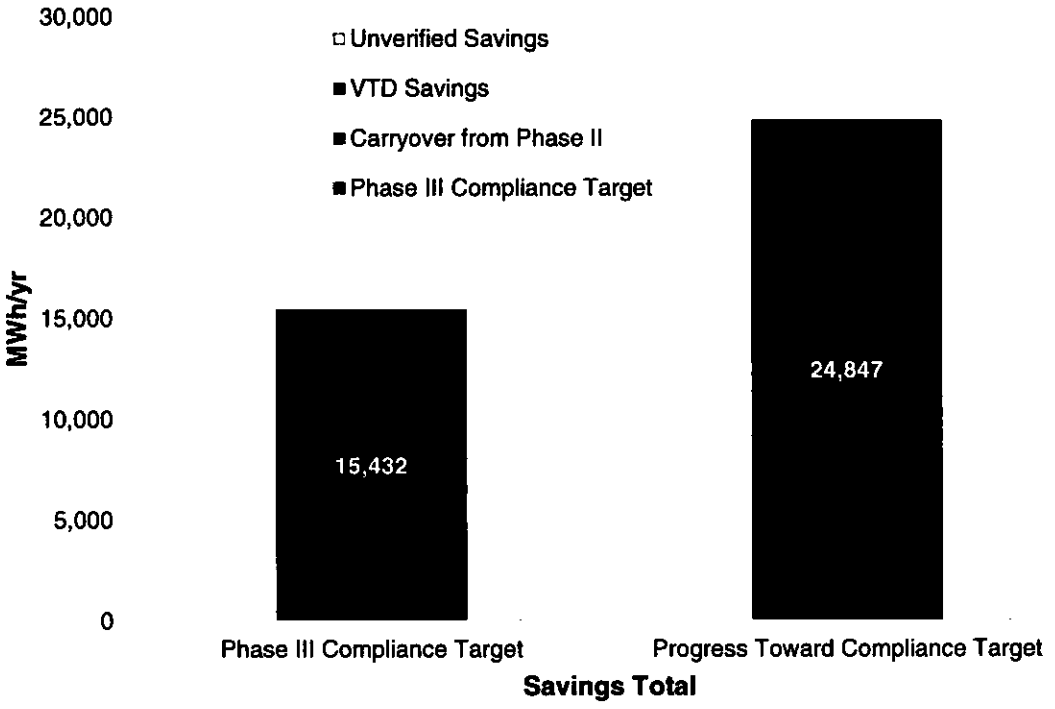


Source: Navigant analysis.

The Phase III Implementation Order established a GNI energy savings target of 3.5% of the portfolio savings goal. The GNI savings target for Duquesne Light is 15,432 MWh/yr and is based on verified gross savings. Figure 5 compares the VTD performance for the GNI customer segment to the Phase III savings target. Duquesne Light has achieved 161.0% of the Phase III GNI energy savings target.

[7] As noted in the January 15, 2019 Semi-Annual Report, Navigant's PY9 Annual Report for low income savings achievements erroneously excluded the contributions to the low income carve-out from PY8 Multifamily Housing Retrofit activities. Those savings total 99 MWh and are now reflected in the low income savings achievements. The PY9 Annual Report's low income savings achievements indicated 5,210 MWh for the phase (excluding Phase II carryover). The correct total is 5,309 MWh.

Figure 5: EE&C Plan Performance Against Phase III GNI Compliance Target



Source: Navigant analysis.

2.3 Phase III DR Achievements to Date

The Phase III DR performance target for Duquesne Light is 42 MW. Compliance targets for DR programs are based on average performance across events. Targets were established at the system level, which means the load reductions measured at the customer meter must be escalated to reflect transmission and distribution losses.

Act 129 DR events are triggered by PJM's day-ahead load forecast. When the day-ahead forecast is above 96% of the peak load forecast for the year, a DR event is initiated for the following day. In PY10, six DR events were called. Table 1 lists the days that DR events were called and the verified gross demand reductions achieved by each program. Table 1 also lists the average DR performance for PY10 and for Phase III to date. Duquesne's average DR performance to date is above the Phase III compliance reduction target by 30% (performance–goal/goal).

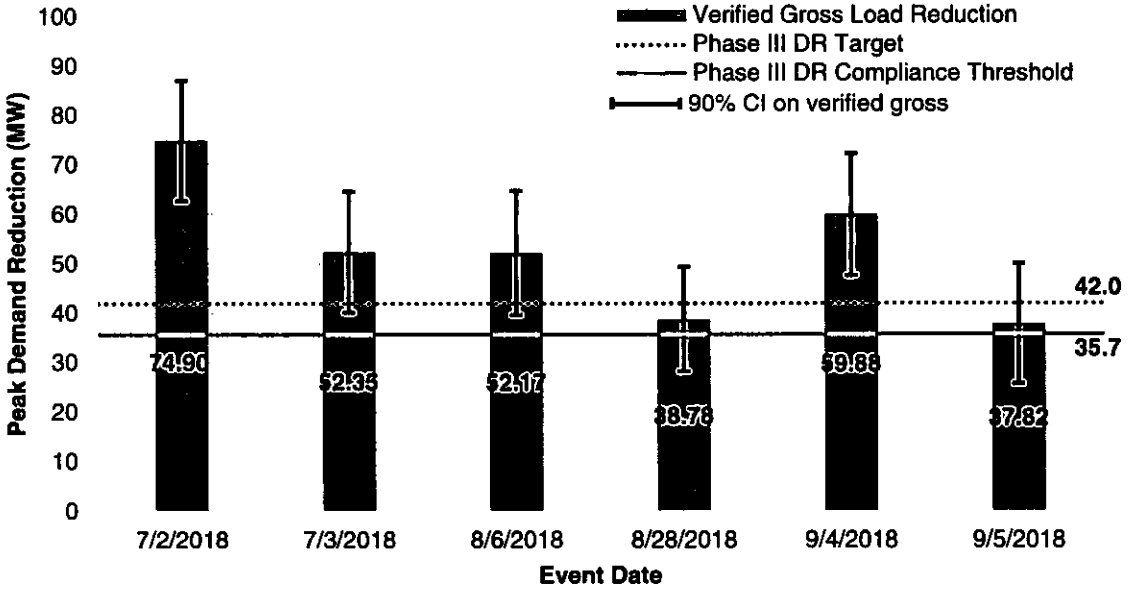
Table 1: DR PYVTD and VTD Performance by Event (MW)

Event Date	Start Hour (Hour Ending)	End Hour (Hour Ending)	Small CI Load Curtailment	Large CI Load Curtailment	Residential DLC	BDR	Average Portfolio MW Impact
2017-06-13	15	18	0.47	61.51	N/A	N/A	61.99
2017-07-20	15	18	0.43	63.37	N/A	N/A	63.81
2017-07-21	15	18	0.39	50.98	N/A	N/A	51.38
2018-07-02	15	18	1.63	73.28	N/A	N/A	74.90
2018-07-03	15	18	0.59	51.76	N/A	N/A	52.35
2018-08-06	15	18	2.15	50.03	N/A	N/A	52.17
2018-08-28	15	18	1.32	37.46	N/A	N/A	38.78
2018-09-04	15	18	1.52	58.36	N/A	N/A	59.88
2018-09-05	15	18	0.75	37.08	N/A	N/A	37.82
PYVTD - Average PY10 DR Event Performance							**52.65**
VTD - Average Phase III DR Event Performance							**54.79**

Source: Navigant analysis.

The Commission's Phase III Implementation Order also established a requirement that EDCs achieve at least 85% of the Phase III compliance reduction target in each DR event. For Duquesne Light, this translates to a 35.7 MW minimum for each DR event. Figure 6 compares the performance of each of the DR events in PY10 to the event-specific minimum and average targets.

Figure 6: Event Performance Compared to 85% Per-Event Target



Source: Navigant analysis.

2.4 Phase III Performance by Customer Segment

Table 2 presents the participation, savings, and spending by customer sector for PY10. The residential, small commercial and industrial (C&I), large C&I sectors are defined by EDC tariff and the residential low income and governmental/educational/nonprofit sector were defined by statute (66 Pa. C.S. § 2806.1). The residential low income segment is a subset of the residential customer class and the GNI segment will include customers who are part of the small C&I or large C&I rate classes. The savings, spending, and participation values for the LI and GNI segments have been removed from the parent sectors in Table 2.

Table 2: Program Year 10 Summary Statistics by Customer Segment

Parameter	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI	Total
Number of participants*	75,561	23,497	517	278	174	**100,027**
PY10 Energy Realization Rate	90%	87%	147%	93%	98%	**99%**
PYVTD MWh/yr	36,755	4,864	19,455	23,524	12,830	**97,427**
PY10 Demand Realization Rate	90%	89%	150%	93%	70%	**97%**
PYVTD MW/yr (Energy Efficiency)	4.07	0.50	2.89	3.22	1.48	**12.17**
PYVTD MW (Demand Response)	N/A	N/A	0.91	48.81	2.92	**52.65**
Incentives ($1,000)**	$1,173	$633	$1,246	$2,309	$1,079	**$6,440**

*Navigant updated PY10 participant counts for Large C&I Demand Response (DR) Curtailable that were previously reported in the January Semi-Annual Report and the July Preliminary Annual Report. Two participants were moved from GNI to Small C&I (Non-GNI).

**Large C&I DR Curtailable PY10 incentives were initially allocated in the January Semi-Annual Report and July Preliminary Annual Report to the Large C&I (Non-GNI) segment. Incentives are distributed here across Small C&I (Non-GNI), Large C&I (Non-GNI), and GNI in alignment with the program participants. Related to cross-sector sales, a portion of REEP: Residential Energy Efficiency (Upstream Lighting) incentives are reallocated from Residential (Non-LI) to Small C&I (Non-GNI).

Source: Navigant analysis.

Table 3 summarizes plan performance by sector since the beginning of Phase III.

Table 3: Phase III Summary Statistics by Customer Segment

Parameter	Residential (Non-LI)	Residential LI	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI	Total
Number of Participants*	217,607	64,007	1,371	574	332	**283,891**
P3TD Energy Realization Rate	95%	89%	127%	100%	100%	**101%**
VTD MWh/yr	122,409	9,977	50,330	60,633	24,847	**268,196**
P3TD Demand Realization Rate	96%	93%	129%	104%	78%	**102%**
VTD MW (Energy Efficiency)	13.42	1.03	7.45	7.11	2.77	**31.78**
VTD MW (Demand Response)**	N/A	N/A	0.74	48.66	5.39	**54.79**
Incentives ($1,000)***	$4,275	$633	$2,302	$4,512	$1,845	**$13,567**

*Phase III participation counts for the Large C&I DR Curtailable are included here but are not cumulative. Instead, counts for this program represent the maximum number of annual participants during the phase. Navigant also updated PY10 participant counts for this program that were previously reported in the January Semi-Annual Report and the July Preliminary Annual Report. Two participants were moved from GNI to Small C&I (Non-GNI).

**These VTD MW achievements are not cumulative, but represent the average Phase III DR event performance.

***Large C&I DR Curtailable PY10 incentives were initially allocated in the January Semi-Annual Report and July Preliminary Annual Report to the Large C&I (Non-GNI) segment. Incentives are distributed here across Small C&I (Non-GNI), Large C&I (Non-GNI), and GNI in alignment with the program participants. Related to cross-sector sales, a portion of REEP: Residential Energy Efficiency (Upstream Lighting) incentives are reallocated from Residential (Non-LI) to Small C&I (Non-GNI).

Source: Navigant analysis.

2.5 Summary of Participation by Program

Participation is defined differently for programs depending on the program delivery channel and data tracking practices. The participant definition nuances vary by program and are summarized by program in Table 4. Table 5 provides the current participation totals for PY10 and Phase III.

Table 4: Program Participation Definitions

Programs	Component	Definition
REEP: Residential Energy Efficiency Low-Income Energy Efficiency Residential Appliance Recycling Express Efficiency Small/Medium Midstream Lighting Small Commercial Direct Install Multifamily Housing Retrofits Commercial Efficiency Community Education Energy Efficiency Large Midstream Lighting Industrial Efficiency Public Agency Partnership	Downstream/ Midstream Rebates or Kits	A participant is a customer participating in the given program within a given reporting period (e.g., Q1 through Q4 for PY10), represented by a unique participant account number. The counts appearing in Table 5 represent the summations of the unique customer participant account numbers in the tracking system for the given program in each of the periods represented (i.e., PYRTD or P3TD). Customers participating in a program more than once within a reporting period (e.g., PYRTD) are counted once; customers participating more than once but in different annual periods or programs are counted more than once (once in each period and/or program).

Programs	Component	Definition
Large Curtailable Load Program	DR Curtailment	A participant is a customer participating in the program within the program event period for the program year (e.g., June-September 2018), represented by a unique participant account number. The count appearing in Table 5 represents the summation of the unique customer participant account numbers in the tracking system for the program, including all account numbers for which DR activity has been reported for at least one event during the program period for the year.
Residential Behavioral Savings Program	Home Energy Reports	A participant is a customer that is a member of the program's treatment group whose energy consumption is analyzed at the end of the program year, represented by an unique account number.
REEP: Residential Energy Efficiency (Upstream Lighting)	Upstream rebates for lamp sales	Participation cannot be counted because reported program data comprises lamp sales activities and not individual participating customer activities.
REEP: Residential Energy Efficiency	Giveaways	A portion of REEP program savings result from giveaways during events in which the utility has participated (event giveaways). Duquesne Light tracks events and the measures given away and not the individual participants who receive the measures.
Low-Income Energy Efficiency		A portion of program savings results from low income-specific events during which the utility provides free kits to attendees. Duquesne Light tracks events and the measures given away and not the individual participants who receive the measures.
Residential Whole House Retrofit	Direct Installs Audits	Defined similarly to the downstream/midstream rebates or kits component. Additionally, whole house retrofits also occur in multifamily buildings where a mix of market rate and low income audits occur. The income status of individual participants is not known, but the known building-level proportion of tenants that are low income is used to split the total count of participants between the market rate and low income programs. Whole house retrofit program activities in some multifamily buildings engage landlords and building managers and not individual tenants. In either case, a participant is defined as a rate-paying customer who received any efficiency measures from the program (i.e., a treated dwelling).
Low-Income Whole House Retrofit		

Source: Navigant analysis.

Table 5: EE&C Portfolio Participation by Program

Program	PYTD Participation	P3TD Participation
REEP: Residential Energy Efficiency	21,106	42,684
REEP: Residential Energy Efficiency (Upstream Lighting)	N/A	N/A
Residential Appliance Recycling	2,416	6,046
Residential Behavioral Savings	51,987	168,551
Residential Whole House Retrofit[8]	52	326
Low-Income Energy Efficiency[8]	23,497	64,007
Express Efficiency	308	700

[8] Navigant's evaluation found that four market rate participants were originally reported in the low income category. These four participants have been moved from LIEEP to WHRP.

Program	PYTD Participation	P3TD Participation
Small/Medium Midstream Lighting	164	487
Small Commercial Direct Install	8	140
Multifamily Housing Retrofit	18	25
Commercial Efficiency	77	136
Large Midstream Lighting	95	296
Industrial Efficiency	*30*	*66*
Public Agency Partnership	107	219
Community Education	44	90
Large C&I DR Curtailable	118	118*
Portfolio Total	**100,027**	**283,891**

*P3TD participation counts for the Large C&I DR Curtailable are not cumulative but instead represent the maximum number of annual participants during the phase.

Source: Navigant analysis.

2.6 Summary of Impact Evaluation Results

During PY10, Navigant completed impact evaluations for many of the energy efficiency programs in the portfolio. Table 6 summarizes the realization rates and net-to-gross (NTG) ratios by program or evaluation initiative.

Table 6: Impact Evaluation Results Summary

Program\Initiative	Energy Realization Rate	Demand Realization Rate	Net to Gross Ratio
REEP: Residential Energy Efficiency	77%	83%	0.72
REEP: Residential Energy Efficiency (Upstream Lighting)	99%	99%	0.43
Residential Appliance Recycling	99%	99%	0.46
Residential Behavioral Savings	78%	78%	1.00
Residential Whole House Retrofit	92%	93%	1.00
Low Income Energy Efficiency	87%	89%	1.00
Express Efficiency	178%	180%	0.58
Small/Medium Midstream Lighting	56%	41%	0.72
Small Commercial Direct Install	99%	102%	0.99
Multifamily Housing Retrofit	95%	93%	0.45
Commercial Efficiency	96%	99%	0.60
Large Midstream Lighting	60%	64%	0.72
Industrial Efficiency	96%	91%	0.31
Public Agency Partnership	97%	57%	0.45
Community Education	103%	106%	0.45
Large C&I Demand Response Curtailable	N/A	103%	1.00

Source: Navigant analysis.

Findings from NTG research are not used to adjust compliance savings in Pennsylvania. Instead, NTG research provides directional information for program planning purposes. Navigant conducted high impact measure (HIM) research for measures implemented during PY10. Navigant identified A-Line LED lamps as the high impact measure for the C&I Midstream Lighting Program and for the C&I portfolio in general. Table 7 presents NTG findings for HIMs studied in PY10.

Table 7: High Impact Measure Net-to-Gross

HIM	Free Ridership	Spillover	Net-to-Gross Ratio
A-Line LEDs	0.26	0.00	0.74

Source: Navigant analysis.

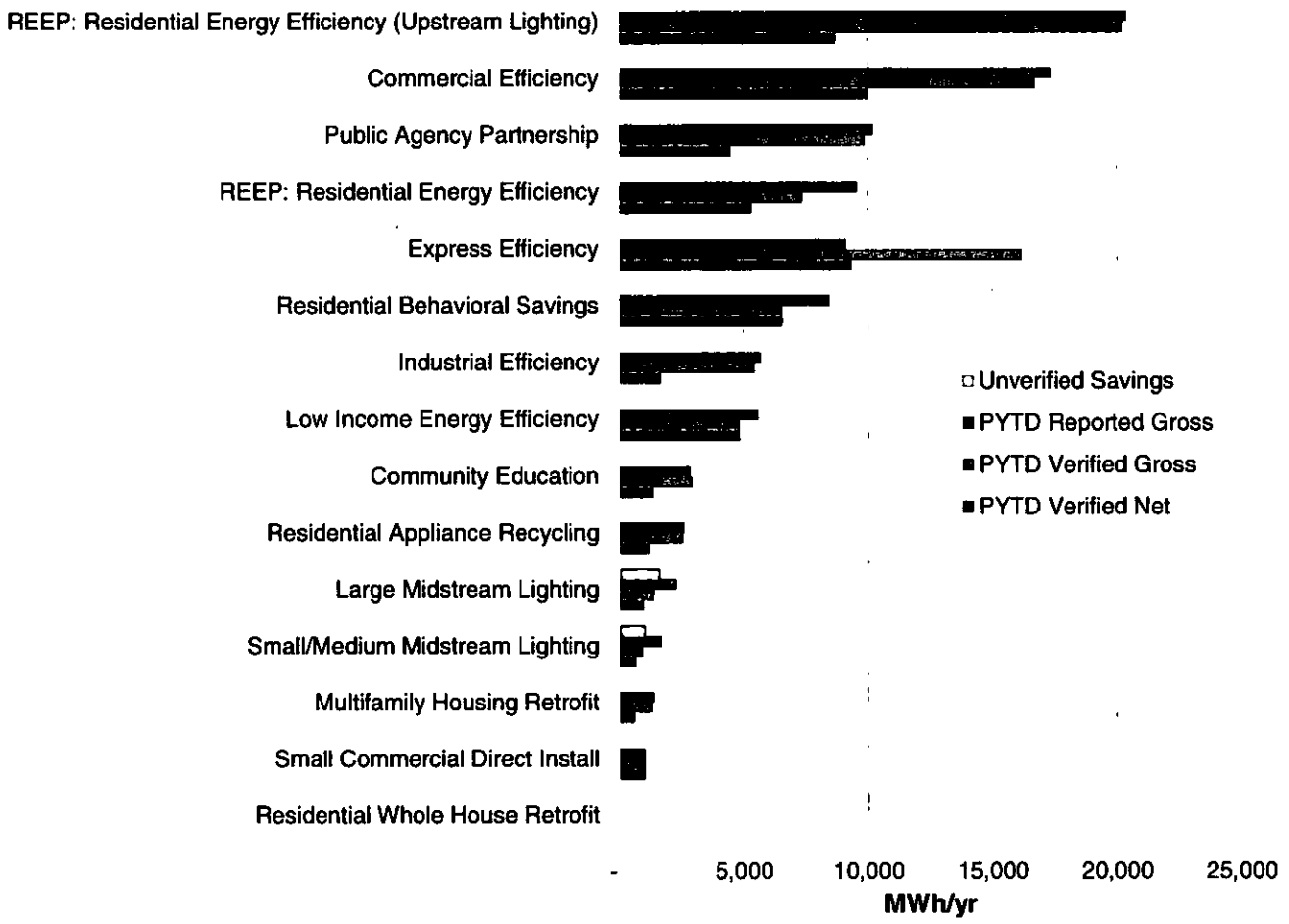
2.7 Summary of Energy Impacts by Program

Act 129 compliance targets are based on annualized savings estimates (MWh/yr). Each program year, the annual savings achieved by EE&C program activity are recorded as incremental annual (or first-year) savings and added to an EDC's progress toward compliance. Incremental annual savings estimates are presented in Section 2.7.1. Lifetime energy savings incorporate the effective useful life (EUL) of installed measures and estimate the total energy savings associated with EE&C program activity. Lifetime savings are used in the TRC Test, by program participants when assessing the economics of upgrades, and by the statewide evaluator (SWE) when calculating the emissions benefits of Act 129 programs. Section 2.7.2 presents the lifetime energy savings by program.

2.7.1 Incremental Annual Energy Savings by Program

Figure 7 presents a summary of the PYTD energy savings by program for PY10. The energy impacts in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. The verified gross savings are adjusted by the energy realization rate and the verified net savings are adjusted by both the realization rate and the NTG ratio.

Figure 7: PYTD Energy Savings by Program[9]

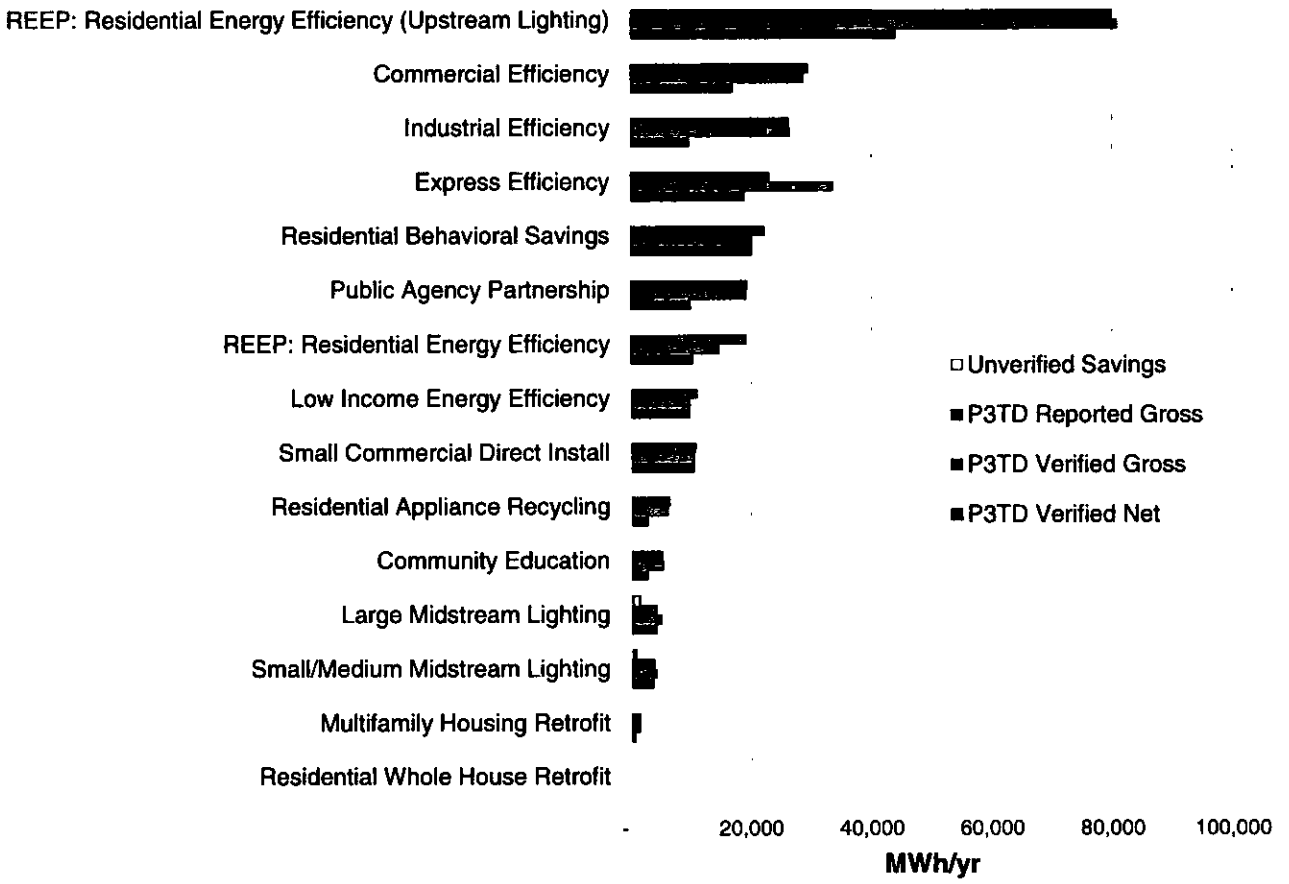


Source: Navigant analysis.

Figure 8 presents a summary of the energy savings by program for Phase III of Act 129.

[9] This figure includes unverified savings associated with the Small/Medium Midstream Lighting program (1,050 MWh/yr) and the Large Midstream Lighting program (1,621 MWh/yr). These savings will be verified during PY11.

Figure 8: P3TD Energy Savings by Program[10]



Source: Navigant analysis.

Table 8 summarizes energy impacts by program through PY10. It also presents reported and verified savings and excludes the unverified savings from the Small/Medium and Large Midstream Lighting programs.

[10] This figure includes unverified savings associated with the Small/Medium Midstream Lighting program (1,050 MWh) and the Large Midstream Lighting program (1,621 MWh). These savings will be verified during PY11.

Table 8: Incremental Annual Energy Savings by Program (MWh/yr)

Program	PYRTD (MWh/yr)	PYVTD Gross (MWh/yr)	PYVTD Net (MWh/yr)	RTD (MWh/yr)	VTD Gross (MWh/yr)	VTD Net (MWh/yr)
REEP: Residential Energy Efficiency	9,554	7,348	5,316	19,424	14,881	10,498
REEP: Residential Energy Efficiency (Upstream Lighting)	20,357	20,219	8,702	80,013	80,893	44,063
Residential Appliance Recycling	2,622	2,596	1,202	6,587	6,257	2,911
Residential Behavioral Savings	8,457	6,577	6,577	22,368	20,264	20,264
Residential Whole House Retrofit	16	15	15	134	114	114
Low Income Energy Efficiency	5,583	4,864	4,864	11,148	9,977	9,883
Express Efficiency	9,110	16,188	9,331	23,167	33,700	19,041
Small/Medium Midstream Lighting	1,665	925	662	4,018	4,381	3,720
Small Commercial Direct Install	1,045	1,033	1,026	10,934	10,688	10,613
Multifamily Housing Retrofit	1,376	1,308	595	1,641	1,561	749
Commercial Efficiency	17,349	16,718	9,998	29,645	28,862	17,114
Large Midstream Lighting	2,303	1,375	984	4,366	5,222	4,388
Industrial Efficiency	5,682	5,431	1,662	26,383	26,549	9,875
Public Agency Partnership	10,207	9,856	4,484	19,600	19,333	10,139
Community Education	2,883	2,973	1,353	5,338	5,514	2,898
Portfolio Total	**98,208**	**97,427**	**56,770**	**264,767**	**268,196**	**166,270**

Source: Navigant analysis.

The VTD savings reported from prior years, for the following programs, have changed since the PY9 final annual report was submitted. The SWE determined that PY9 verified savings related to the Residential Energy Efficiency Program (REEP): Residential Energy Efficiency (Upstream Lighting) and Express Efficiency (via cross-sector sales) were greater than originally reported.

- REEP: Residential Energy Efficiency (Upstream Lighting), gross energy: 655 MWh/yr increase
- REEP: Residential Energy Efficiency (Upstream Lighting), net energy: 281 MWh/yr increase
- Express Efficiency, gross energy: 100 MWh/yr increase
- Express Efficiency, net energy: 43 MWh/yr increase

2.7.2 Lifetime Energy Savings by Program

Table 9 presents the PYTD and P3TD lifetime energy savings by program. Lifetime energy savings are calculated by multiplying the annual energy savings by the efficient measure useful lifetime (EUL). Per the PA 2016 TRC Order, the measure EUL does not exceed 15 years for any measure in the portfolio. Early replacement measures are subject to a dual baseline calculation, leading to modified lifetime savings. For these measures, savings relative to the in-place baseline equipment are used for the remaining useful

lifetime (RUL) of the base equipment. After the RUL, savings relative to code equipment are used for the remainder of the efficient measure's EUL.

Table 9: Lifetime Energy Savings by Program (MWh)

Program Name	PYVTD Gross Lifetime (MWh)	PYVTD Net Lifetime (MWh)	VTD Gross Lifetime (MWh)	VTD Net Lifetime (MWh)
REEP: Residential Energy Efficiency	57,966	41,935	157,434	110,554
REEP: Residential Energy Efficiency (Upstream Lighting)	120,134	51,705	601,704	337,451
Residential Appliance Recycling	17,433	8,070	42,675	19,854
Residential Behavioral Savings	6,577	6,577	19,877	19,877
Residential Whole House Retrofit	176	176	975	975
Low-Income Energy Efficiency	23,415	23,415	51,866	51,368
Express Efficiency	225,009	129,694	457,523	258,713
Small/Medium Midstream Lighting	6,046	4,326	34,569	29,567
Small Commercial Direct Install	13,097	13,005	143,726	142,717
Multifamily Housing Retrofit	15,937	7,251	18,319	8,554
Commercial Efficiency	250,655	149,908	428,137	254,035
Large Midstream Lighting	9,506	6,802	41,505	35,118
Industrial Efficiency	80,855	24,745	394,469	146,732
Public Agency Partnership	141,917	64,563	280,801	147,402
Community Education	44,093	20,059	80,660	42,263
Portfolio Total	**1,012,817**	**552,231**	**2,754,240**	**1,605,181**

Source: Navigant analysis.

The VTD lifetime savings reported from prior years, for the following programs, have changed since the PY9 final annual report was submitted. The SWE determined that PY9 verified lifetime savings related to REEP: Residential Energy Efficiency (Upstream Lighting) and Express Efficiency (via cross-sector sales) were greater than originally reported. These lifetime savings adjustments relate directly to the PY9 verified savings adjustments previously described under Table 8.

- REEP: Residential Energy Efficiency (Upstream Lighting), gross lifetime energy: 4,697 MWh/yr increase
- REEP: Residential Energy Efficiency (Upstream Lighting), net lifetime energy: 2,013 MWh/yr increase
- Express Efficiency, gross lifetime energy: 717 MWh/yr increase
- Express Efficiency, net lifetime energy: 307 MWh/yr increase

2.8 Summary of Demand Impacts by Program

Duquesne Light's Phase III EE&C programs achieve peak demand reductions in two ways. The first is through coincident reductions from energy efficiency measures and the second is through dedicated DR offerings that exclusively target temporary demand reductions on peak days. Energy efficiency reductions coincident with system peak hours are reported and used in the calculation of benefits in the TRC Test

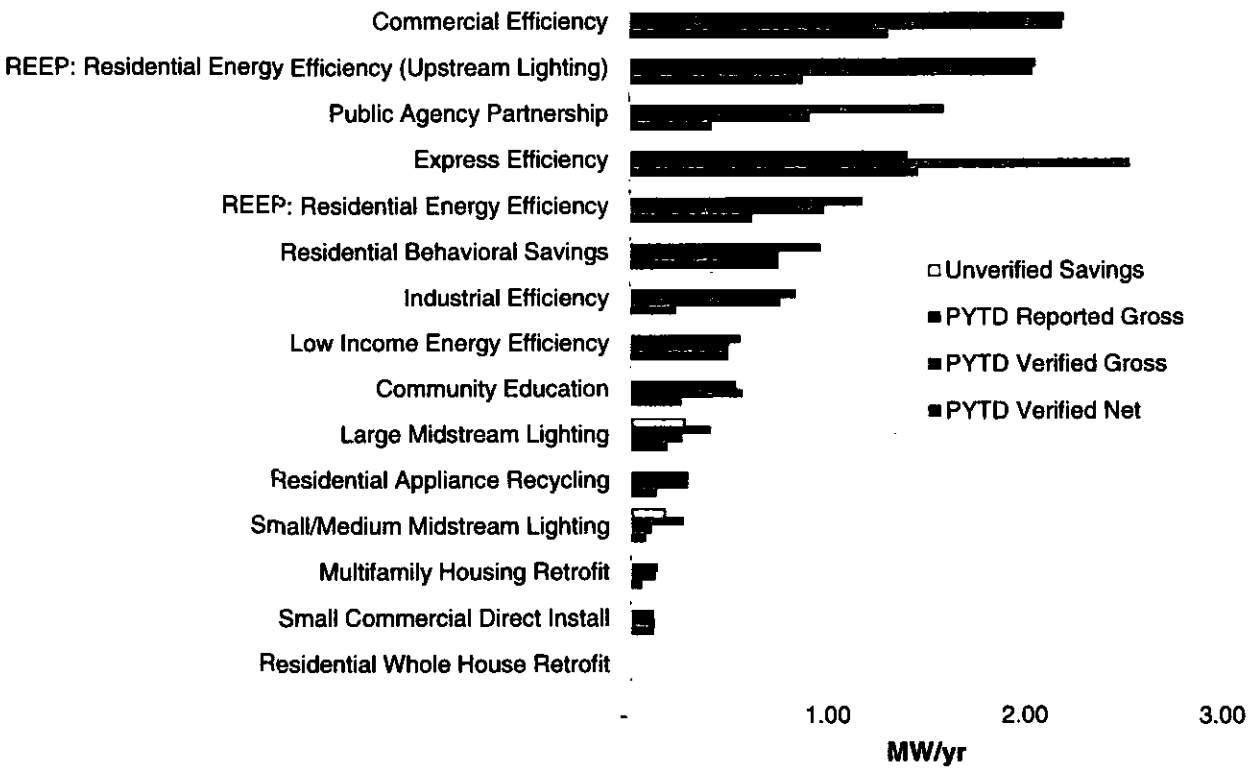
but do not contribute to Phase III peak demand reduction compliance goals. Phase III peak demand reduction targets are exclusive to DR programs.

The two types of peak demand reduction savings are treated differently for reporting purposes. Peak demand reductions from energy efficiency are generally additive across program years, meaning that the P3TD savings reflect the sum of the first-year savings in each program year. Conversely, DR goals are based on average portfolio impacts across all events so cumulative DR performance is expressed as the average performance of each of the DR events called in Phase III to date. Because of these differences, demand impacts from energy efficiency and DR are reported separately in the following sub-sections.

2.8.1 Energy Efficiency

Act 129 defines peak demand savings from energy efficiency as the average expected reduction in electric demand from 2:00 p.m. to 6:00 p.m. EDT on non-holiday weekdays from June through August. Unlike Phase I and Phase II Act 129 reporting, the peak demand impacts from energy efficiency in this report are presented at the meter level and do not reflect adjustments for transmission and distribution losses. Figure 9 presents a summary of the PYTD demand savings by energy efficiency program for PY10.

Figure 9: PYTD Demand Savings by Energy Efficiency Program[11]

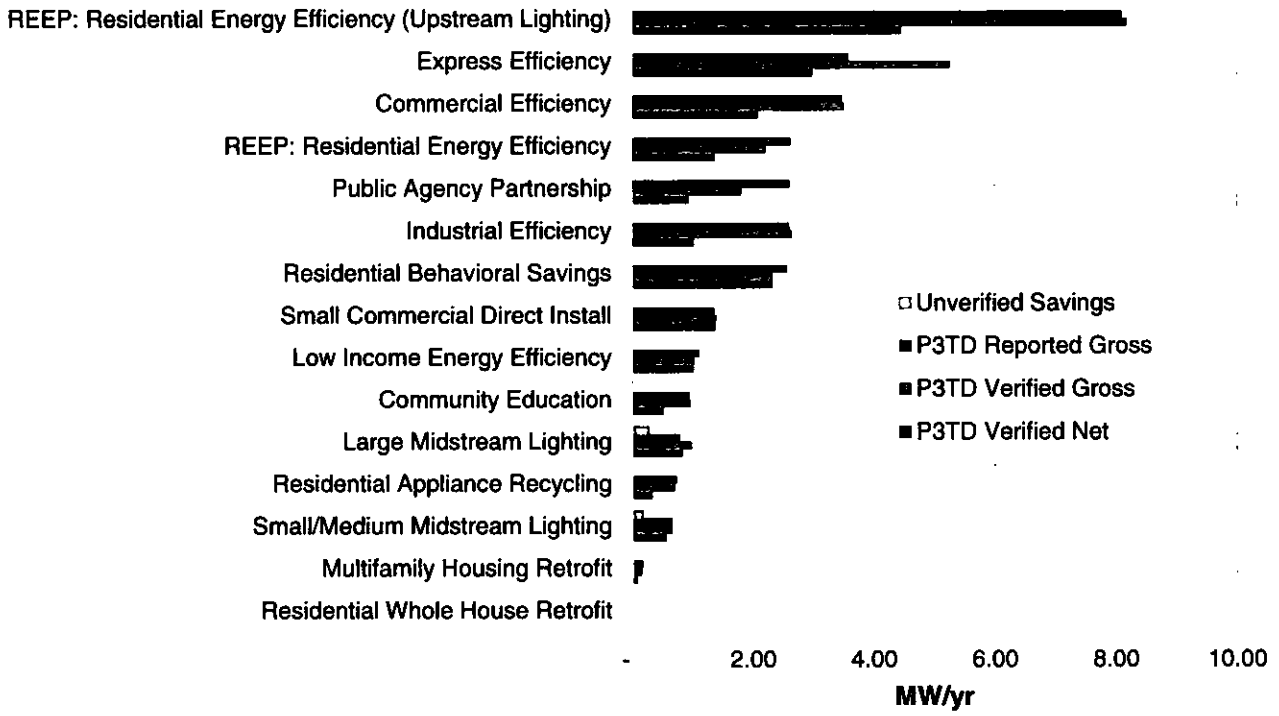


Source: Navigant analysis.

[11] This figure includes unverified savings associated with the Small/Medium Midstream Lighting program (0.18 MW/yr) and the Large Midstream Lighting program (0.28 MW/yr). These savings will be verified during PY11.

Figure 10 presents a summary of the P3TD demand savings by energy efficiency program for Phase III of Act 129.

Figure 10: P3TD Demand Savings by Energy Efficiency Program[12]



Source: Navigant analysis.

A summary of the peak demand impacts by energy efficiency program through the current reporting period are presented in Table 10. Table 10 presents reported and verified savings and excludes the unverified savings from the Small/Medium and Large Midstream Lighting programs.

Table 10: Peak Demand Savings by Energy Efficiency Program (MW/yr)*

Program Name	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
REEP: Residential Energy Efficiency	1.18	0.98	0.62	2.62	2.21	1.37
REEP: Residential Energy Efficiency (Upstream Lighting)	2.06	2.05	0.88	8.10	8.19	4.46
Residential Appliance Recycling	0.29	0.29	0.13	0.74	0.70	0.33
Residential Behavioral Savings	0.97	0.75	0.75	2.55	2.31	2.31
Residential Whole House Retrofit	0.00	0.00	0.00	0.01	0.01	0.01
Low Income Energy Efficiency	0.56	0.50	0.50	1.10	1.03	1.01
Express Efficiency	1.41	2.54	1.46	3.58	5.26	2.99
Small/Medium Midstream Lighting	0.27	0.11	0.08	0.66	0.65	0.56
Small Commercial Direct Install	0.12	0.12	0.12	1.36	1.39	1.38

[12] This figure includes unverified savings associated with the Small/Medium Midstream Lighting program (0.18 MW/yr) and the Large Midstream Lighting program (0.28 MW/yr). These savings will be verified during PY11.

Program Name	PYRTD (MW/yr)	PYVTD Gross (MW/yr)	PYVTD Net (MW/yr)	RTD (MW/yr)	VTD Gross (MW/yr)	VTD Net (MW/yr)
Multifamily Housing Retrofit	0.14	0.13	0.06	0.17	0.16	0.07
Commercial Efficiency	2.21	2.19	1.31	3.47	3.50	2.08
Large Midstream Lighting	0.41	0.26	0.19	0.78	0.98	0.83
Industrial Efficiency	0.84	0.76	0.23	2.59	2.63	1.02
Public Agency Partnership	1.60	0.92	0.42	2.61	1.80	0.93
Community Education	0.54	0.57	0.26	0.94	0.96	0.52
Portfolio Total	**12.58**	**12.17**	**7.01**	**31.31**	**31.78**	**19.87**

*Navigant removed the Large C&I DR Curtailable from this table given that it is not an energy efficiency program, rather, a DR program. The reader should note this difference from previous years' reports.
Source: Navigant analysis.

The VTD savings reported from prior years have changed for certain programs, since the PY9 final annual report was submitted. The SWE determined that PY9 verified savings related to REEP: Residential Energy Efficiency (Upstream Lighting) and Express Efficiency (via cross-sector sales) were greater than originally reported.

- REEP: Residential Energy Efficiency (Upstream Lighting), gross energy: 0.066 MW/yr increase
- REEP: Residential Energy Efficiency (Upstream Lighting), net energy: 0.028 MW/yr increase
- Express Efficiency, gross energy: 0.014 MW/yr increase
- Express Efficiency, net energy: 0.006 MW/yr increase

2.8.2 DR

Act 129 defines peak demand savings from DR as the average reduction in electric demand during the hours when a DR event is initiated. Phase III DR events are initiated according to the following guidelines:

1. Curtailment events shall be limited to the months of June through September.
2. Curtailment events shall be called for the first 6 days of each program year (starting in PY9) in which the peak hour of PJM's day-ahead forecast for the PJM Regional Transmission Organization (RTO) is greater than 96% of the PJM RTO summer peak demand forecast for the months of June through September.
3. Each curtailment event shall last 4 hours.
4. Each curtailment event shall be called such that it will occur during the day's forecasted peak hour(s) above 96% of PJM's RTO summer peak demand forecast.
5. Once six curtailment events have been called in a program year, the peak demand reduction program shall be suspended for that program year.

The peak demand impacts from DR are presented at the system level in this report and reflect adjustments to account for transmission and distribution losses. Duquesne Light uses the following line loss percentages/multipliers by sector.

- Residential = 6.9% or 1.0741
- Small C&I = 6.9% or 1.0741
- Large C&I = 6.9% or 1.0741 and 0.8% or 1.0081[13]

Table 11 summarizes the PYVTD and VTD demand reductions for each of the DR programs in the EE&C Plan and for the whole DR portfolio. VTD demand reductions are the average performance across all Phase III DR events independent of how many events occurred in a given program year. The relative precision columns in Table 11 indicate the margin of error (at the 90% confidence interval) around the PYVTD and VTD demand reductions.

Table 11: Verified Gross DR Impacts by Program

Program	PYVTD Gross MW	PYVTD Relative Precision (90%)	VTD Gross MW	VTD Relative Precision (90%)*
Large Curtailable Load	52.65	9.3%	54.79	7.4%
Portfolio Total	**52.65**	**9.3%**	**54.79**	**7.4%**

*This represents the error from the baseline uncertainty of the DR analysis. This does not represent sampling error.
Source: Navigant analysis.

Impacts were estimated using either a customer baseline (CBL) with an optional weather-sensitivity adjustment or using a regression analysis. The determination of which approach to use for each customer was based on which method provided the most accurate estimate of consumption when applied to hypothetical events in summer 2018 (the testing criteria described in Navigant's Phase III evaluation plan).

2.9 Summary of Fuel Switching Impacts

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

2.10 Summary of Cost-Effectiveness Results

A detailed breakdown of program finances and cost-effectiveness is presented in Table 12. TRC benefits in Table 12 were calculated using gross verified impacts. Net present value (NPV) PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 12: Summary of Portfolio Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$6,440		$12,483	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$10,653		$16,983	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$17,093		$29,465	
		EDC	**CSP**	**EDC**	**CSP**

[13] The 0.8% line loss factor applies to certain participants on the HPVS rate.

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
5	Design & Development [2]	$0	$0	$55	$438
6	Administration, Management, and Technical Assistance [3]	$96	$594	$1,426	$2,829
7	Marketing [4]	$26	$0	$136	$20
8	Program Delivery [5]	$450	$8,390	$1,177	$21,305
9	EDC Evaluation Costs	$995		$2,019	
10	SWE Audit Costs	$400		$1,429	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$10,951		$30,834	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$28,044		$60,300	
14	Total NPV Lifetime Electric Energy Benefits	$34,510		$86,028	
15	Total NPV Lifetime Electric Capacity Benefits	$16,890		$35,690	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$5,438		$16,021	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$2,570		-$5,667	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$54,268		$132,071	
19	**TRC Benefit-Cost Ratio [8]**	**1.94**		**2.19**	

[1] Includes direct install equipment costs and costs for EE&C kit.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

* Rows 1-11 are presented in nominal dollars (PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020); P3TD = $2016

Source: Navigant analysis.

TRC benefit-cost ratios are calculated by comparing the total NPV TRC benefits and the total NPV TRC costs. Table 13 shows the TRC ratios by program and for the portfolio. The benefits in Table 13 were calculated using gross verified impacts. Costs and benefits are expressed in 2018 dollars.

PY10 portfolio gross TRC cost effectiveness generally was strong and carried by REEP, Express Efficiency, and Commercial Efficiency. Those three programs contributed almost 60 percent PY10 benefits and less than 50 percent of PY10 costs that inform TRC calculations. TRCs fell below 1.00 for Low Income Energy Efficiency, Residential Whole House Retrofit, Multifamily Housing Retrofit, and Small Commercial Direct Install. Residential Whole House Retrofit is the program with the lowest TRC during PY10. However, program activities and costs have been relatively limited for this program. Finally, the portfolio gross TRC is nearly 2.00.

Table 13: PY10 Gross TRC Ratios by Program ($1,000)*

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
REEP: Residential Energy Efficiency	$9,940	$5,058	1.97	$4,882
Residential Appliance Recycling	$808	$403	2.00	$405
Residential Behavioral Savings	$337	$105	3.21	$232
Residential Whole House Retrofit	$8	$85	0.09	($77)
Low Income Energy Efficiency	$1,043	$1,496	0.70	($453)
Residential Subtotal	**$12,136**	**$7,147**	**1.70**	**$4,989**
Express Efficiency	$10,407	$2,577	4.04	$7,831
Small/Medium Midstream Lighting	$472	$273	1.73	$199
Small Commercial Direct Install	$575	$686	0.84	($111)
Multifamily Housing Retrofit	$652	$1,139	0.57	($487)
Commercial Efficiency	$11,452	$5,683	2.02	$5,770
Large Midstream Lighting	$714	$357	2.00	$357
Industrial Efficiency	$3,657	$1,887	1.94	$1,771
Public Agency Partnership	$5,946	$4,191	1.42	$1,755
Community Education	$2,645	$2,315	1.14	$330
Large C&I DR Curtailable	$5,611	$1,790	3.13	$3,821
Non-Residential Subtotal	**$42,132**	**$20,897**	**2.02**	**$21,234**
Portfolio Total	**$54,268**	**$28,044**	**1.94**	**$26,223**

*Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020

Source: Navigant analysis.

Table 14 presents PY10 cost-effectiveness using net verified savings to calculate benefits. Net TRC cost effectiveness for the residential programs generally followed the pattern of gross TRC cost effectiveness. Costs and benefits for net TRCs are the same as those for gross TRCs for Residential Behavioral Savings, Residential Whole House Retrofit, Low-Income Energy Efficiency, and Large C&I DR Curtailable given that NTG ratios are assumed to be 1.00. Non-residential net TRC cost effectiveness results were also positive for eight of the 15 programs.

Table 14: PY10 Net TRC Ratios by Program ($1,000)*

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
REEP: Residential Energy Efficiency	$5,054	$3,790	1.33	$1,265
Residential Appliance Recycling	$374	$403	0.93	($29)
Residential Behavioral Savings	$337	$105	3.21	$232
Residential Whole House Retrofit	$8	$85	0.09	($77)
Low-Income Energy Efficiency	$1,043	$1,496	0.70	($453)
Residential Subtotal	**$6,817**	**$5,879**	**1.16**	**$938**
Express Efficiency	$5,999	$1,884	3.18	$4,115
Small/Medium Midstream Lighting	$337	$245	1.37	$92
Small Commercial Direct Install	$571	$686	0.83	($115)
Multifamily Housing Retrofit	$296	$696	0.43	($400)
Commercial Efficiency	$6,849	$3,860	1.77	$2,989
Large Midstream Lighting	$511	$320	1.60	$191
Industrial Efficiency	$1,119	$1,455	0.77	($336)
Public Agency Partnership	$2,705	$2,392	1.13	$313
Community Education	$1,204	$1,210	0.99	($6)
Large C&I DR Curtailable	$5,611	$1,790	3.13	$3,821
Non-Residential Subtotal	**$25,203**	**$14,539**	**1.73**	**$10,664**
Portfolio Total	**$32,019**	**$20,418**	**1.57**	**$11,602**

*Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020

Source: Navigant analysis.

Table 15 summarizes cost-effectiveness by program for Phase III of Act 129. Cost and benefits are discounted back to 2016.

Table 15: P3TD Gross TRC Ratios by Program ($1,000)*

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
REEP: Residential Energy Efficiency	$40,894	$18,693	2.19	$22,202
Residential Appliance Recycling	$1,772	$964	1.84	$808
Residential Behavioral Savings	$1,142	$661	1.73	$481
Residential Whole House Retrofit	$58	$363	0.16	($305)
Low-Income Energy Efficiency	$2,122	$2,810	0.76	($688)
Residential Subtotal	**$45,989**	**$23,492**	**1.96**	**$22,497**
Express Efficiency	$18,824	$4,823	3.90	$14,002
Small/Medium Midstream Lighting	$2,052	$651	3.15	$1,401
Small Commercial Direct Install	$5,636	$3,108	1.81	$2,527
Multifamily Housing Retrofit	$660	$1,706	0.39	($1,046)
Commercial Efficiency	$16,935	$7,495	2.26	$9,440
Large Midstream Lighting	$2,532	$1,306	1.94	$1,226
Industrial Efficiency	$15,031	$4,615	3.26	$10,416
Public Agency Partnership	$10,536	$6,359	1.66	$4,177
Community Education	$4,057	$3,160	1.28	$897
Large C&I DR Curtailable	$9,820	$3,586	2.74	$6,234
Non-Residential Subtotal	**$86,082**	**$36,808**	**2.34**	**$49,274**
Portfolio Total	**$132,071**	**$60,300**	**2.19**	**$71,772**

*Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020
Source: Navigant analysis.

Table 16 presents P3TD cost-effectiveness results using net verified savings to calculate benefits. Cost and benefits are discounted back to 2016.

Table 16: P3TD Net TRC Ratios by Program ($1,000)*

Program	TRC NPV Benefits	TRC NPV Costs	TRC Ratio	TRC Net Benefits (Benefits – Costs)
REEP: Residential Energy Efficiency	$24,062	$14,180	1.70	$9,882
Residential Appliance Recycling	$824	$964	0.86	($140)
Residential Behavioral Savings	$1,142	$661	1.73	$481
Residential Whole House Retrofit	$58	$363	0.16	($305)
Low-Income Energy Efficiency	$2,117	$2,810	0.75	($693)
Residential Subtotal	**$28,205**	**$18,979**	**1.49**	**$9,226**
Express Efficiency	$10,645	$3,860	2.76	$6,785
Small/Medium Midstream Lighting	$1,746	$606	2.88	$1,140
Small Commercial Direct Install	$5,596	$3,108	1.80	$2,488
Multifamily Housing Retrofit	$309	$1,281	0.24	($973)
Commercial Efficiency	$10,052	$5,416	1.86	$4,637
Large Midstream Lighting	$2,135	$1,250	1.71	$884
Industrial Efficiency	$5,714	$3,421	1.67	$2,293
Public Agency Partnership	$5,555	$4,335	1.28	$1,220
Community Education	$2,169	$2,027	1.07	$142
Large C&I DR Curtailable	$9,820	$3,586	2.74	$6,234
Non-Residential Subtotal	**$53,740**	**$28,891**	**1.86**	**$24,849**
Portfolio Total	**$81,945**	**$47,870**	**1.71**	**$34,075**

*Costs and benefits are expressed as follows: PY8 = 2016, PY9 = 2017, PY10 = 2018, PY11 = 2019, PY12 = 2020
Source: Navigant analysis.

These P3TD results presented in Section 2.10 include PY9 TRC updates to the REEP: Residential Energy Efficiency and Express Efficiency (via cross-sector sales) programs. These updates were driven by the SWE and relate to Upstream Lighting. PY9 TRC changes include the following.

- REEP: Residential Energy Efficiency (Upstream Lighting)
    - Gross TRC changed to 1.88 from 1.85
    - Net TRC changed to 1.27 from 1.26
- Express Efficiency
    - Gross TRC changed to 4.91 from 4.88
    - Net TRC changed to 3.09 from 3.07

Navigant updated Large C&I DR Curtailable PY9 TRC results, and these changes are also reflected in the P3TD TRCs of Section 2.10. The 0.8% line loss factor had not been applied correctly to certain participant results at the time of PY9 annual reporting. Gross and net TRC ratios for the program changed to 3.20 from 3.32.

These PY9 TRC changes did not affect the overall portfolio gross TRC ratio of 2.59, but the overall portfolio net TRC ratio decreased from 1.84 to 1.83.

2.11 Comparison of Performance to Approved EE&C Plan

Table 17 presents PY10 expenditures, by program, compared to the budget estimates set forth in the EE&C Plan for PY10. All the dollars in Table 17 are nominal.

Table 17: Comparison of PY10 Expenditures to Phase III EE&C Plan ($1,000)

Program	PY10 Budget from EE&C Plan	PY10 Actual Expenditures	Ratio (Actual/Plan)
REEP: Residential Energy Efficiency	$2,746	$3,560	1.30
Residential Appliance Recycling	$227	$493	2.18
Residential Behavioral Savings	$346	$105	0.30
Residential Whole House Retrofit	$213	$85	0.40
Low-Income Energy Efficiency	$1,301	$1,496	1.15
Express Efficiency	$1,579	$1,754	1.11
Small/Medium Midstream Lighting	$559	$273	0.49
Small Commercial Direct Install	$934	$686	0.73
Multifamily Housing Retrofit	$851	$649	0.76
Commercial Efficiency	$1,836	$2,193	1.19
Large Midstream Lighting	$1,349	$355	0.26
Industrial Efficiency	$3,051	$1,503	0.49
Public Agency Partnership	$2,052	$1,660	0.81
Community Education	$492	$549	1.12
Large C&I DR Curtailable	$1,864	$2,030	1.09
Portfolio Total	**$19,400**	**$17,391**	**0.90**

Source: Navigant analysis.

Table 18 presents P3TD expenditures, by program, compared to the budget estimates set forth in the EE&C Plan through PY10. All dollars in Table 18 are nominal.

Table 18: Comparison of P3TD Expenditures to Phase III EE&C Plan ($1,000)

Program	Phase III Budget from EE&C Plan through PY10	P3TD Actual Expenditures	Ratio (Actual/Plan)
REEP: Residential Energy Efficiency	$11,785	$12,451	1.06
Residential Appliance Recycling	$972	$1,262	1.30
Residential Behavioral Savings	$1,485	$704	0.47
Residential Whole House Retrofit	$915	$389	0.42
Low-Income Energy Efficiency	$2,709	$3,077	1.14
Express Efficiency	$3,949	$4,408	1.12
Small/Medium Midstream Lighting	$1,399	$703	0.50

Program	Phase III Budget from EE&C Plan through PY10	P3TD Actual Expenditures	Ratio (Actual/Plan)
Small Commercial Direct Install	$2,337	$3,299	1.41
Multifamily Housing Retrofit	$2,129	$1,333	0.63
Commercial Efficiency	$5,034	$4,280	0.85
Large Midstream Lighting	$3,699	$1,406	0.38
Industrial Efficiency	$8,363	$4,147	0.50
Public Agency Partnership	$4,812	$3,580	0.74
Community Education	$1,154	$1,269	1.10
Large C&I DR Curtailable	$4,551	$4,318	0.95
Portfolio Total	**$55,295**	**$46,626**	**0.84**

Source: Navigant analysis.

Table 19 compares PY10 verified gross program savings compare to the energy savings projections filed in the EE&C Plan.

Table 19: Comparison of PY10 Actual Program Savings to EE&C Plan Projections for PY10

Program	EE&C Plan for PY10	PY10 VTD Gross MWh Savings	Ratio (Actual/Plan)
REEP: Residential Energy Efficiency	12,946	27,567	2.13
Residential Appliance Recycling	1,763	2,596	1.47
Residential Behavioral Savings	6,037	6,577	1.09
Residential Whole House Retrofit	350	15	0.04
Low-Income Energy Efficiency	3,650	4,864	1.33
Express Efficiency	7,030	16,188	2.30
Small/Medium Midstream Lighting	3,893	925	0.24
Small Commercial Direct Install	2,187	1,033	0.47[14]
Multifamily Housing Retrofit	1,782	1,308	0.73
Commercial Efficiency	10,115	16,718	1.65
Large Midstream Lighting	9,393	1,375	0.15
Industrial Efficiency	16,804	5,431	0.32
Public Agency Partnership	11,693	9,856	0.84
Community Education	1,874	2,973	1.59
Large C&I DR Curtailable	N/A	N/A	N/A
Portfolio Total	**89,517**	**97,427**	**1.09**

[14] The Small Commercial Direct Install program has greatly over-achieved Phase III planned savings over PY8 and PY9. Duquesne Light reduced program activities during PY10 after goals were reached.

Source: Navigant analysis.

Table 20 compares Phase III verified gross program savings compare to the energy savings projections filed in the EE&C Plan.

Table 20: Comparison of Phase III Actual Program Savings to EE&C Plan Projections for Phase III

Program	EE&C Plan Through PY10	VTD Gross MWh Savings	Ratio (Actual/Plan)
REEP: Residential Energy Efficiency	73,358	95,775	1.31
Residential Appliance Recycling	4,408	6,257	1.42
Residential Behavioral Savings	12,073	20,264	1.68
Residential Whole House Retrofit	700	114	0.16
Low-Income Energy Efficiency	7,299	9,977	1.37
Express Efficiency	21,089	33,700	1.60
Small/Medium Midstream Lighting	7,786	4,381	0.56
Small Commercial Direct Install	4,374	10,688	2.44
Multifamily Housing Retrofit	4,010	1,561	0.39
Commercial Efficiency	30,345	28,862	0.95
Large Midstream Lighting	18,787	5,222	0.28
Industrial Efficiency	50,413	26,549	0.53
Public Agency Partnership	28,063	19,333	0.69
Community Education	3,749	5,514	1.47
Large C&I DR Curtailable	N/A	N/A	N/A
Portfolio Total	**266,455**	**268,196**	**1.01**

Source: Navigant analysis.

- Duquesne Light achieved 135% of the EE&C Plan energy savings goals specified for the residential programs through PY10. Duquesne Light expended 100% of the EE&C Plan residential program budgets through the same 3-year term. Similar to previous years, the Upstream Lighting component of REEP, the Residential Behavioral Savings (HER) program, and the HER component of LIEEP remain as the primary drivers for these achievements during the phase. The Whole House Retrofit Program (WHRP) generated only 15 MWh/yr of gross verified energy savings in the market rate segment because PY10 efforts focused primarily on the low income market segment.

- The non-residential program energy savings achieved by Duquesne Light through PY10 of the phase fell short of the utility's non-residential program savings goal, as reflected in its EE&C Plan, achieving 86% of PY10 goals. Over PY8 through PY10, Duquesne Light achieved 81% of its savings goal and expended 74% of the EE&C Plan non-residential program budgets (excluding the Large C&I DR Curtailable program). The Small Commercial Direct Install (SCDI) program has greatly over-achieved planned savings and, as a result, Duquesne Light reduced program activities during PY10. Other programs such as the MFHR, PAPP, Industrial Efficiency Program (IEP), and Midstream are below savings targets.

- PY10 was the second year the Large C&I DR Curtailable program reported demand achievements. Since the beginning of Phase III and through nine events called across PY9 and PY10, the program has expended 95% of its budget and achieved above the Phase III compliance reduction target by 30% (performance–goal/goal).

2.12 Findings and Recommendations

Duquesne Light continued activities into the third year of Phase III. Large C&I DR Curtailable included six events in PY10, non-residential program energy savings represented nearly half of the portfolio energy efficiency savings, and REEP: Residential Energy Efficiency (Upstream Lighting) continued its significant contributions representing roughly one-third of PY10 accomplishments. Activities continue to ramp up as well. PY10 verified energy savings were almost 20% greater than PY9 achievements. Navigant evaluated all PY10 program activities to some extent, and Table 21 presents overarching findings and recommendations for consideration during future planning and evaluations.

Table 21: Summary of Evaluation Recommendations

Evaluation Activity	Finding	Recommendation
Measure mix investigations	Duquesne Light is on track to meet Phase III compliance targets. For example, through PY10, the portfolio has achieved approximately 83 percent of the gross energy compliance target (60 percent if excluding Phase II carryover). Duquesne Light has also achieved approximately 60 percent of the low income carve-out goal. The majority of these savings have been achieved through lighting measures, primarily LEDs.	Savings opportunities for lighting measures are expected to decrease in PY12 and during the next phase, Phase IV. Duquesne Light should continue expanding the activities related to current non-lighting savings and explore new non-lighting measure opportunities among residential and non-residential customers. Navigant understands this is currently a specific focus of Duquesne Light. Non-lighting measures can introduce additional costs and implementation complexities. Investigating these other measure opportunities during PY11 can help Duquesne Light refine implementation approaches before PY12 and Phase IV restrictions on lighting are in place. Finally, expanding activities into non-lighting measures may have a positive impact on free ridership rates.

Evaluation Activity	Finding	Recommendation
Contact information gathering and process evaluation outreach	Navigant continues to see a growing trend among customers who do not want to answer phone calls from unknown numbers. The team shared a similar finding during PY9. This trend is having an impact on telephone surveying efforts and completion rates. Lower telephone survey completion rates may not be unique to Duquesne Light, but a National trend among consumers given the recent increases in telemarketing scams. Consumers are less willing to pick up the phone from unknown numbers.	Duquesne Light's data tracking system (PMRS) currently captures participant name, account number, street address, and phone number for most programs. Navigant notes that Duquesne Light also captures email addresses for many participants within certain applications and sign-up forms. Those email addresses are recorded in the data tracking system in some cases, but not all cases. As considerations for Phase IV updates, Duquesne Light should formally incorporate email addresses into data tracking systems. This will facilitate email and web-based outreach and surveying among a population that may prefer email contact instead of phone. Email contact could lead to higher satisfaction among customers who are wary of unknown phone numbers. However, Duquesne Light may be required to first understand what is feasible and what coordination is necessary with other departments such as billing and marketing that may also rely on email communications.

Source: Navigant analysis.

3. EVALUATION RESULTS BY PROGRAM

This section documents the gross impact, net impact, and process evaluation activities conducted in PY10 along with the outcomes of those activities. Not every program receives an evaluation every year. For example, in-depth research activities, including participant process and NTG surveys, were not completed in PY10 for all programs. Only the Midstream programs (Small/Medium Midstream Lighting and Large Midstream Lighting) included NTG surveys. Instead, Navigant uses previous year results from PY9 or PY8 and applies them to PY10 reported results to arrive at verified results. When certain types of research are not conducted in a given year, Navigant will use the previous year's results per the approved Phase III Evaluation Plan. Table 22 shows the evaluation activity matrix as currently conveyed in the Evaluation Plan. Following these reporting activities, Navigant and Duquesne Light anticipate refining the planned activities for the remainder of the phase.

Table 22: Evaluation Activity Matrix

Program	PY8			PY9			PY10			PY11			PY12		
	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process
REEP: Residential Energy Efficiency*	☒			X	X	X	☒			X	X	X	☒		
REEP: Upstream Lighting	☒			X	X	X	☒			X	X	X	☒		
Residential Appliance Recycling	☒	☒	☒				☒			X	X	X	☒		
Residential Behavioral Savings	☒	∞		X	**	X	☒	∞		X	**	X	☒	∞	
Residential Whole House Retrofit				X		X	☒		☒			X	☒		
Low-Income Energy Efficiency***	☒			X		X	☒			X		X	☒		
Express Efficiency††	☒			X	X	X	☒			X	X	X	☒		
Midstream Lighting††	☒	☒	☒	X			☒	☒	☒	X			☒	☒	☒
Small Commercial Direct Install	☒				t	t									
Multifamily Housing Retrofit	☒				X	X				X	X	X			
Commercial Efficiency††	☒			X	X	X	☒			X	X	X	☒		

Program	PY8			PY9			PY10			PY11			PY12		
	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process	Gross	Net	Process
Industrial Efficiency[tt]				X	X	X	X			X	X	X	X		
Public Agency Partnership[tt]	X			X	X	X	X		X	X	X	X	X		
Community Education	X				X	X	X				X	X	X		
Large C&I DR Curtailable				X			X			X			X		

*While verification surveys are not performed each year for REEP, Navigant conducts an application review for the program's rebates, which influences the program's realization rate.

**The results of the impact evaluation for this program are net savings, such that no separate net savings assessment is necessary.

***At least one component of this program will receive impact evaluation each year.

[l] Net-to-gross (NTG) and process evaluation research was planned for the Small Commercial Direct Install (SCDI) program in PY9. However, this program was targeted to achieve savings and planned budgets for the Phase and, as a result, Duquesne Light reduced program activities during PY10. Since NTG and process research is focused primarily on providing observations and recommendations which feed into program planning this research was not completed for SCDI in PY9.

[tt] Several non-residential program impact evaluations rely on 2-year rolling sample approaches. Generally, projects from each program year inform the gross verified impact results.

Source: Navigant Evaluation Plan.

3.1 Residential Energy Efficiency Program

REEP is designed to encourage customers to make an energy efficient choice when purchasing and installing household appliance and equipment measures by offering customers educational materials and financial incentives. Program educational materials include an online survey to help promote the availability of the REEP Rebates. Duquesne Light also holds regular events within several retail stores to educate consumers on energy efficiency products and to provide a platform for more broadly educating consumers on other programs falling under Duquesne Light's larger portfolio. Table 23 identifies the measures rebated during PY10, and notes that Duquesne Light added the Residential Connected Thermostats in early 2019.

Table 23: Duquesne Light PY10 Residential Rebated Measures

Measure
ENERGY STAR® Certified Dehumidifier
ENERGY STAR® Certified Freezer
ENERGY STAR® Certified Refrigerator
ENERGY STAR® Certified Room Air Conditioner
Residential Connected Thermostats
Programmable Thermostat
Variable Speed Pool Pump
Smart Strip Surge Protector
Central Air Conditioner (>15 SEER)
Heat Pump (>15 SEER, >8.5 HSPF)
Furnace with High Efficiency Fan Motor
ENERGY STAR® Certified Ductless Mini-Split Heat Pump
ENERGY STAR® Certified Heat Pump Water Heater (EF >2.0)
Solar Water Heater
Ceiling/Attic Insulation (≥ R-49)
Floor Insulation (≥ R-30)
Wall Insulation (add R-6)
Occupancy Sensor (infrared, ultrasonic detector, hard-wired)

Source: Duquesne Light[15]

REEP also provides measures in the form of energy efficiency kits free of charge to Duquesne Light customers who attend targeted community outreach events or who complete self-paced online home energy audits. In PY10, similar to PY9, energy efficiency kits contained LED bulbs and two LED night lights, and specifically:

- Apogee LED Kit (for those who completed the online home energy audit): reported savings: 410 kWh
    - Four 9 W LEDs
    - Two 11 W LEDs
    - Two 15 W LEDs
    - Two LED night lights
- Four bulb LED kit (for those who attended targeted community outreach events): reported savings: 180 kWh

[15] Duquesne Light. Watt Choices. Phase III Rebates. https://www.duquesnelight.com/energy-money-savings/watt-choices/residential. Retrieved October 15, 2019.

- Two 9 W LEDs
- One 11 W LED
- One 15 W LED

- Lamp Giveaways (i.e., single lamp kits given away at outreach events)
  - One 11 W LED (reported savings: 45 kWh)
  - One 9 W LED (reported savings: 36 kWh)
  - One LED night light (reported savings: 26 kWh)

In addition to the equipment rebate and efficiency kit program components, a third REEP program component—upstream lighting—provides point of purchase discounts on LEDs for customers. This is a more streamlined approach to discounting and is more readily engaged by customers since it does not require rebate forms. The elimination of rebate forms at the transaction level, in favor of bulk processing, significantly cuts processing costs.

Participation is counted differently for rebate, kit, and upstream lighting participants. For rebates and kits tied to an individual customer, a participant is a customer participating in the given program within a given reporting year (e.g., Q1 through Q4 for PY10), represented by a unique participant account number within the tracking system. Customers participating in a program more than once within a reporting year (i.e., PYRTD) are counted once; customers participating more than once but in different years or in different programs are counted more than once (once in each year and/or program). A portion of REEP kits program savings result from giveaways during events in which the utility has participated (event giveaways). For these events, Duquesne Light tracks events and the measures given away and not the individual participants who received the measures, so participation cannot be determined. Finally, participation in the REEP Upstream Lighting program component is not defined because reported program data tracks lamp sales activities and not individual participating customers/purchasers.

3.1.1 Participation and Reported Savings by Customer Segment

Table 24 presents the participation counts, reported energy and demand savings, and incentive payments for REEP in PY10 by customer segment.

Table 24: REEP Participation and Reported Impacts*

Parameter	Residential (Non-LI) REEP	Residential (Non-LI) REEP Upstream Lighting	Residential (Non-LI) Total
PYTD # Participants	21,106	N/A	21,106
PYRTD MWh/yr	9,554	20,357	29,910
PYRTD MW/yr	1.18	2.06	3.24
PY10 Incentives ($1,000)**		$1,083	

*Excludes counts of customers who received efficiency kits during events giveaways and customers who purchased discounted bulbs via the upstream lighting component, neither of which is tracked at the customer level.

**Duquesne Light combines financial related information here for the two program components 1) REEP: Residential Energy Efficiency and 2) REEP: Residential Energy Efficiency (Upstream Lighting) under REEP: Residential Energy Efficiency. Otherwise, energy and demand impacts are reported separately for these two programs.

Source: Navigant Evaluation Plan.

3.1.2 Gross Impact Evaluation

Navigant conducted primary research for the REEP gross impact evaluation during PY9 and limited its activities for the program during PY10. While the PY10 activities for REEP were limited, the team still carried out separate and distinct activities for the three components—equipment rebates, efficiency kits, and upstream lighting.

For equipment rebates, the PY10 evaluation relied on two data sources in estimating realization rates for energy and demand savings: the PY9 participant survey that produced a verified installation rate and an application file review of PY10 projects. Findings from both efforts were combined to arrive at the PY10 gross impact results. Previously in PY9, Navigant surveyed 75 randomly selected PY9 participants to verify installation of their reported measures, which totaled 97 measures because participants can receive rebates for more than one measure. The team also randomly selected 75 PY10 participants and requested the associated applications of those participants. These 75 participants had a combined total of 102 equipment rebate measures (similar to PY9, with some participants receiving a rebate for more than one measure). Duquesne Light then sent the team copies of the following:

- Completed application forms
- Equipment and appliance receipts; work orders and invoices detailing the equipment installed and confirming the transactions and purchases
- Copies of Duquesne Light utility bills to confirm that the participant is a utility customer

The team's application file review relied on the following verification checklist for deemed or partially deemed savings measures. Navigant notes that Duquesne Light engaged a new CSP for rebate processing and continues to see increased rebate activities on its web portal. These application file review activities also served as a means to verify the data processing carried out by the new CSP and through the online portal, which is seeing increased traffic. The team carried out the same activities during the PY9 evaluation.

- Participant has valid utility account number
- Measure(s) is on approved list and all parameters necessary for calculating savings are present
- Rebate payment date is in the current program period being verified
- Proof of purchase identifies qualifying measure and is dated within the period being verified
- Unit kilowatt-hours and kilowatts are correct for each listed measure; for partially deemed measures this involves reviewing the additional inputs required by the technical reference manual (TRM). These data were not always provided in PMRS but rather sometimes obtained for the sample of participants by reviewing the application files, receipts indicating measure details, or through searches of secondary sources for a given make or model number. When available, Navigant used a TRM deemed or default value to estimate savings.

For the REEP kits, Navigant completed a census of the individual measures making up each kit against the TRM for accuracy. The team then applied the verified installation rate found through the survey effort completed in PY9 that included 46 participants. The combined findings from the PY10 TRM measure review and recalculation and the PY9 participant survey inform the gross impact results.

For upstream lighting, the team also completed a multi-pronged approach to verify gross impact results. First, the team checked the CSP's detailed records against what had been reported in the Duquesne

Light program database (PMRS), both for savings and for bulb counts, for a census of the line items in the CSP's detailed participation data. Additionally, the team recalculated savings for each lamp and built up to a total savings value for upstream lighting. Total savings were calculated by confirming the default baseline wattage, applying the TRM savings algorithm, and confirming the ENERGY STAR status of the bulb.

The upstream lighting evaluation also relied on the results of the PY9 in-store intercepts to estimate the proportions of program bulbs (standard and specialty LEDs) going into residential and non-residential sockets. During PY9, the team completed intercept interviews in 12 stores and interviewed 327 individuals; 210 of these individuals purchased program bulbs. The portion of bulbs going into non-residential sockets experience additional hours of use (HOU) over residential sockets. Per Duquesne Light's EE&C Plan, Navigant reallocated savings from REEP to the C&I program Express Efficiency (Section 3.6). Additional details on the in-store intercepts and reallocation of savings are provided in Appendix A.

Table 25 shows the evaluation activities for the REEP components. The sample shown for rebates relates to the participants randomly selected during PY10 for application file reviews.

Table 26 and Table 27 show the gross energy and demand results for REEP.

Table 25: REEP Gross Impact Sample Design for PY10

Stratum	Population Size*	Achieved Sample Size	Evaluation Activity
Rebates	2,376	102	Apply PY9 participant survey findings; engineering desk reviews/application file reviews for a sample of projects
Kits	19,704	N/A	Apply PY9 participant survey findings; TRM review
Upstream Lighting – Standard LEDs	N/A	N/A	Apply PY9 cross-sector sales rate; census review of PMRS and detailed CSP records
Upstream Lighting – Standard LEDs	N/A	N/A	Apply PY9 cross-sector sales rate; census review of PMRS and detailed CSP records
Program Total	**22,080**	**102**	

*Counts differ from Table 24 that shows a unique count of participants. This table shows the unique count of participants in each stratum. For example, a customer participating in both rebates and kits is counted once in each.

Source: Navigant Evaluation Plan.

The sample coefficient of variation (C_v) and relative precision for rebates represents the statistics associated with the PY10 application file review only. While the PY9 survey results do inform the realization rate and contain uncertainty, Navigant conveys only the uncertainty associated with PY10's application file review within Table 26 to report the statistics associated with that specific effort. Historically, the uncertainty associated with rebates impact verification is primarily driven by the application file review. Surveying for installation verification results in minimal uncertainty and typically confirms virtually all reported installations (e.g., the PY9 installation verification rate was 99.7%).

Table 26: REEP Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
Rebates	624	109%	0.49	7.0%
Kits	8,930	75%	0.42	9.1%

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
Standard LED	8,044	83%	0.48	6.3%
Specialty LED	12,313	110%	0.32	7.0%
Program Total	**29,910**	**92%**		**4.4%**

Source: Navigant Evaluation Plan.

Table 27: REEP Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
Rebates	0.40	101%	0.26	3.7%
Kits	0.78	74%	0.47	10.1%
Standard LED	0.81	83%	0.48	6.3%
Specialty LED	1.25	110%	0.32	7.0%
Program Total	**3.24**	**93%**		**4.0%**

Source: Navigant Evaluation Plan.

The following factors led to variations between the reported and verified savings and led to the observed realization rates for the REEP components.

- Equipment Rebates
    - Savings adjusted for 26 of the 102 measures examined via the application file review.
    - Navigant found two instances where the application did not include a copy of the utility bill. However, Navigant was able to confirm that the participant was a Duquesne Light customer through program and customer tracking data (Duquesne Light also deployed a similar process for these instances). The review identified several applications with limited information (e.g., non-descriptive invoices). Navigant had to research retailer websites to confirm that several rebated measures were ENERGY STAR rated. The team was able to research details online to confirm savings for these applications, but the applications themselves were not sufficient to confirm measure eligibility.
    - Navigant observed that for 10 of 32 central AC units and two out of five air source heat pumps, equipment sizes were rounded to the nearest ton. For example, many 2.5-ton units were rounded up in program tracking data to 3 tons. In addition, seven central AC units had SEER values that were rounded up or did not match the invoice in the application.
    - Navigant's random sample drew two ductless mini-split measures and five air source heat pumps. For each case, Navigant found that application details were limited and required online research. The verified savings differed from reported savings for each case, yielding energy realization rates ranging from 50% to 344%.
- Efficiency Kits
    - From the TRM review, deemed savings per kit changed only slightly, by an increase in savings of about 1% per kit. The same adjustment was made in PY9.

- From the PY9 survey findings, Navigant found that, on average, respondents installed or planned to install roughly 6 of the 8 LEDs included in the kits. This is the largest driver of the REEP kits realization rate.

- Upstream Lighting

  - Navigant's recalculation of savings using the TRM and baseline bulb wattage assumptions adjusted the realization rate to 110% for energy and 115% for demand before making any adjustments for cross-sectors sales (i.e., before accounting for any HOU changes). Changes primarily related to Navigant assuming different baseline wattages for some bulbs.

  - Navigant also reviewed bulbs to confirm ENERGY STAR compliance, and the team made confirmations for all model numbers.

  - Navigant reallocated some savings to the C&I Express Efficiency program based on the PY9 in-store intercept findings. Savings for those bulbs going into non-residential sockets increased due to longer runtime hour assumptions.

    - For standard LEDs, Navigant found that 22 of 633 PY9 bulbs (3.5%) were installed in multifamily common areas.

    - For specialty LEDs, Navigant found that 25 of 599 PY9 bulbs (4.2%) were installed in office and lodging buildings.

    - For PY10, Navigant moved an equivalent percentage of bulbs from the REEP program to the Express Efficiency program. The removal of these bulbs from REEP resulted in a final realization rates of 99% for energy and demand.

    - Additional details are provided in Appendix A.

3.1.3 Net Impact Evaluation

The PY10 net impact evaluation for REEP relies on the NTG estimations developed during the PY9 evaluation. During PY9, Navigant determined the free ridership and spillover values separately for the three individual components of the program. For the equipment rebates and efficiency kits, Navigant used a phone survey to gain insight into participants behavior and purchasing habits. Question batteries aligned with guidance from the SWE Framework to develop intention and influence scores. Navigant also quantified free ridership scores separately for the LED lamps and LED nightlights within the kits.

For upstream lighting NTG research, Navigant used an intercept survey conducted at 12 store locations to estimate free ridership among bulb purchasers. The team also conducted a general population survey that estimated free ridership and spillover. The average free ridership of the two survey efforts plus the general population survey's spillover rate were used to estimate the upstream lighting NTG ratio during PY9.

Table 28 shows the REEP net impact sample design for PY10. In addition, Table 29 shows the net impact evaluation results for PY10.

Table 28: REEP Net Impact Sample Design

Stratum	Stratum Boundaries	Population Size*	Achieved Sample Size	Response Rate
Rebates	All measures	2,376	102	N/A
Kits	All measures	19,704	N/A	N/A
Standard LED	All measures	N/A	N/A	N/A
Specialty LED	All measures	N/A	N/A	N/A
Program Total		**22,080**	**N/A**	**N/A**

*Counts differ from Table 24 that shows a unique count of participants. This table shows the unique count of participants in each stratum. For example, a customer participating in both rebates and kits are counted once in each.

Source: Navigant Evaluation Plan.

Table 29: REEP Net Impact Evaluation Results

Stratum	PYVTD MWh/yr	Free Ridership	Spillover	NTG Ratio	Relative Precision (at 85% CL)
Rebates	678	0.62	0.08	0.45	7.0%
Kits	6,670	0.33	0.08	0.75	7.8%
Standard LED	6,653	0.66	0.09	0.43	16.2%
Specialty LED	13,566	0.65	0.09	0.43	18.1%
Program Total	**27,567**	**0.58**	**0.08**	**0.51**	**8.7%**

Source: Navigant Evaluation Plan.

High Impact Measure Research

Navigant did not conduct research for HIMs for REEP in PY10.

3.1.4 Verified Savings Estimates

In Table 30, the realization rates and NTG ratios determined by Navigant are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for REEP in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 30: REEP PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	29,910	3.24
PYVTD Gross	27,567	3.03
PYVTD Net	14,018	1.50
RTD	99,437	10.73
VTD Gross	95,775	10.39
VTD Net	54,561	5.83

Source: Navigant Evaluation Plan.

The VTD savings contribution from prior years has changed since the PY9 Final Annual report. Navigant's PY9 evaluation determined that some LED bulbs reported through the Upstream Lighting program component were not ENERGY STAR compliant. As a result, verified savings for any associated model numbers in question were recorded as zero. However, the SWE's review determined that all LED

bulbs reported by Duquesne Light in PY9 were ENERGY STAR compliant. Navigant corrected the PY9 VTD to reflect these SWE changes. Navigant first reported this in the PY10 Preliminary Annual Report, and the update did not require any refiling of the PY9 Final Annual report by Duquesne Light. The following summarizes the increases made to certain verified values from the PY9 report. These updates are reflected within this report throughout the various permutations of achievements, and impact Express Efficiency via cross-sector sales adjustments. All changes are conveyed as follows:

- REEP: Residential Energy Efficiency (Upstream Lighting), gross energy: 655 MWh
- REEP: Residential Energy Efficiency (Upstream Lighting), gross demand: 0.066 MW
- REEP: Residential Energy Efficiency (Upstream Lighting), net energy: 281 MWh
- REEP: Residential Energy Efficiency (Upstream Lighting), net demand: 0.028 MW
- Express Efficiency, gross energy: 100 MWh
- Express Efficiency, gross demand: 0.014 MW
- Express Efficiency, net energy: 43 MWh
- Express Efficiency, net demand: 0.006 MW

3.1.5 Process Evaluation

The process evaluation for the REEP program in PY10 included the following activities:

- Program tracking data examinations
- TRM savings calculation review
- Application file reviews (REEP Rebates only)
- ENERGY STAR retailer interviews

The activities examined the program design, program administration, program implementation and delivery, and market response. The process evaluation findings and details can be found in the accompanying PY10 Residential Program Evaluation Report. Highlights of the process evaluation are summarized here:

REEP Rebates:

- Duquesne Light is generally applying TRM savings algorithms and assumptions correctly to rebated measures. Navigant examined Duquesne Light's PMRS that tracks program activities at the measure level. This review examined data fidelity and the appropriate application of the TRM to measures to estimate reported savings. These are previously described for the REEP gross impacts analysis as well.
- Navigant performed an in-depth application file review of 75 PY10 participants who purchased 102 rebated measures to determine the performance of the application processing cycle. Navigant was able to confirm that, for the majority of the sample, the reported energy savings

were accurate. The REEP Rebate impact realization rates mainly reflect changes from the application file reviews for 26 of the 102 measures where adjustments were needed.

- Central AC and air source heat pump savings are based on SEER and capacity ratings. However, capacity values in program tracking databases are generally rounded to whole ton numbers (e.g., a 2.5-ton unit is rounded up to a 3-ton unit). This was seen in 10 out of 32 central AC units and two out of five air source heat pumps. The use of these rounded numbers is yielding savings estimates that are roughly 10% higher than if the actual capacity was used.

- The current HVAC rebate application form does not collect information on heating capacity for ductless mini-split systems. Further, Duquesne Light relies on default heating capacity values for ductless mini-split systems and air source heat pumps to estimate reported savings. However, the TRM requires equipment specific inputs for the saving's algorithm. Navigant's random sample drew two ductless mini-split measures and five air source heat pumps. For each case, Navigant found that application details were limited, which required online research. This additional research uncovered, on average, savings that were approximately 184% higher than what was reported. Duquesne Light is aware of this and exploring opportunities to refine data tracking as part of Phase IV updates.

- Navigant reached out to 53 program participating retail partners in PY10. Of these partners, Navigant was able to successfully perform in-depth interviews with 12 of them, seven representing larger big box stores and five representing smaller local stores. When partners were asked if their store benefited from the program, seven out of 12 said that they thought it did. However, it was discovered that the program does not necessarily change how employees promote or stock the rebated measures.

REEP Kits:

- No process evaluation was conducted in PY10 for REEP kits.

REEP Upstream Lighting:

- The evaluation team reviewed the lamp-level program details to confirm that Duquesne Light and its Upstream Lighting CSP are reporting savings details correctly and in accordance with the 2016 TRM for each lamp-specific entry. Overall for PY10, Navigant found that data are tracked appropriately. Minor discrepancies resulted in minor adjustments for both energy and demand savings. Most often, these discrepancies could be traced to Navigant determining different baseline bulb wattage assignments than those of the CSP.

3.1.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 31. TRC benefits in Table 31 were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 31: Summary of REEP Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
1	EDC Incentives to Participants [1]	$1,083	$3,845
2	EDC Incentives to Trade Allies	$0	$0
3	Participant Costs (net of incentives/rebates paid by utilities)	$1,498	$6,964

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$2,580		$10,809	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$4	$71
6	Administration, Management, and Technical Assistance [3]	$15	$90	$204	$435
7	Marketing [4]	$24	$0	$128	$0
8	Program Delivery [5]	$52	$2,085	$91	$6,429
9	EDC Evaluation Costs	$151		$302	
10	SWE Audit Costs	$60		$220	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$2,478		$7,884	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$5,058		$18,693	
14	Total NPV Lifetime Electric Energy Benefits	$6,039		$24,860	
15	Total NPV Lifetime Electric Capacity Benefits	$2,025		$7,095	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$2,704		$10,979	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$829		-$2,039	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$9,940		$40,894	
19	**TRC Benefit-Cost Ratio [8]**	**1.97**		**2.19**	

[1] Includes direct install equipment costs and costs for EE&C kit.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant Evaluation Plan.

Table 32 presents program financials and cost-effectiveness on a net savings basis.

Table 32: Summary of REEP Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
1	EDC Incentives to Participants [1]	$1,083	$3,844
2	EDC Incentives to Trade Allies	$0	$0

3	Participant Costs (net of incentives/rebates paid by utilities)	$229		$2,451	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$1,312		$6,296	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$4	$71
6	Administration, Management, and Technical Assistance [3]	$15	$90	$204	$435
7	Marketing [4]	$24	$0	$128	$0
8	Program Delivery [5]	$52	$2,085	$91	$6,429
9	EDC Evaluation Costs	$151		$302	
10	SWE Audit Costs	$60		$220	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$2,478		$7,884	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$3,790		$14,180	
14	Total NPV Lifetime Electric Energy Benefits	$3,071		$14,536	
15	Total NPV Lifetime Electric Capacity Benefits	$1,030		$4,058	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$1,375		$6,474	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$421		-$1,006	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$5,054		$24,062	
19	**TRC Benefit-Cost Ratio [8]**	**1.33**		**1.70**	

[1] Includes direct install equipment costs and costs for EE&C kit.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant Evaluation Plan.

3.1.7 Status of Recommendations

The PY10 impact and process evaluation activities led to the following findings and recommendations, along with a summary of how Duquesne Light plans to address the recommendation in program delivery.

Finding:
Through Navigant's verification activities of Upstream Lighting, the team changed baseline wattage levels for 156 of 443 model numbers (35%) associated with PY10 activities (41% of specialty lamps; 22% of

standard lamps). These adjustments resulted in a realization rate of 103% (prior to any cross-sector sales adjustments). During PY9, the team changed baseline wattages for 91 of 402 model numbers (23%), all of which related to specialty lamps.

Recommendation:
Duquesne Light should incorporate Navigant's verification feedback (which is also informed by data collected by the SWE) into baseline wattage assumption determinations. Duquesne Light can also leverage Navigant for more frequent reviews of new model numbers as they are introduced to the program.

Duquesne Light Status Report:
Duquesne Light will consider the feasibility of incorporating ongoing feedback from Navigant on wattage assumptions for lamps currently included in the program and any new lamps introduced to the program.

Finding:
Navigant's PY10 REEP Rebate application file review found that, in most cases, savings were under-reported for air source heat pumps and ductless mini-split heat pumps.

Recommendation:
Duquesne Light should expand the rebate application or data tracking to capture more information about these heat pumps (e.g., model number specification looks-ups by the CSP). Navigant makes this recommendation so that reported savings are better aligned to verified savings which can refine tracking progress toward goals. Duquesne Light would first need to weigh the benefits of additional data against participant burdens.

Duquesne Light Status Report:
Duquesne Light will evaluate the savings impact variances and assess whether tracking system modifications are indicated. In the past, the variance has not justified the added complexity, Duquesne Light will actively reconsider this recommendation to determine if adjustments are necessary.

3.2 Residential Appliance Recycling Program

The Residential Appliance Recycling Program (RARP) seeks to produce cost-effective, long-term, coincident peak demand reduction and annual energy savings in the residential market sector. The program plans to do this 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 to customers who allow the utility to remove and recycle eligible refrigerators ($35) and freezers ($35). The program implementation contractor in PY10 was ARCA.

A RARP participant is a customer participating within a given reporting year (e.g., Q1 through Q4 for PY10) represented by a unique participant account number within the tracking system. Customers participating in a program more than once within a reporting year (i.e., PYRTD) are counted once; customers participating more than once but in different years or in different programs are counted more than once (once in each year and/or program).

3.2.1 Participation and Reported Savings by Customer Segment

Table 33 presents the participation counts, reported energy and demand savings, and incentive payments for RARP in PY10 by customer segment.

Table 33: RARP Participation and Reported Impacts

Parameter	Residential (Non-LI)
PYTD # Participants	2,416
PYRTD MWh/yr	2,622
PYRTD MW/yr	0.29
PY10 Incentives ($1,000)	$90

Source: Navigant analysis.

3.2.2 Gross Impact Evaluation

During Phase III, Navigant used the basic level of verification rigor to confirm impacts for RARP. Navigant conducted primary research for the RARP gross impact evaluation during PY8 and limited its activities for the program during PY10, which are similar to PY9's activities. Generally, the PY10 evaluation relied on two data sources in estimating realization rates for energy and demand savings, a census review of CSP PY10 program tracking data and survey results from the PY8 evaluation effort. Navigant historically has relied on the TRM defaults to calculate the unit energy consumption (UEC), as specified by the TRM. However, for PY10 Navigant expanded the program tracking data review task by calculating savings using all the appliance data collected by the CSP to update the PY10 UEC estimates prior to applying the survey results from the PY8 evaluation effort.

The program tracking data review consisted of the following steps:

1. Comparison of CSP tracking data to Duquesne Light participant data for consistency
2. Check of equipment specifications within CSP tracking data to confirm measure eligibility (for example, refrigerators and freezers must be 10 years or older and between 10 and 30 cubic feet in size)
3. Recalculation of savings for each appliance using the TRM's regression equation and the equipment specifications gathered by the CSP

The program tracking data review and recalculation resulted in a slight increase in the verified gross energy and demand impacts for refrigerators and a decrease for freezers.

During PY8, Navigant completed surveys with a total of 159 participants who recycled 170 appliances. Within that group, 134 participants recycled 138 refrigerators, and 30 participants recycled 32 freezers. Some of those participants are counted within both groups given that participants can recycle up to two appliances per address per calendar year.

Table 34 shows the evaluation activities for PY10 RARP gross energy and demand. Table 35 and Table 36 show the gross energy and demand results for RARP, respectively.

Table 34: RARP Gross Impact Sample Design for PY10

Stratum	Population Size*	Achieved Sample Size	Evaluation Activity
Refrigerators	2,071	2,071	Apply PY8 findings; recalculate savings for all units using TRM and equipment specifications
Freezers	490	490	Apply PY8 findings; recalculate savings for all units using TRM and equipment specifications
Program Total	**2,561**	**2,561**	

*Strata-specific population counts shown here differ from the program population count of Table 33. Participants who recycled both a refrigerator and a freezer are counted once for the program but counted once within each stratum within this table. This count also reflects the reported population which includes three duplicate entries (verified refrigerator population is 2,068).

Source: Navigant analysis.

Table 35: RARP Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
Refrigerators	2,149	103%	0.19	2.4%
Freezers	474	81%	0.11	2.8%
Program Total	**2,622**	**99%**		**2.1%**

Source: Navigant analysis.

Table 36: RARP Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
Refrigerators	0.24	103%	0.19	2.4%
Freezers	0.05	81%	0.09	2.4%
Program Total	**0.29**	**99%**		**2.1%**

Source: Navigant analysis.

The following factors led to the variation between the reported and verified savings and led to the observed realization rates. Ultimately, the variations drove the realization rate above a value of 1.00 for refrigerators and below 1.00 for freezers.

- Navigant uses the actual equipment specifications and the actual date of manufacture for the given appliances, as captured by the CSP in the tracking details, when applying the TRM algorithms to arrive at gross impacts. Duquesne Light assumed a certain portion of units would be manufactured before 1990. Further, the TRM defaults used by Duquesne Light for reported savings assume certain equipment characteristics for recycled units. Adjustments for these considerations drove the energy and demand realization rates to values slightly above 100 percent for refrigerators and down to 81% for freezers.

- Realization rates for refrigerators also changed from 100% due to adjustments to the number of units recycled. During PY8, three additional units were verified as recycled. This refrigerator recycling verification rate is also applied to the PY10 activities.

3.2.3 Net Impact Evaluation

Per Navigant's Evaluation Plan and consistent with PY9 activities, the team relied on PY8 results for the estimates of participant free ridership and spillover. Navigant plans to conduct NTG research in PY11 to update these estimates. Navigant's free ridership and spillover research aligned to the methodologies required by the SWE within the Framework's Appendix B section.[16] Additionally, Navigant investigated free ridership individually for refrigerators and freezers. Table 37 clarifies that there is no RARP net impacts sample given that the analysis relies on the PY8 evaluation findings. Table 38 shows the results of the analysis. Navigant reported similarly during PY9.

Table 37: RARP Net Impact Sample Design

Stratum	Stratum Boundaries	Population Size*	Achieved Sample Size	Response Rate
Refrigerators	All Refrigerators	2,071	N/A	N/A
Freezers	All Freezers	490	N/A	N/A
Program Total	All Units	**2,561**	**N/A**	

*Strata-specific population counts shown here differ from the program population count of Table 33. Participants who recycled both a refrigerator and a freezer are counted once for the program but counted once within each stratum within this table. This count also reflects the reported population which includes three duplicate entries (verified refrigerator population is 2,068).

Source: Navigant analysis.

[16] SWE Phase III Evaluation Framework. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

Table 38: RARP Net Impact Evaluation Results

Stratum	PYVTD	Free Ridership (%)	Spillover (%)	NTG Ratio	Relative Precision (at 85% CL)
Refrigerators	2,212	0.63	0.07	0.44	15.8%
Freezers	384	0.42	0.01	0.59	8.4%
Program Total	**2,596**	**0.60**	**0.06**	**0.46**	**12.9%**

Source: Navigant analysis.

The RARP NTG ratio is 46%. That is informed by the strata-specific results from PY8 and the mix of refrigerators and freezers from PY10. The following provides additional details about the NTG ratio estimates sourced from PY8.

- The RARP free ridership rate from PY8 is 63% for refrigerators, 42% for freezers, and 60% combined for the program when accounting for the PY10 population mix.
- The spillover rate is 6% for the RARP program participants.

High Impact Measure Research
Navigant did not conduct research for HIMs for RARP in PY10.

3.2.4 Verified Savings Estimates

In Table 39, the realization rates and NTG ratios determined by Navigant are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for RARP in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 39: RARP PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	2,622	0.29
PYVTD Gross	2,596	0.29
PYVTD Net	1,202	0.13
RTD	6,587	0.74
VTD Gross	6,257	0.70
VTD Net	2,911	0.33

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report.

3.2.5 Process Evaluation

Navigant conducted a process evaluation for RARP in PY8. Those activities included a participant survey that inform both the PY9 and PY10 evaluation activities. Through discussions with Duquesne Light during PY10, Navigant learned that the utility and its CSP ARCA continue to implement RARP in a similar fashion to PY8 and PY9 activities. The accompanying PY10 Residential Program Evaluation report contains additional details about RARP and highlights are summarized here:

- **Progress Toward Goals.** The PY10 RARP exceeded its savings target for PY10, at 147% of goal.

- **Average Age.** The average age of all recycled refrigerators within the program for PY10 was 23 years, and the average age of freezers was 26 years. Duquesne Light's reported savings assumes that 56% of recycled refrigerators and 85% of freezers were manufactured before 1990. However, Navigant's review of the CSP's detailed tracking data found that that only 30% of refrigerators and 47% of freezers were manufactured before 1990.

- **Average Size.** The average size of PY10 recycled refrigerators and freezers was 18 and 15 cubic feet, respectively.

- **TRM Regression Equation.** In previous evaluations, Navigant relied on the TRM's default input values when calculating savings with the TRM's regression equations that estimate recycled refrigerator and freezer savings. For PY10, the team used the CSP's detailed tracking data to source appliance-specific input values instead of TRM defaults. Recalculation of savings using this approach slightly increased verified estimates over reported estimates for refrigerators and decreased estimates for freezers to a realization rate of 81%. Freezers recycled through RARP during PY10 appear to save less energy than the TRM would assume for typical Act 129 recycling programs, as indicated by the TRM defaults and Duquesne Light's assumptions.

3.2.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 40. TRC benefits in Table 40 were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 40: Summary of RARP Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$90		$204	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-$90		-$204	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$0		$0	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$6
6	Administration, Management, and Technical Assistance [3]	$1	$8	$36	$38
7	Marketing [4]	$0	$0	$0	$20
8	Program Delivery [5]	$30	$345	$53	$761
9	EDC Evaluation Costs	$13		$27	
10	SWE Audit Costs	$6		$19	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$403		$964	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$403	$964
14	Total NPV Lifetime Electric Energy Benefits	$620	$1,364
15	Total NPV Lifetime Electric Capacity Benefits	$188	$408
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0	$0
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0	$0
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$808	$1,772
19	**TRC Benefit-Cost Ratio [8]**	**2.00**	**1.84**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs Includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 41 presents program financials and cost-effectiveness on a net savings basis.

Table 41: Summary of RARP Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$90		$204	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-$90		-$204	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$0		$0	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$6
6	Administration, Management, and Technical Assistance [3]	$1	$8	$36	$38
7	Marketing [4]	$0	$0	$0	$20
8	Program Delivery [5]	$30	$345	$53	$761
9	EDC Evaluation Costs	$13		$27	
10	SWE Audit Costs	$6		$19	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$403		$964	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**	**$0**
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$403	$964
14	Total NPV Lifetime Electric Energy Benefits	$287	$635
15	Total NPV Lifetime Electric Capacity Benefits	$87	$190
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0	$0
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0	$0
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$374	$824
19	**TRC Benefit-Cost Ratio [8]**	**0.93**	**0.86**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.2.7 Status of Recommendations

The limited activities around PY10 impact and process evaluations led to the following findings and recommendations, along with a summary of how Duquesne Light plans to address the recommendation in program delivery.

Finding:
The PY10 evaluation activities relied on appliance-specific characteristics gathered by the CSP to calculate energy savings estimates via the TRM's regression equations. This approach differs from previous evaluations and Duquesne Light's approach to reported savings, both of which use TRM defaults applied to the TRM's regression equations in lieu of appliance-specific characteristics. As a result, Navigant estimated slightly greater refrigerator savings and lower freezer savings.

Recommendation:
Duquesne Light should modify reported savings to incorporate more of the CSP's tracking data that captures appliance characteristics. Navigant estimates that the TRM defaults result in over-reported savings for freezers, for example. Changing methods would likely result in better alignment of reported savings to verified savings in PY11 and PY12. As an alternative to using the CSP's tracking data for reported savings in a given program year, Duquesne Light could update refrigerator and freezer reported savings assumptions by using the PY8 through PY10 historical averages for the various inputs to the TRM's regression equation in place of the TRM defaults.

Duquesne Light Status Report:
Duquesne Light agrees to adopt Navigant's alternative recommendation and calculate new savings values for recycled refrigerators and freezers based on PY8 through PY10 historical averages.

Finding:
Throughout Phase III, Duquesne Light has captured significant equipment specification information to accurately estimate appliance energy and demand savings using the TRM's regression equations. However, Duquesne Light and its CSP do not capture nameplate photographs of recycled equipment as requested by the SWE as part of their quarterly data requests. Navigant notes that this was resolved with the SWE who determined that the data provided and Navigant's evaluation activities are sufficient information to verify program achievements. However, Navigant also notes that the SWE's original request is not being met.

Recommendation:
Duquesne Light should plan to have its CSP capture nameplate photographs of all recycled appliances during Phase IV. This presumes that this process can be established with Duquesne Light's CSP at the start of the new phase and not sooner. If capturing all nameplates is problematic to Duquesne Light, then a sample of nameplate photos could be obtained to meet the SWE's data request.

Duquesne Light Status Report:
Duquesne Light had already negotiated its Phase III contract when the SWE adopted this requirement. The additional requirement of obtaining nameplate photos would require a change in the existing PA PUC approved CSP contract. This consideration for a change to the program will occur in Phase IV, if the program continues.

3.3 Residential Behavioral Savings Program

The Residential Behavior Savings program (HER program) influences behavior change in customers by providing information via an energy report mailed to participants on a regular basis. These reports provide participants with information about their recent energy use and compare the usage to that of similar homes. The reports also provide participants with energy-saving tips, some of which are tailored to the participants' circumstances. Other studies have shown this set of information stimulates participants to reduce their energy use, creating average energy savings in the 1%-2% range.

Duquesne Light launched the HER program in PY4 to target high use residential customers. The current program participation levels include 13,631 customers from the 2012 market rate wave, 38,356 participants from the 2015 market rate wave, 13,385 customers from the 2015 low income wave, and 3,318 customers from the 2018 low income wave (based on PY10 monthly averages). The 2018 low income wave is being evaluated for the first time in the PY10 HER evaluation. Navigant completed a randomized control trial (RCT) validation of the wave in September 2018, and the treatment and control groups were found to be randomly allocated, as confirmed by Navigant and approved by the SWE. Similar to the existing 2015 low income wave, savings are reported and verified under LIEEP. The administration, implementation, and evaluation for those low income participants are similar to their market rate participant counterparts. The low income evaluation results are detailed in Section 3.4.7.

Navigant obtained new low income classifications during the PY8 evaluation as part of a 2016 low income status rescreening effort conducted by Duquesne Light. These classifications were used to identify any market rate customers that had been reclassified as low income, and vice versa. No rescreening has occurred to update reclassifications, and per the PY10 SWE-approved Evaluation Plan, Navigant maintains these reclassifications. The savings from these customers, though not included in the low income waves, contribute to the low income PY10 savings for LIEEP, as shown in Section 3.4.7. Ultimately with this update and consistent with PY8 and PY9 approaches, 3.5% of the 2012 market rate wave savings and 4.2% of the 2015 market rate wave savings are reallocated to LI HER savings.

A participant is a customer receiving HERs during the program year (i.e., PY10). The participant count represents the number of unique participants who received HERs during PY10. The program is an opt-out program in which the CSP, Oracle, enrolls participants in the program based on an RCT program design. Enrolled customers can opt out of the program by calling or emailing the program implementer.

In the RCT design, eligible customers are randomly assigned to treatment and control groups. Due to random assignment, any difference in usage between treatment customers (i.e., the program participants) and control customers is a result of participation in the program.

3.3.1 Participation and Reported Savings by Customer Segment

Table 42 presents the participation counts, reported energy and demand savings, and incentive payments for HER in PY10. Low income HER participant results are reflected in LIEEP, as shown in Section 3.5.

Table 42: HER Participation and Reported Impacts

Parameter	Residential (Non-LI)
PYTD # Participants	51,987
PYRTD MWh/yr	8,457
PYRTD MW/yr	0.97
PY10 Incentives ($1,000)	$0

Source: Navigant analysis.

3.3.2 Gross Impact Evaluation

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

Navigant estimated program savings by adhering to the SWE's guidance described by the Framework.[17] The team used a monthly lagged dependent variable (LDV) model, also known as a post-program regression (PPR) model. This model uses post-enrollment program observations only and replaces the household fixed effect with the household's energy use in the same calendar month of the pre-program year to account for household-level variation in energy use. The model takes the form shown in Equation 1:

Equation 1: LDV Model Specification

$$kWh_{im} = \beta_o + \sum_{m=1}^{12} \beta_{1m} yrmo_m + \sum_{m=1}^{12} \beta_{2m} yrmo_m \cdot kWh_{im-12} + \sum_{m=1}^{12} \beta_{3m} yrmo_m \cdot treatment_{im} + \varepsilon_{im}$$

where

kWh_{im}	is customer *i*'s average daily energy usage in bill *m*.
β_o	is the intercept of the regression equation.
β_{1m}	is the coefficient on the bill year-month *m*.
$yrmo_m$	is the indicator variable equal to one for each year-month in the analysis.
β_{2m}	is the coefficient on the home-specific pre-assignment usage term which is interacted with bill month.
kWh_{im-12}	is customer *i*'s average daily energy usage lagged by 12 months.
β_{3m}	is the estimated treatment effect in kWh per day per customer. This is the main parameter of interest.
$treatment_{im}$	is the treatment indicator variable. Equal to one when the treatment is in effect for the treatment group and zero otherwise.
ε_{im}	is the error term

The LDV model is the preferred model used for reporting savings. As a check on the robustness of the savings estimates, a linear fixed-effects regression (LFER) model was also run. Due to the experimental design of the program, the two models should generate similar results. In the LFER model, average daily consumption by participant and non-participant *i* in billing period *m*, is denoted by kWh_{im}. This is referred to as a fixed-effects model because it includes a household-specific fixed-effects term. Equation 2: formally presents the equation for this model.

Equation 2: Fixed-Effects Regression Model

$$kWh_{im} = \beta_i + \sum_{m=1}^{12} \beta_{1m} yrmo_m + \sum_{m=1}^{12} \beta_{2m} yrmo_m \cdot treatment_{im} + \varepsilon_{im}$$

where

β_i	is the household-specific fixed-effect that implicitly captures all participant-specific and non-participant-specific effects on electricity use that do not change

[17] SWE Framework. http://www.puc.pa.gov/Electric/pdf/Act129/SWE_PhaseIII-Evaluation_Framework102616.pdf

over time. The calculation of the fixed-effect term does not require knowledge of which characteristics at each household are unchanged.

β_{1m} is the coefficient on the bill year-month *m*.

β_{2m} is the estimated treatment effect in kWh per day; the main parameter of interest. Estimated separately for each month and year.

An advantage of the LFER model is that the time-invariant characteristics (observed and unobserved) are excluded from the model through the household fixed-effect term. The drawback of the LFER model is that it is less precise because the household-level fixed effect term relies exclusively on within-customer variation. The explanatory powers of time-invariant characteristics are lost because those terms are eliminated from the model. Navigant found the LFER model corroborated the savings found from the LDV model.

The team deployed specific data management methodologies to prepare billing data for the regressions. These methodologies are informed in part by feedback Navigant received from the SWE during previous evaluations. Monthly billing data was calendarized by expanding the billing periods (which follow variable meter read schedules) to daily data and then collapsing into a common calendar basis. Each month of usage data represents an aggregation of the usage data from the bills that contain data for that month. Estimated reads, which are infrequent for Duquesne Light, were handled by summing the consecutive estimated reads with the first actual read that followed and dividing that aggregated use across the number of days since the previous actual read. Finally, participants and non-participants that moved out of Duquesne Light territory during PY10 were included in the regression analysis until move-out occurred and monthly billing data ceased. There is a monotonically decreasing number of participants per month for each cohort.

Navigant calculated participant counts following a standard approach where the last available month of billing data is calculated for each account and the household is assumed to be active for all months prior. This provides a monthly participant count for the program year. A customer is considered a participant for PY10 so long as their account was active for at least 1 month during PY10.

Table 43 summarizes the sampling strategy for the PY10 evaluation. Both regression models use billing data from all treatment and control households that are enrolled in the HER program. The sampling strategy is considered to be a census approach where data from all households are used in the analysis, as shown in Table 43.

Table 43: HER Gross Impact Sample Design for PY10

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
HER	51,987	51,987	Regression analysis
Program Total	**51,987**	**51,987**	

Source: Navigant analysis.

The verified ex post energy savings for HER in PY10 were 6,577 MWh, after accounting for double-counted savings with other Duquesne Light energy efficiency programs. Navigant calculated the demand savings by dividing the total energy savings for the year (in MWh) by 8,760 hours. This yields 0.75 MW. A summary of ex ante HER program energy savings is shown in Table 44. Additional details are also provided in Appendix C.

Table 44: HER Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
HER	8,457	78%	N/A	0.0%
Program Total	**8,457**	**78%**		**0.0%**

Source: Navigant analysis.

Table 45: HER Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
HER	0.97	78%	N/A	0.0%
Program Total	**0.97**	**78%**		**0.0%**

Source: Navigant analysis.

The following factors led to variation between the reported and verified savings and led to the observed realization rates.

- Energy savings per participant home were verified lower than the CSP's reported estimate
    - Double-counted savings analysis was not completed by the CSP
        - Double-counted savings made up 21% of gross verified HER savings, an increase over PY9 double-counted savings.
        - The increase is largely due to the HER marketing effort for energy efficiency kits that began in the last quarter of PY9.
    - Low income rescreening was not completed by the CSP
        - Low income rescreening transferred 3.5% of the 2012 market rate wave and 4.2% of the 2015 market rate wave savings to the low income HER component.

Behavioral Program and Component Absolute Precision

Navigant calculated the absolute precision results for the HER waves. Section 6.1.1.1.1 of the Phase III Evaluation Framework requires the program-level verification for these behavioral programs to achieve an absolute precision of ±0.5% at the 95% confidence level (two-tailed), while individual waves may have a wider margin of error. Regression details, precisions, and error estimates are provided in Appendix C.

Note that errors are not reflected in Table 44. Instead, Table 44 reflects the uncertainty associated with the sampling (i.e., relative precision at the 85% confidence level). Navigant analyzed all HER program data via its census approach and did not use sampling. There is no sampling uncertainty.

3.3.3 Net Impact Evaluation

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

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

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

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

Free ridership and spillover are incorporated into the results of the HER regression analysis based on customer billing records. Non-participant spillover is not included in the regression analysis, but the industry standard approach is to assume that non-participant spillover is small for this type of program. It would be primarily driven by conversations that participants may have with non-participant Duquesne Light customers, which are expected to have a relatively small impact on non-participant energy savings. The conservative approach used by Navigant is to assume that non-participant spillover is 0.00 and that the NTG ratio for the HER program is conservatively assumed to be 1.00. As a result, the net and gross savings estimates are the same for the HER program. There is no NTG sample for the HER program.

The team did not consider a sample for the net impact analysis, and net impacts equal the gross impacts. The NTG ratio is assumed to be 1.00.

High Impact Measure Research

Navigant did not conduct research for HIMs for HER program in PY10.

3.3.4 Verified Savings Estimates

In Table 46 the realization rates and NTG ratios determined by Navigant are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for HER in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 46: HER PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	8,457	0.97
PYVTD Gross	6,577	0.75
PYVTD Net	6,577	0.75
RTD	22,368	2.55
VTD Gross	20,264	2.31
VTD Net	20,264	2.31

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report.

3.3.5 Process Evaluation

Navigant completed participant surveys during PY9 and there are no substantial process evaluation activities to report on for HER in PY10. The team plans to conduct process evaluation activities, including participant surveys, during PY11.

The implementation of HER included a marketing effort for energy efficiency kits that began in the last quarter of PY9. The marketing effort was successful in that HER participants received energy efficiency kits at a higher rate than the control group. These kits were the primary source of increased double counted savings in PY10 compared to PY9.

3.3.6 Cost-Effectiveness Reporting

Table 47 presents a detailed breakdown of program finances and cost-effectiveness. TRC benefits were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 47: Summary of Program Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$0		$0	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$0		$0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**$0**		**$0**	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$9
6	Administration, Management, and Technical Assistance [3]	$2	$12	$46	$56
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$34	$29	$59	$421
9	EDC Evaluation Costs	$20		$40	
10	SWE Audit Costs	$8		$28	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$105		$661	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$105		$661	
14	Total NPV Lifetime Electric Energy Benefits	$255		$753	
15	Total NPV Lifetime Electric Capacity Benefits	$82		$389	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0		$0	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0		$0	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$337	$1,142
19	**TRC Benefit-Cost Ratio [8]**	**3.21**	**1.73**

[1] Includes direct install equipment costs.
[2] Includes direct costs attributable to plan and to advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.
[3] Includes processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 48 presents program financials and cost-effectiveness on a net savings basis.

Table 48: Summary of HER Program Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$0		$0	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$0		$0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**$0**		**$0**	
		EDC	**EDC**	**CSP**	**EDC**
5	Design & Development [2]	$0	$0	$3	$9
6	Administration, Management, and Technical Assistance [3]	$2	$12	$46	$56
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$34	$29	$59	$421
9	EDC Evaluation Costs	$20		$40	
10	SWE Audit Costs	$8		$28	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$105		$661	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$105		$661	
14	Total NPV Lifetime Electric Energy Benefits	$255		$753	
15	Total NPV Lifetime Electric Capacity Benefits	$82		$389	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0		$0	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0	$0
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$337	$1,142
19	**TRC Benefit-Cost Ratio [8]**	**3.21**	**1.73**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.3.7 Status of Recommendations

Navigant limited its process evaluation activities for the HER program in PY10 and has no recommendations at this time.

3.4 Residential Whole House Retrofit Program

The Residential WHRP provides resources to residential customers to obtain a residential home energy audit, direct install measures, and rebates for the range of eligible measures similar to those included in the REEP Rebates program. The program services offered are generally the same for low income customers and for market rate (non-low income) customers. Qualifying low income customers are eligible to receive an onsite audit and the direct installation of select measures at no charge to the customer. Market rate customers can receive the same audit and direct installation of measures for a fee of $435, with the possibility of receiving up to $250 in rebates for installing recommended measures. Low income customers are also eligible to receive other major measures, installed at no cost if appropriate, beyond the simpler direct installation measures. These can include replacement refrigerators, for example. Savings from market rate customers are counted officially as WHRP savings, while savings from low income customers are counted officially as one of the sources of savings for LIEEP (Section 3.5).

Program participants may live in single-family dwellings or multifamily dwellings. Furthermore, WHRP audits can be requested by utility-customers or can be initiated by landlords. Landlord-requested audits tend to be identical to resident-requested audits, except that they are initiated differently. Customers with gas space and water heating receive a walkthrough audit, whereas customers with electric space and water heating are eligible to receive a comprehensive audit. Duquesne Light is also teaming up with the gas utility within its service territory to serve some customers supplied by both organizations. Similar audits are conducted, and costs are shared by both utilities. When audits are requested for multifamily dwellings by a building's landlord, the low income status of each treated apartment is not reported. Instead, the landlord reports the percentage of LI dwellings in the building; this is used to distribute savings between WHRP (non-LI) and LIEEP. During PY10, only one such multifamily building received landlord-requested audits and had fewer than 100% of residents qualifying as low income.

In addition to audit-based participation, many multifamily participants are identified through the utility's Multifamily Housing Retrofit program (MFHR), and the implemented measures are not associated with a residential energy audit. In these situations, common-area efficiency improvements are made to the building through that program, but any measures installed to individually-metered dwellings are referred to WHRP for in-apartment improvements. The MFHR program focuses on buildings serving predominantly low income households, but occasionally less than 100% of the units are in fact low income. Participating building owners/managers are required to report the percentage of units in the building that meet low income eligibility requirements. WHRP therefore may make improvements to a mix of low income and market rate customer apartments referred through the MFHR program, with savings allocated to WHRP and LIEEP based on the percentage of units reported as low income by the building owner/manager. Navigant notes that the MFHR program (Section 3.9) uses a similar approach to estimate the portion of savings that contribute to the Phase III low income carve-out goal.

Individual income status is not recorded for each specific dwelling treated in WHRP after having been referred from MHFR. All efficiency measures implemented in this way are installed at no cost. The only multifamily buildings participating in WHRP during PY10 via the MFHR program with less than 100% low income dwellings received only efficient lighting improvements; these buildings did not receive refrigerators. Only participants verified as low income received replacement refrigerators and no market rate participants received refrigerators. All verified savings associated with refrigerators are assigned to LIEEP and the Phase III low income carve-out goal.

Given the nature of overlapping WHRP activities across the market rate and low income segments, descriptions of program implementation activities, evaluation activities, and verification results and findings are generally combined within this report for the market rate WHRP and the low income WHRP component within LIEEP. Verified savings are then split between the market rate and low income programs using the previously described considerations. The majority of WHRP activities relate to the low income segment. Reported market rate activities only originate from two small streams of participation:

the four market-rate customers that requested and received residential audits and the multifamily buildings referred from MHFR where fewer than 100% of dwelling occupants are low income.

A participant is a rate-paying customer who received any efficiency measures from the program within a given reporting year (e.g., Q1 through Q4 for PY10). As discussed in this section, a customer can participate in different ways: receiving an energy audit requested by either the customer or the customer's landlord and residing in a multifamily dwelling that received treatment through the program. Duquesne Light's tracking data system, PMRS, aggregates WHRP activities and does not track individual audits or multifamily dwelling treatments. Instead, detailed records from the CSP capture individual audit and direct install activities occurring in each of the individual dwelling units. These CSP details, after being vetted against PMRS, served as the primary data source for Navigant's evaluation activities.

3.4.1 Participation and Reported Savings by Customer Segment

Table 49 presents the participant counts, reported energy and demand savings, and incentive payments for WHRP in PY10. These relate to the market rate WHRP activities only.

Table 49: WHRP Participation and Reported Impacts

Parameter	Residential (Non-LI) WHRP
PYTD # Participants	52
PYRTD MWh/yr	16
PYRTD MW/yr	0.00
PY10 Incentives ($1,000)	$0

Source: Navigant analysis.

3.4.2 Gross Impact Evaluation

Navigant conducted gross impact evaluation activities for WHRP in PY10, which included similar activities as those carried out in PY9 plus the addition of onsite verifications for select projects. First, the PY10 evaluation relied on a participant survey to verify that the direct-installed measures were implemented and that audits occurred for the customers that participated in WHRP through audit-requests made by the residents themselves, or on their behalf by their landlord. The survey also gathered information to support process evaluation activities.

Navigant had individual contact information for participants that received audits through WHRP, but limited information was available to identify which dwellings within a building received treatment that were referred through the MFHR program. For such projects, tracking data simply indicated the total quantity of efficiency measures implemented into the entire multifamily building. Navigant therefore assumed an equal distribution of measures across all treated dwellings and performed onsite verification at a sample of treated dwellings. For these onsite visits, the quantity and type of relevant equipment (e.g., LED lamps, LED nightlights, and refrigerators) was capture by field teams.

In addition to surveying and onsite verification activities, Navigant conducted an engineering desk review of activities and savings for each measure that was directly installed through WHRP. The team completed a savings review against the TRM and the CSP's detailed tracking data that described the measures installed for each participant during their audit. WHRP relies on TRM defaults, where available, to estimate reported savings per measure. Although this level of detail is not included in PMRS for all measures (i.e., PMRS may reflect some aggregation), the CSP's tracking data does include algorithms, inputs, and assumptions that are consistent with the TRM. Further, the PMRS-reported energy savings and demand reduction are consistent with the corresponding values shown in the CSP's tracking data. Navigant also relied on the TRM defaults and the count of measures installed, as verified. Finally, the

engineering desk review also vetted the allocations of savings to the market rate WHRP and low income WHRP component within LIEEP.

Table 50 shows the achieved sample size per stratum for the WHRP activities. These sample sizes include both market-rate and LI participants. The two categories were not separately stratified, since their implementation was identical except for participant cost and the availability of the refrigerator recycling measures. Further, there are barriers that prevent the market rate and LI components to be evaluated separately. Specifically, that market-rate participation was very low, and the majority of market rate participants were statistically determined rather than positively identified. The strata shown in Table 50 are consistent with the LI-WHRP stratum in Table 57 that describes the LIEEP gross impact sample design. Navigant notes that the survey verification results are the same across both market rate and low income participants.

Table 50: WHRP Gross Impact Sample Design for PY10

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Resident- and Landlord-requested Audits	675*	40	Participant surveys and engineering desk reviews
WHRP-MF building-level retrofits	223**	4	Interview with organization representative, onsite verification, and engineering desk reviews
WHRP-very large MF retrofit projects	1,321	11	Interview with organization representative, onsite verification, and engineering desk reviews
Program Total	**2,219**	**55**	

* Market-rate WHRP audit-based population is 24, but the verified survey population size is 675 after considering the portion of low income participants that are included in the stratum.

** Market-rate WHRP "MF building-level retrofits" population is 28, but the survey population size is 223 after considering the portion of low income participants that are included in the stratum.

Source: Navigant analysis.

In the WHRP sampling plan, Navigant proposed a target sample size of 60 and 20 respondents, respectively, for the resident- and landlord-requested audit strata. That figure went to 80 once these two groups combined into a single stratum. Navigant was unable to achieve this target for this combined stratum. Many of these participants did not personally enroll themselves in the program, but rather, cooperated after their landlord-initiated participation on their behalf. This indicates that many of these participants did not initiate or actively pursue the program themselves. As a result, Navigant had difficulty reaching these individuals and convincing them to participate in a telephone survey.

For the remaining two strata, which focused on building-level retrofit projects, Navigant was able to exceed the target sample size of 3 and 10 for the "WHRP-MF building-level retrofits" and "WHRP-very large MF retrofit projects" strata, respectively.

Navigant intentionally over-sampled within the sample design to gain additional insights from participants, in support of process evaluation research. While the sample target was not achieved for one stratum, Navigant did achieve a relative precision well below 15% for impacts at the program level.

Table 51 and Table 52 show the gross energy and demand results for WHPR. These tables, which convey market rate results, exclude the results of the last stratum, WHRP-very large MF retrofit projects, because it contributes to low income achievements only. Details on this stratum can be found in Section 3.5.

Table 51: WHRP Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_V or Error Ratio	Relative Precision at 85% C.L.
Resident- and Landlord-requested Audits	6	102%	0.14	3.2%
WHRP-MF building-level retrofits	10	85%	0.25	24.4%
Program Total	**16**	**92%**		**3.7%**

Source: Navigant analysis.

Table 52: WHRP Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	Sample C_V or Error Ratio	Relative Precision at 85% C.L.
Resident- and Landlord-requested Audits	0.001	106%	0.14	3.2%
WHRP-MF building-level retrofits	0.001	86%	0.26	25.0%
Program Total	**0.002**	**93%**		**3.9%**

Source: Navigant analysis.

The following factors led to the variations between the reported and verified savings, which led to the observed realization rates for WHRP.

Navigant surveyed customers who participated in the audit-based implementation of the program and found that direct install measures were implemented as reported in most cases. The team found several instances where participants removed/replaced measures or where counts of measures differed from the reported counts (e.g., for LED lights, nightlights, or smart strip measures).

Realization rates also reflect adjustments after Navigant reviewed deemed measure savings assumptions against the TRM. The biggest driver for the realization rate change related to adjustments to refrigerator replacement savings (details are included in the LIEEP program results, Section 3.5, as this mainly relates to low income participants). Navigant previously noted that only low income participants received refrigerators. However, this specific detail was only determined after surveying was completed. The team opted against post-stratification to segment refrigerator verification influences from market rate participants given the small sample and the relatively small impact on the market rate program and overall portfolio.

Similar results were found during onsite visits for measures that were installed through the WHRP-Multifamily building-level retrofits. All measures installed in this way during PY10 were implemented through retrofit project initiatives at properties managed by three different organizations. Each of these projects had varying standards of documentation, making the attribution of precise savings to a given dwelling very precise for some properties, and less precise for others. Despite this, Navigant was mostly able to confirm the installation of reported measures. The largest driver for the realization rate change related to adjustments to refrigerator replacement savings.

Finally, Navigant reassigned a portion of savings from low income to market rate. Specifically, Navigant positively identified four audit-based participants originally reported as low income but who were also designated as fee-for-service within CSP tracking details. This indicates that the participants are market rate and paid for their audits. Navigant notes that the survey-based verification stratum's installation verification rate applies to both market rate and low income projects. However, the final realization rates

noted in Table 51 and Table 52 (market rate WHRP) differ from Table 58 and Table 59 (LIEEP WHRP). The difference relates to the reallocation of these four participants' savings.

In addition to these four previously mentioned customers that were positively identified, there was also further market rate participation that was identified statistically within a property (rather than positive identification). This occurred in multifamily buildings where the income status of each participant was not individually reported, but the percentage split of the low income versus market rate was provided for the entire building. In this way, the statistical split was applied to the full-building results in order to separate between market rate and low income. Navigant reviewed those building splits reported by Duquesne Light and agreed with them, resulting in no changes.

3.4.3 Net Impact Evaluation

For PY10 and similar to PY9, Navigant did not complete an NTG assessment for the market rate or low income portions of WHRP. Low income participants are assumed to exhibit no free ridership or spillover tendencies and receive an NTG ratio of 1.00. Although a few market-rate participants were positively identified, most were identified statistically at the building level. This revealed that the majority of WHRP activities occurred within the low income market segment. Further, where income status was readily identified, market rate participation levels were not substantial enough to support NTG research.

High Impact Measure Research
Navigant did not conduct research for HIMs for WHRP in PY10.

3.4.4 Verified Savings Estimates

In Table 53, the realization rates and NTG ratios determined by Navigant are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for WHRP in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 53: WHRP PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	16	0.00
PYVTD Gross	15	0.00
PYVTD Net	15	0.00
RTD	134	0.01
VTD Gross	114	0.01
VTD Net	114	0.01

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report

3.4.5 Process Evaluation

Navigant conducted process evaluations for WHRP in PY9 and carried out similar research in PY10. For PY10, Navigant also included research to cover the implementation stream related to multifamily building-wide retrofits. This included interviews with property management from each of the three organizations that participated in this aspect of WHRP during PY10. In terms of process evaluation, these interviews were relatively limited, focusing primarily on resident and management satisfaction. Further detail on the

WHRP process evaluation results and findings are shown in Section 3.5.5, as the participants related to those projects were almost entirely in the low income segment.

3.4.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 54. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 54: Summary of WHRP Program Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$0		$0	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$0		$0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**$0**		**$0**	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$5
6	Administration, Management, and Technical Assistance [3]	$1	$8	$38	$35
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$34	$25	$65	$174
9	EDC Evaluation Costs	$12		$25	
10	SWE Audit Costs	$5		$18	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$85		$363	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$85		$363	
14	Total NPV Lifetime Electric Energy Benefits	$6		$29	
15	Total NPV Lifetime Electric Capacity Benefits	$2		$9	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$1		$16	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0		$4	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$8		$58	
19	**TRC Benefit-Cost Ratio [8]**	**0.09**		**0.16**	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 55 presents program financials and cost-effectiveness on a net savings basis.

Table 55: Summary of WHRP Program Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$0		$0	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$0		$0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**$0**		**$0**	
		EDC	**EDC**	**CSP**	**EDC**
5	Design & Development [2]	$0	$0	$3	$5
6	Administration, Management, and Technical Assistance [3]	$1	$8	$38	$35
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$34	$25	$65	$174
9	EDC Evaluation Costs	$12		$25	
10	SWE Audit Costs	$5		$18	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$85		$363	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$85		$363	
14	Total NPV Lifetime Electric Energy Benefits	$6		$29	
15	Total NPV Lifetime Electric Capacity Benefits	$2		$9	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$1		$16	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0		$4	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$8		$58	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
19	**TRC Benefit-Cost Ratio [8]**	**0.09**	**0.16**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

3.4.7 Status Recommendations

The impact and process evaluation activities in PY10 led to the following findings and recommendations, along with a summary of how Duquesne Light plans to address the recommendation in program delivery. These are applicable to both the market rate and low income components of WHRP.

Finding:
Duquesne Light and the CSP track direct install measure details for each audit completed. However, program activities are not recorded at the audit or participant level within Duquesne Light's tracking database (PMRS) for audit-based measures. Instead, installation activities are combined, by measure type, at the monthly-invoice level. This aggregation of savings makes it challenging for savings to be verified at the participant-level particularly for larger, multifamily projects.

Recommendation:
Duquesne Light should record audit-based WHRP activities within its tracking database (PMRS) at the audit level. These additional details would increase the transparency around program activities and expedite actions related to Act 129 compliance. Audit-level details would also aid more timely quality control and the confirmation of accurate savings recording. Alternatively, Duquesne Light could create a clearer link between audit-level details and PMRS. For example, Duquesne Light could have its CSP record PMRS project IDs within its audit-level detailed databases to create explicit links between the two data sources.

Duquesne Light Status Report:
The multifamily component of this program does not enroll dwelling unit participants, it enrolls multifamily facilities. Most, if not all, WHRP reported impact occurs in connection with multifamily engagements and occurs only when multifamily facility dwelling units are individually metered. Navigant's recommendation to track individual dwelling units in PMRS is outside the scope of this program and such requirements would serve only as an additional barrier to this hard-to-reach market. Duquesne Light will work with Navigant to review data collection and adjust as necessary to effectively support measurement of these programs.

Finding:
Duquesne Light and the CSP track direct install measure details for WHRP building-level retrofits using a variety of documentation methods. For each of the three participating property-management organizations in PY10, measure-level data was reported in a different format and level of detail. Typically, measure-install data was aggregated to the building-level within the CSP tracking data. This aggregation was not consistently matched in PMRS. Rather, project initiatives were often aggregated across buildings for a given month. This lack of consistency obfuscated participation details and required multiple inquiries with various stakeholders to support verification activities.

Recommendation:
Navigant recommends that Duquesne Light and its CSP implement a consistent data tracking system across all project initiatives for WHRP building-level retrofits. At a minimum, this should show for each treated property (e.g., multifamily building): 1) the number of treated dwellings; 2) the quantity and details of measures installed to the property; 3) the income status split for the property. Navigant also notes that a further improvement here would be providing this level of detail specifically for each treated dwelling, along with the address and apartment number of the dwelling. Finally, Navigant also recommends that Duquesne Light and its CSP extend the granular data to PMRS and provide property- or dwelling-level details, rather than aggregating multiple properties together.

Duquesne Light Status Report:
Duquesne Light recognizes the reporting inconsistences and explains that it changed vendors in the middle of PY10 (7 months into PY10). The diversity in the data collection was caused, primarily, by reporting of multiple CSPs implementing the program in PY10. Duquesne Light anticipates that these inconsistencies will normalize under implementation by a single implementer.

Finding:
The CSP's detailed program tracking data that Duquesne Light uses to report savings and that Navigant uses to estimate verified savings excludes participant telephone numbers (while telephone numbers are typically available for most other programs). Participant name, address, and account number are recorded. Participant telephone numbers are retrieved from other databases and reconciled against the tracking data. This relates to resident-requested and some landlord-requested audits and not to larger multifamily building-level retrofits.

Recommendation:
Consistent with a recommendation made by Navigant in PY9, Duquesne Light should have its CSP record telephone numbers within the detailed program tracking data to aid Duquesne Light's own customer feedback research as well as evaluation activities that typically rely on telephone surveys. Duquesne Light might also consider capturing email addresses and recording them in tracking data if such a request to participants is considered reasonable. Navigant notes that reaching customers by telephone has become increasingly difficult with the rise of telemarketing scams. Augmenting phone numbers with email addresses may produce more fruitful outreach and research results.

Duquesne Light Status Report:
Duquesne Light will explore the feasibility of adding phone and email information to detailed tracking data (not the PMRS tracking data) with the new CSP that is ramping up activities during PY11.

Finding:
Navigant found that the EDC Direct Install Refrigerator/Freezer Recycling with Replacement Interim Measure Protocol's (IMP's) algorithm deemed values were not applied nor were the EDC Data Gathered refrigerator specifications for the units recycled through WHRP in PY10. Navigant's verified savings reflect adjustment to account for the IMP's deemed values.

Recommendation:
Navigant recommends that Duquesne Light and its CSP track details for each refrigerator that is recycled and each refrigerator that is installed to replace the recycled refrigerator. Specifically, the details should include those that are used in the IMP's algorithm to estimate energy savings (e.g., date of manufacture, space volume, refrigerator type, etc.). Data tracking systems and procedures currently implemented by Duquesne Light for RARP can be leverage here for WHRP.

Duquesne Light Status Report:
Duquesne Light will update its reported savings assumptions for recycled refrigerators to use the IMP's savings defaults, and historical program data will be used where defaults are not available (e.g., percent of units manufactured before 1990).

3.5 Low-Income Energy Efficiency Program

LIEEP comprises participation by qualified low income customers (households at or below 150% of federal poverty income guidelines) in the following program components, as noted in Duquesne Light's EE&C Plan:

- Whole House Retrofit program (LI WHRP)
- Residential Behavioral Savings program (LI HER)
- Multifamily Housing Retrofits program (MFHR)

These market rate counterpart programs are described in other program-specific sections of this report. The programs are additionally offered to low income customers and referred to as components of the overall LIEEP program.

Participation and reporting of achievements for WHRP occurred for the first time of the phase during PY9 and continued through PY10. For PY10 and similar to PY9, most program activities occurred among low income participants, and those activities and related evaluation findings are described in Section 3.4.

Beyond the previously described components, Duquesne Light provides low income customers with energy efficiency kits at no charge. These low income kit (LI kits) activities are captured and reported under LIEEP and contribute to the low income carve-out goal. These LI kits are equivalent to the kits distributed by Duquesne Light through REEP to market rate participants and are specifically targeted to low income participants through the utility's outreach efforts.

Duquesne Light also engaged low income utility customers through a number of low income-specific community events where it handed out other energy efficiency measures such as kits and LED lamps. For these community events, Duquesne Light tracks events and the measures given away and not the individual participants who receive the measures. Participation counts are not defined for these measures.

For the components LI WHRP, LI HER, and LI kits, verified savings attributable to the low income sector are reflected in LIEEP and in Duquesne Light's progress toward the Phase III low income carve-out goal. While not a part of LIEEP, a portion of savings from the MFHR program also contributes to the low income carve-out goal. Specifically, 92%[18] of that program's savings have been allocated to low income customers, based on the percentage of units in treated buildings in which qualified low income households reside. All PY10 program savings are reflected in the MFHR program section of this report, Section 3.9, and not in the LIEEP section.

LI HER participation is defined as a customer under the low income rate class and receiving HERs during the program year. The current program participation levels include 13,385 customers from the 2015 low income wave and 3,318 customers from the 2018 low income wave (based on PY10 monthly billing data). The 2018 low income wave is being evaluated for the first time in the PY10 HER evaluation. As discussed in Section 3.3, Navigant identified 3.5% of customers in the 2012 market rate wave and 4.2% of customers in the 2015 market rate wave as being reclassified as low income customers. The savings from these customers, though not included in the low income waves, are incorporated into the low income PY10 savings for LIEEP and contribute to the low income carve-out goal.

For the LI WHRP during PY10, participants are counted the same as the market rate WHRP, by counting each individual participant or audit. Additionally, given that WHRP audits also occur in multifamily

[18] Duquesne Light completed 25 MFHR projects were completed during PY10. The 92% reflects a verified savings-weighted average.

buildings where a mix of market rate and low income audits occur, the income status of individual participants cannot always be positively identified. For participants who received measures through landlord-requested audits or building-level retrofits, Navigant used the building-level proportion of low income tenants to split the total count of participants between the market rate and low income programs.

For LI kits, a participant is a customer participating in the program within a given reporting year (e.g., Q1 through Q4 for PY10), represented by a unique participant account number within the tracking system. This is the same as the REEP kits counting method.

Participation is not counted for other low income giveaway activities at community events. Instead, Duquesne Light tracks events and the measures given away and not the individual participants who receive them.

3.5.1 Participation and Reported Savings by Customer Segment

Table 56 presents the participation counts, reported energy and demand savings, and incentive payments for LIEEP in PY10 by customer segment. Given the previously described approach to counting participants, the counts in Table 56 relate to LI HER, LI WHRP, and LI kits only.

Table 56: LIEEP Participation and Reported Impacts

Parameter	Residential LI Kits	Residential LI WHRP	Residential LI HER	Residential LI Total
PYTD # Participants	4,627	2,167	16,703	23,497
PYRTD MWh/yr	2,247	1,740	1,596	5,583
PYRTD MW/yr	0.19	0.19	0.18	0.56
PY10 Incentives ($1,000)	$0	$633	$0	$633

Source: Navigant analysis.

3.5.2 Gross Impact Evaluation

In-depth gross impact evaluations occurred for the LI HER and LI WHRP. Navigant primarily relied on the PY9 gross impact evaluation results for the LI kit component of LIEEP.

Navigant completed LI HER activities in coordination with the HER market rate counterpart and applied the same methodologies as detailed in Section 3.3. Similarly, LI WHRP evaluations occurred in coordination with the market rate WHRP activities, as described in Section 3.4. The majority of audit activities occurred among low income participants, and the split of savings across the market rate and low income segments is primarily related to the previously described multifamily building proportional splits.

Table 57 shows the LIEEP sample design for PY10. LIEEP components are not stratified except for LI WHRP. LI WHRP (and the market rate component, WHRP) was implemented through three efforts during PY10 (as described in Section 3.4): resident-requested audits, landlord-requested audits, and multifamily building-level retrofits. Of the two audit-based implementations, the former is initiated by a Duquesne Light customer, while the latter is initiated by a multifamily landlord of a residential Duquesne Light customer. Although they differ in how they are initiated, the audits themselves typically have otherwise consistent implementation.

In addition to audit-based participation, many multifamily participants are identified through the utility's MFHR, and the implemented measures are not associated with a residential energy audit. In these situations, common-area efficiency improvements are made to the building through that program, but any

measures installed to individually metered dwellings are referred to the WHRP for in-apartment improvements. There were three project initiatives that fell within this channel of implementation during PY10, with one of these projects accounting for the majority of the reported savings. Navigant combined all measures from the smaller two project initiatives into a single stratum and created another separate stratum for the measures implemented through the very large project initiative.

Table 58 and Table 59 show the energy and demand gross impact results for LIEEP, respectively.

Table 57: LIEEP Gross Impact Sample Design for PY10

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
LI Kits	4,700	N/A	Apply PY9 participant survey findings; TRM review
LI HER	16,703	16,703	Regression analysis
LI WHRP - Resident and Landlord initiated audits	675*	40	Participant surveys and engineering desk reviews (low income and market rate combined)
LI WHRP - MF building-level retrofits	223**	4	Onsite verification and engineering desk review (low income and market rate combined)
LI WHRP - Very large MF building-level retrofits	1,321	11	Onsite verification and engineering desk review
Program Total	**23,622**	**16,758**	

*Low income WHRP audit-based population is 651, but the verified survey population size is 675 after considering the portion of market rate participants that are included in the stratum.

**Low income WHRP "MF building-level retrofits" population is 195, but the survey population size is 223 after considering the portion of market rate participants that are included in the stratum.

Source: Navigant analysis.

Navigant initially planned to survey resident-initiated audit participants separately from landlord-initiated audit participants. Due to a lower response rate than expected, the team was not able to achieve its target sample (however, the response rate was ultimately similar to PY9's). Therefore, the LI WHRP - Resident and Landlord initiated audits stratum represents the combination of the original two strata described in a sample planning memo shared with the SWE.[19] Navigant completed surveys with 36 residential-initiated audits and four landlord-initiated audits to inform verification results. Navigant notes that it designed its sample target as an over-sample to gain additional insights from participants to support process evaluation research.

The remaining two WHRP strata relied on onsite verifications to confirm the installation and operation of retrofitted measures. The team initially planned to visit a total of 13 retrofitted apartment dwellings and was able to visit 15. These two strata represent over 70% of WHRP reported savings in PY10.

The verified ex post energy savings for LI HER in PY10 were 1,892 MWh after adjusting for double-counted savings with other Duquesne Light energy efficiency programs. LI HER demand savings are calculated by dividing the energy savings by 8,760 hours. This is consistent with PY8, PY9, and guidance from the Framework. LI HER demand savings were 0.22 MW.

[19] DLC PY10 Sampling Plan WHRP Update 26 July 2019 shared with the SWE on July 26, 2019.

For the remaining LI kits stratum, the verified ex post energy savings reflect adjustments based on a review of savings estimates against TRM algorithms and assumptions and the installation verification determined during PY9 participant surveying.

Table 58: LIEEP Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
LI Kits	2,247	74%	0.40	10.9%
LI HER	1,596	119%	0.00	0.0%
LI WHRP - Resident and Landlord initiated audits	482	76%	0.14	3.2%
LI WHRP - MF building-level retrofits	137	85%	0.25	24.4%
LI WHRP - Very large MF building-level retrofits	1,121	74%	0.01	0.4%
Program Total	**5,583**	**87%**		**3.7%**

Source: Navigant analysis.

Table 59: LIEEP Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
LI Kits	0.19	73%	0.47	12.9%
LI HER	0.18	119%	0.00	0.0%
LI WHRP - Resident and Landlord initiated audits	0.05	77%	0.14	3.2%
LI WHRP - MF building-level retrofits	0.02	86%	0.26	25.0%
LI WHRP - Very large MF building-level retrofits	0.12	75%	0.01	0.7%
Program Total	**0.56**	**89%**		**3.6%**

Source: Navigant analysis.

The following factors led to the variation between the reported and verified savings and led to the observed realization rates.

The energy realization rate for LI HER is 119%. Navigant found that energy savings per participant home were verified at slightly lower than the CSP's reported estimate. Before re-balancing low income individuals from the market rate HER wave (see Section 3.3), the realization rate was 102%. Reallocating a portion of savings (272 MWh) from the market rate HER wave to the low income HER wave increased the realization rate.

The realization rates for LI kits reflects the verification estimates produced during the PY9 evaluation. Navigant found that participants are not installing all eight LEDs or all two LED nightlights provided within the kits. On average, respondents installed or plan to install roughly six of the eight LED lights provided. This reflects the verified installation rate and the driver for the 74% energy and 74% demand realization rates.

The realization rates for the WHRP strata are in alignment within PY9 findings. Similar to PY9 findings, one of the largest drivers of the realization rate involved Navigant's adjustments to the deemed measure

savings assumptions for recycled and replaced refrigerators. Navigant relied on the defaults and algorithms in the EDC Direct Install Refrigerator/Freezer Recycling with Replacement Interim Measure Protocol (IMP).[20] Navigant found that neither the deemed values nor the EDC Data Gathered refrigerator specifications were applied for the PMRS-reported values for the units recycled through WHRP in PY10. To determine gross savings, Navigant used IMP defaults and determined that no recycled units were manufactured before 1990 (0%, Navigant's input to the IMP algorithm where a default value is not available). Duquesne Light's reported savings for this measure assumed that the recycled refrigerator consumed 1,170 kWh/yr per unit. Navigant's recalculation with the aforementioned considerations estimated recycled refrigerator consumption of 975 kWh/yr. Navigant agreed with the replacement ENERGY STAR refrigerator consumption of 393 kWh/yr, an IMP default value. The realization rate for this measure is 75% and these measures represent 77% of WHRP reported savings.

Navigant surveyed customers that participated in the audit-based implementation of WHRP (LI WHRP - Resident and Landlord initiated audits stratum) and found that direct install measures were implemented as reported in most cases. The team found several instances where participants removed/replaced measures or where counts of measures differed from the reported counts (e.g., for LED lights, nightlights, or smart strip measures).

Behavioral Program and Component Absolute Precision

Navigant calculated the absolute precision results for the LI HER wave. Section 6.1.1.1.1 of the Phase III Evaluation Framework requires the program-level verification for these behavioral programs to achieve an absolute precision of ±0.5% at the 95% confidence level (two-tailed), while individual waves may have a wider margin of error. Regression details, precisions, and error estimates are provided in Appendix C.

Errors are not reflected in Table 58. Instead, Table 58 reflects the uncertainty associated with the sampling (i.e., relative precision at the 85% confidence level). Navigant analyzed all HER program data via its census approach and did not use sampling. There is no sampling uncertainty to report.

3.5.3 Net Impact Evaluation

NTG ratios are assumed to equal 1.00 for LIEEP. Navigant assumes that no free ridership or spillover activity occurred among the low income participants of LIEEP in PY10. This assumption is consistent with SWE guidance. LI HER gross impacts equal net impacts given the nature of the RCT approach (see Section 3.3).

High Impact Measure Research

Navigant did not conduct research for HIMs for LIEEP program in PY10.

3.5.4 Verified Savings Estimates

In Table 60, the realization rates and NTG ratios determined by Navigant are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for LIEEP in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

[20] Interim Measure Protocols from PA PUC Evaluation Common Site. https://nmrgroupinc.sharepoint.com

Table 60: LIEEP PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	5,583	0.56
PYVTD Gross	4,864	0.50
PYVTD Net	4,864	0.50
RTD	11,148	1.10
VTD Gross	9,977	1.03
VTD Net	9,883	1.01

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report.

3.5.5 Process Evaluation

Navigant conducted process evaluation research for LI WHRP during PY10. Process evaluations for LI HER and LI Kits were completed during PY9. For LI WHRP, Navigant surveyed customers who received audit-based measures, and interviewed site contacts for multifamily projects that received multifamily building-wide retrofits. The same participants included in the impact evaluation samples also informed these process evaluation samples, and there are no other samples or strata to describe. Process evaluation activities occurred in tandem with the market rate counterpart program. Details on activities and findings can be found in the related program-specific sections of this report, and further information is provided in the PY10 Residential Program Evaluation Report.

Satisfaction with WHRP, and the associated experiences with the different processes of the program, was high in PY10 for the surveyed participants in the LI WHRP - Resident and Landlord initiated audits stratum. Those participants gave an average score for "overall experience" with WHRP, on a scale from 0 to 10 of 9.2. The property managers interviewed and associated with the remaining LI WHRP strata gave satisfaction scores of 10 for most aspects. The one exception was one property manager of the LI WHRP - very large multifamily building-level retrofits stratum (representing the majority of program savings). One individual responded with a score of 8 when asked "How satisfied have residents been with the equipment they received?" The project manager shared that some residents complained to him that the new refrigerators were too small.

3.5.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 61. TRC benefits in Table 61 were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 61: Summary of Program Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$633		$554	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$0		$0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$633		$554	
		EDC	**CSP**	**EDC**	**CSP**

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
5	Design & Development [2]	$0	$0	$6	$27
6	Administration, Management, and Technical Assistance [3]	$6	$37	$94	$176
7	Marketing [4]	$0	$0	$6	$0
8	Program Delivery [5]	$34	$698	$65	$1,665
9	EDC Evaluation Costs		$62		$125
10	SWE Audit Costs		$26		$92
11	**Program Overhead Costs (Sum of rows 5 through 10)**		$863		$2,256
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs		**$0**		**$0**
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**		$1,496		$2,810
14	Total NPV Lifetime Electric Energy Benefits		$823		$1,601
15	Total NPV Lifetime Electric Capacity Benefits		$217		$431
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits		$53		$121
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)		-$50		-$31
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**		$1,043		$2,122
19	**TRC Benefit-Cost Ratio [8]**		**0.70**		**0.76**

[1] Includes direct install equipment costs and costs for EE&C kits.

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 62 presents program financials and cost-effectiveness on a net savings basis.

Table 62: Summary of LIEEP Program Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
1	EDC Incentives to Participants [1]	$633	$554
2	EDC Incentives to Trade Allies	$0	$0
3	Participant Costs (net of incentives/rebates paid by utilities)	$0	$0
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$633	$554

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
		EDC	CSP	EDC	CSP
5	Design & Development [2]	$0	$0	$6	$27
6	Administration, Management, and Technical Assistance [3]	$6	$37	$94	$176
7	Marketing [4]	$0	$0	$6	$0
8	Program Delivery [5]	$34	$698	$65	$1,665
9	EDC Evaluation Costs	$62		$125	
10	SWE Audit Costs	$26		$92	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$863		$2,256	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$1,496		$2,810	
14	Total NPV Lifetime Electric Energy Benefits	$823		$1,598	
15	Total NPV Lifetime Electric Capacity Benefits	$217		$429	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$53		$121	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$50		-$31	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$1,043		$2,117	
19	**TRC Benefit-Cost Ratio [8]**	**0.70**		**0.75**	

[1] Includes direct install equipment costs and costs for EE&C kits.

[2] Includes direct costs attributable to plan and advance the programs. Note: The design of the HERs program should be included here, while the actual development and mailing of HERs would be attributable to Program Delivery.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs. For behavioral programs, this includes the printing and postage of HERs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.5.7 Status of Recommendations

Navigant's process evaluation activities for LIEEP during PY10 occurred in tandem with each component's market rate counterpart. Findings and recommendations are included in those previous program sections for the given market rate component. The PY10 impact and process evaluation activities also led to the following finding and recommendation, along with a summary of how Duquesne Light plans to address the recommendation in program delivery.

Finding:
Duquesne Light's Phase III LIEEP achievements and low income carve-out achievements rely substantially on lighting measures. For PY10 specifically, these lighting measures originate from the LI Kits and LI WHRP activities. Non-lighting savings primarily originate from LI HER and the LI WHRP refrigerator recycling and replacement activities. While Duquesne Light is currently on track to meet Phase III goals, opportunities for lighting will be limited in PY12.

Recommendation:
Duquesne Light should continue expanding the activities related to current non-lighting savings activities and explore new non-lighting measure opportunities among low income customers. For example, Duquesne Light may consider expanding insulation and HVAC improvement opportunities among LI WHRP activities. Exploring these avenues during PY11 can help Duquesne Light refine implementation approaches before PY12.

Duquesne Light Status Report:
Duquesne Light changed CSPs for LI WHRP in the middle of PY10 (7 months into PY10). The new CSP's contract was only approved in December of 2018, and the vendor is currently getting up to speed for low income activities. Duquesne Light continually searches for additional activities related to low income savings and will do so with this new CSP.

3.6 Commercial Efficiency/Express Efficiency Programs

As noted in Duquesne Light's Phase III EE&C Plan filing,[21] "the Express Efficiency, Commercial Efficiency, and Industrial Efficiency Programs provide common incentives for a full range of common measures to assist C&I customers of all sizes and in all key market segments to overcome barriers to adopt energy efficiency measures. These programs put in place a baseline program design, with set incentive levels and measure content. The design provides an overarching programmatic structure with calculated incentives for customized projects or itemized incentives for standard measures."

While all three programs share these characteristics, as a group they represent a significant percentage of projected portfolio savings. Only two (Express Efficiency and Commercial Efficiency) have been grouped together for evaluation purposes, the Industrial Efficiency program is evaluated separately.

The Express Efficiency Program (EXP) provides rebates to offset the higher cost of high efficiency equipment when compared to standard efficiency equipment. Program incentives promote customer indifference to the higher cost of high efficiency equipment and increase customer adoption of high efficiency equipment. The EXP targets all Duquesne Light C&I customers with maximum demand less than 300 kW, that are not already participating in other Act 129 programs. The EXP is delivered by a core team of DLC staff.

Similar to the EXP, the Commercial Efficiency Program (CEP) provides rebates to offset the higher cost of high efficiency equipment when compared to standard efficiency equipment. Program incentives promote customer indifference to the higher cost of high efficiency equipment and increase customer adoption of high efficiency equipment. The CEP also includes energy audits which provide business customers a reliable source of information about their energy use and ways to save energy, reduce operating costs, lower carbon emissions, and improve air quality. The CEP targets all Duquesne Light commercial customers with maximum monthly demand equal to or greater than 300 kW. The CEP is delivered by Franklin Energy, the program's CSP. Key support by Franklin Energy includes outreach and assistance to trade allies that sell and install qualifying products, use of energy surveys to assist customers in identifying opportunities, and application qualification and processing of payment.

A participant is a customer participating in the given program within a given reporting year (e.g., Q1 through Q4 for PY10), represented by a unique participant account number within the tracking system. Customers participating in a program more than once within a reporting year (i.e., PYRTD) are counted once; customers participating more than once but in different years or programs are counted more than once (once in each year and/or program).

3.6.1 Participation and Reported Savings by Customer Segment

Table 63 presents the participation counts, reported energy and demand savings, and incentive payments for the two programs in PY10, by customer segment/program.

[21] Duquesne Light Company – Revised Phase III Energy Efficiency and Conservation Plan

Table 63: CEP/EXP Participation and Reported Impacts

Parameter	Small C&I (Non-GNI)	Large C&I (Non-GNI)	Total
PYTD # Participants	308	77	385
PYRTD MWh/yr	9,110	17,349	26,460
PYRTD MW/yr	1.41	2.21	3.62
PY10 Incentives ($1,000)	$812	$1,045	$1,857

Source: Navigant analysis.

3.6.2 Gross Impact Evaluation

For the PY10 evaluation and as described in the Evaluation Plan for PY10, Navigant relied on projects previously sampled and verified from PY9 and combined those with additional sampled projects from PY10. Navigant used this rolling 2-year verification approach to estimate the realization rate for PY10. Navigant will use a similar method for PY11 where a combination of these PY10 projects will be combined with PY11 project to create a new realization rate for PY11 activities.

Table 64 provides the resulting population and sampling sizes. Table 65 and Table 66 show the gross energy and demand results for IEP, respectively.

Table 64: CEP/EXP Gross Impact Sample Design

Stratum	Population Size	Achieved Sample Size (PY9/PY10 Combined)	Evaluation Activity
Commercial - Large	7	6	Verification Only Visit, Verification and Trending Visit
Express - Large	0	0	Verification Only Visit, Verification and Trending Visit
Commercial - Medium	39	8	Verification Only Visit, Verification and Trending Visit
Express - Medium	12	7	Verification Only Visit, Verification and Trending Visit
Commercial - Small	62	4	Verification Only Visit, Phone Verification
Express - Small	319	13	Verification Only Visit, Phone Verification
Standard LED (cross-sector Upstream Lighting)*	N/A	N/A	Apply PY9 cross-sector sales rate; census review of PMRS and detailed CSP records
Specialty LED (cross-sector Upstream Lighting)*	N/A	N/A	Apply PY9 cross-sector sales rate; census review of PMRS and detailed CSP records
Total	**439**	**38**	

*Cross sector sales from the REEP Upstream Lighting program to commercial customers are included in the CEP/EXP program group. The methodology and results are detailed in Appendix A.

Source: Navigant analysis.

Table 65: CEP/EXP Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	PYVTD MWh/yr	Sample C_v or Error Ratio	Relative Precision at 90% C.L.*
Commercial - Large	6,652	79%	5,231	0.26	21.2%
Express - Large	0	N/A	0	N/A	N/A
Commercial - Medium	8,428	109%	9,217	0.11	7.6%
Express - Medium	2,097	106%	2,222	0.16	11.9%
Commercial - Small	2,269	100%	2,270	0.00	0.1%
Express - Small	7,013	170%	11,896	0.51	25.3%
Standard LED (cross-sector Upstream Lighting)**	0	N/A	1,283	13.26	200.7%
Specialty LED (cross-sector Upstream Lighting)**	0	N/A	787	7.38	184.8%
Program Total	**26,460**	**124%****	**32,906**		**13.1%**

*Commercial Efficiency/Express Efficiency was sampled targeting 90/15 for PY10.

**Cross sector sales from the REEP Upstream Lighting program to commercial customers are included in the CEP/EXP program group. The methodology and results are detailed in Appendix A. These savings which are included in verified but not reported values contribute to higher realization rates.

Source: Navigant analysis.

Table 66: CEP/EXP Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	PYVTD MW/yr	Sample C_v or Error Ratio	Relative Precision at 90% C.L.*
Commercial - Large	0.78	87%	0.68	0.26	21.4%
Express - Large	0	N/A	0	N/A	N/A
Commercial - Medium	1.07	108%	1.16	0.17	11.1%
Express - Medium	0.22	106%	0.23	0.33	23.9%
Commercial - Small	0.35	100%	0.35	0.00	0.0%
Express - Small	1.19	166%	1.98	0.48	23.5%
Standard LED (cross-sector Upstream Lighting)**	0.00	N/A	0.16	13.26	200.7%
Specialty LED (cross-sector Upstream Lighting)**	0.00	N/A	0.17	7.38	184.8%
Program Total	**3.62**	**131%****	**4.73**		**13.9%**

*Commercial Efficiency/Express Efficiency was sampled targeting 90/15 for PY10.

**Cross sector sales from the REEP Upstream Lighting program to commercial customers are included in the CEP/EXP program group. The methodology and results are detailed in Appendix A. These savings which are included in verified but not reported values contribute to higher realization rate.

Source: Navigant analysis.

The factors affecting the CEP and EXP realization rates for PY10 are:

- Eighteen projects had verified HOU that differed from the values used in the ex ante calculations. This primarily affected sites where the implementer used deemed HOU from the 2016 TRM.
- Four projects had controls on the lights that were either not accounted for in the ex ante calculations or mis-labeled in the ex ante calculations.
- Three sites had fewer fixtures installed than indicated in the project files, reducing savings.
- One site had electric heating but had been listed as unknown. Changing the Interactive Factor (IF) reduced the energy savings.
- One site had reduced energy and demand savings based on trended supply and return fan data.
- One site had measures that did not qualify for energy savings based on an Interim Measure Protocol's (IMP's) requirements. Navigant applied those requirements resulting in a baseline change and a 0% realization rate for those measures.

3.6.3 Net Impact Evaluation

Navigant did not conduct NTG evaluation for CEP and EXP in PY10. Per Navigant's Evaluation Plan, the team relied on PY9 results for the estimates of participant free ridership and spillover. Navigant plans to conduct NTG research in PY11 to update these estimates.

Navigant applied the NTG factor for CEP and EXP using the results from the PY9 telephone survey of program participants. Navigant attempted a census of all program decision makers in PY9, achieving 24 survey completes, where each decision maker was asked about one project and up to three measures. Similar to PY9, the team used a single, combined NTG ratio of 0.60 for CEP and EXP and applied it to all strata as shown in Table 67.

Table 67: CEP/EXP Net Impact Evaluation Results

Target Group	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Relative Precision (at 85% CI)
CEP/EXP	0.40	0.00	0.60	4.4%

Source: Navigant analysis.

High Impact Measure Research
Navigant did not conduct research for HIMs for CEP or EXP in PY10.

3.6.4 Verified Savings Estimates

In Table 68, Navigant applied the realization rates and NTG ratios to the reported energy and demand savings estimates to calculate the verified savings estimates for CEP and EXP in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 68: EXP/CEP PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	26,460	3.62
PYVTD Gross	32,906	4.73
PYVTD Net	19,329	2.77
RTD	52,813	7.06
VTD Gross	62,562	8.76
VTD Net	36,156	5.07

Source: Navigant analysis.

The VTD savings contribution from prior years has changed since the PY9 final annual report. Changes relate to standard LED and specialty LED savings that are associated with cross-sector sales from upstream lighting. Section 3.1.4 of this report contains details on those changes.

3.6.5 Process Evaluation

Navigant did not conduct a process evaluation for CEP and EXP in PY10. Per Navigant's Evaluation Plan, Navigant completed in-depth process evaluation research in PY9 and the team relied on PY9 results for the estimates of participant free ridership and spillover this year. Navigant plans to conduct NTG and process evaluation research in PY11 to update NTG estimates, determine customer satisfaction rates, and develop recommendations for program improvements.

3.6.6 Cost-Effectiveness Reporting

Table 69 through Table 72 present a detailed breakdown of program finances and cost-effectiveness. Express Efficiency and Commercial Efficiency results are shown separately. TRC benefits in Table 69 and Table 71 were calculated using gross verified impacts for Express Efficiency and Commercial Efficiency, respectively. Table 70 and Table 72 present program financials and cost-effectiveness on a net savings basis for both programs. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 69: Summary of Express Efficiency Program Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$812		$1,476	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$823		$756	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$1,636		$2,232	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$36
6	Administration, Management, and Technical Assistance [3]	$9	$54	$140	$262
7	Marketing [4]	$2	$0	$1	$0
8	Program Delivery [5]	$33	$717	$435	$1,385
9	EDC Evaluation Costs	$91		$198	
10	SWE Audit Costs	$36		$129	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$941		$2,590	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$2,577		$4,823	
14	Total NPV Lifetime Electric Energy Benefits	$7,631		$13,778	
15	Total NPV Lifetime Electric Capacity Benefits	$2,886		$5,272	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$496		$1,105	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$607		-$1,330	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$10,407		$18,824	
19	**TRC Benefit-Cost Ratio [8]**	**4.04**		**3.90**	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 70: Summary of Express Efficiency Program Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$812		$1,477	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$130		-$206	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$943		$1,270	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$36
6	Administration, Management, and Technical Assistance [3]	$9	$54	$140	$262
7	Marketing [4]	$2	$0	$1	$0
8	Program Delivery [5]	$33	$717	$435	$1,385
9	EDC Evaluation Costs	$91		$198	
10	SWE Audit Costs	$36		$129	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$941		$2,590	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$1,884		$3,860	
14	Total NPV Lifetime Electric Energy Benefits	$4,399		$7,792	
15	Total NPV Lifetime Electric Capacity Benefits	$1,664		$2,980	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$286		$623	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$350		-$750	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$5,999		$10,645	
19	**TRC Benefit-Cost Ratio [8]**	**3.18**		**2.76**	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 71: Summary of Commercial Efficiency Program Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$1,045		$1,517	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$3,490		$3,572	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$4,535		$5,089	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$41
6	Administration, Management, and Technical Assistance [3]	$9	$56	$125	$265
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$31	$920	$55	$1,591
9	EDC Evaluation Costs	$94		$190	
10	SWE Audit Costs	$38		$135	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$1,148		$2,405	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$5,683		$7,495	
14	Total NPV Lifetime Electric Energy Benefits	$8,332		$12,610	
15	Total NPV Lifetime Electric Capacity Benefits	$2,676		$3,772	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$920		$1,362	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$476		-$810	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$11,452		$16,935	
19	**TRC Benefit-Cost Ratio [8]**	**2.02**		**2.26**	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 72: Summary of Commercial Efficiency Program Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$1,045		$1,517	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$1,667		$1,493	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$2,712		$3,010	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$41
6	Administration, Management, and Technical Assistance [3]	$9	$56	$125	$265
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$31	$920	$55	$1,591
9	EDC Evaluation Costs	$94		$190	
10	SWE Audit Costs	$38		$135	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$1,148		$2,405	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$3,860		$5,416	
14	Total NPV Lifetime Electric Energy Benefits	$4,983		$7,478	
15	Total NPV Lifetime Electric Capacity Benefits	$1,601		$2,244	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$550		$814	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$285		-$484	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$6,849		$10,052	
19	**TRC Benefit-Cost Ratio [8]**	**1.77**		**1.86**	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.6.7 Status of Recommendations

The impact and limited process evaluation activities in PY10 led to the following finding and recommendation, along with a summary of how Duquesne Light plans to address the recommendation in program delivery.

Finding:
Navigant found inconsistent sourcing for hours of use (HOU), particularly for smaller projects and lighting. Over the PY9/PY10 sample, a total of 17 sites had HOU discrepancies. Additionally, Navigant and its field team found three projects with different HOU from those used in the ex ante calculations, changing the realization rates. However, for these three projects, there were documented HOU in the project files that, if used, would have resulted in minimal difference between ex ante and ex post savings.

Recommendation:
Duquesne should clearly indicate to the CSPs the methodology for determining HOU, and apply that methodology consistently (utilizing customer-reported HOU any time they are more than 10 percent different than the TRM deemed values). Navigant developed this recommendation based on findings from the Commercial Efficiency Program but notes that it is applicable to most of Duquesne Light's C&I programs.

Duquesne Light Status Report:
Duquesne Light will communicate this to its CSPs.

3.7 Small/Medium and Large Non-Residential Midstream Lighting Program

The Duquesne Light Non-Residential Midstream Lighting program was designed to remove barriers by providing point of sale incentives to commercial customers. Common barriers in traditional programs include lengthy application processes and rebate delays. However, this non-residential program offers instant rebates at point of purchase to eligible customers who purchase program LEDs from participating DLC distributor partners. DLC electric commercial-rate customers and contractors are eligible to participate with the exclusion of new construction projects. CLEAResult is the CSP responsible for establishing program guidelines, monitoring program operations, and managing distributor participation.

A participant in this program is the account number associated with one or more qualifying purchases within the program year (e.g., Q1 through Q4 for PY10).

3.7.1 Participation and Reported Savings by Customer Segment

Table 73 presents the participation counts, reported energy and demand savings, and incentive payments for the Midstream Lighting program in PY10 by customer segment.

Table 73: Midstream Lighting Participation and Reported Impacts

Parameter	Small C&I (Non-GNI)	Large C&I (Non-GNI)	Total
PYTD # Participants	164	95	259
PYRTD MWh/yr	1,665	2,303	3,968
PYRTD MW/yr	0.27	0.41	0.68
PY10 Incentives ($1,000)	$97	$129	$226

Source: Navigant analysis.

3.7.2 Gross Impact Evaluation

Because of program changes beginning in October 2018 which are expected to impact the realization rates, the evaluation team applied the realization rate calculated in PY8 and PY9 to the first 4 months of PY10 (June 1 – September 30). The team will then evaluate the next 20 months (through the end of PY11) in a manner consistent with other programs by targeting 85/15 confidence/precision over the 20-month period. In the interim, while those evaluation activities occur, the latter 8 months of PY10 are conveyed as unverified savings in this report.

Several projects (n=12) were implemented before the program changes in October and, using the original program rules, were not reported until the third and fourth quarters of PY10. These projects are included as verified savings for the purposes of this report.

Navigant divided the Large and Small programs into two strata each for the purposes of sampling and defined a project as a unique customer name/invoice and upload-date combination, as this grouped the purchases by both location and time. This created four strata where savings are verified. The team also created five additional strata to capture the unverified projects. For these strata, only reported savings are conveyed and verified savings are zero for this final annual report. Table 74 provides the resulting population and sampling sizes.

Table 74 and Table 75 show the gross energy and demand results for Midstream Lighting.

Table 74: Midstream Lighting Gross Impact Sample Design for PY9/PY10

Stratum	Population Size[22]	Achieved Sample Size	Evaluation Activity
SNUP - Small	65	N/A	Apply PY9 verification findings
SNUP - Large	10	N/A	Apply PY9 verification findings
LNUP - Small	83	N/A	Apply PY9 verification findings
LNUP - Large	15	N/A	Apply PY9 verification findings
SNUP – Small unverified	140	N/A	N/A
SNUP – Large unverified	28	N/A	N/A
LNUP – Small unverified	84	N/A	N/A
LNUP – Large unverified	30	N/A	N/A
LNUP – Certainty unverified	1	N/A	N/A
Total	**456**	**0**	

Source: Navigant analysis.

Table 75: Midstream Lighting Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
SNUP - Small	141	115%	0.36	19.4%
SNUP - Large	474	161%	0.42	18.0%
LNUP - Small	189	330%	1.01	47.4%
LNUP - Large	493	152%	0.55	27.2%
SNUP – Small unverified	438	0%	N/A	N/A
SNUP – Large unverified	612	0%	N/A	N/A
LNUP – Small unverified	243	0%	N/A	N/A
LNUP – Large unverified	899	0%	N/A	N/A
LNUP – Certainty unverified	479	0%	N/A	N/A
Program Total	**3,968**	**58%**		**16.8%**

Source: Navigant analysis.

Navigant's verified results and associated precisions for the strata conveying verified impacts reflect results previously developed and reported in the PY9 final annual report. The unverified strata convey a realization rate of 0%. These will be updated with verification results for the PY11 final annual report. The unverified savings are included in the program total realization rate denominator and no corresponding verified savings are included in the numerator. As a result, the program total realization rate appears lower than what historical program performance suggests.

[22] Participant counts when sampling reflect the total number of projects rather than the total number of participants.

Table 76: Midstream Lighting Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
SNUP - Small	0.02	94%	0.50	26.5%
SNUP - Large	0.06	143%	0.48	20.5%
LNUP - Small	0.04	301%	0.69	32.5%
LNUP - Large	0.09	167%	0.61	30.5%
SNUP – Small unverified	0.08	0%	N/A	N/A
SNUP – Large unverified	0.11	0%	N/A	N/A
LNUP – Small unverified	0.04	0%	N/A	N/A
LNUP – Large unverified	0.15	0%	N/A	N/A
LNUP – Certainty unverified	0.09	0%	N/A	N/A
Program Total	**0.68**	**55%**		**16.5%**

Source: Navigant analysis.

The following factors led to variation between the reported and verified savings and led to the observed realization rates. These factors were reported in PY9, but also apply to the PY10 verified projects.

- **In Service Rate (ISR):** CLEAResult, the CSP for this program, assumed an ISR of 85% for each site. Most sites had an actual ISR of 100%, though several (n=6) had a lower ISR.
- **HOU:** As a new element of the evaluation year, Navigant updated HOU based on customer-reported HOU for all sites where schedules could be confirmed, rather than only those sites with a savings >20 kW. This impacted more than half of the midstream sites (n=23) and led to most of the overall increase in realization rate for this program. Navigant found that many customers (n=8) are prioritizing areas with 24/7 usage for bulb replacement, which increases the energy savings from these installations by as much as 400% for some sites.
- **Building Type:** Navigant adjusted the building type for several of the sites (n=5) where there were no set schedules and normal HOU verification was not possible (e.g., hotel guest rooms). This changed the HOU and coincidence factors for these sites leading to an increase in savings for all five sites.

3.7.3 Net Impact Evaluation

In PY10, the evaluation team assessed free ridership using a customer self-report approach following the SWE Framework guidance.[23] This approach used a survey designed to assess the likelihood that participants would have installed some or all the energy efficiency measures incented by the program, even if the program had not existed. Based on the SWE methodology, the free ridership analysis included the following two elements of free ridership: intention to carry out the energy-efficient project without program funds and influence of the program in the decision to carry out the energy-efficient improvements. The evaluation team also asked program participants questions to quantitatively assess spillover in accordance with the SWE's guidance memorandum on this activity.[24]

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

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

The NTG was then calculated based on the generic formulation illustrated in Equation 3:

Equation 3: Total Net to Gross Ratio

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

Navigant attempted to survey a census of 270 unique decision makers across the program. In some case a unique decision maker was responsible for multiple projects and multiple accounts. Each unique decision maker was asked about one project and up to three measures. The sample design and achieved sample size are shown in Table 77.

Table 77: Midstream Lighting Net Impact Sample Design

Stratum	Unique Decision Makers (Population)	Approach	Targeted Sample Completes	Achieved Sample Completes	Response Rate
LED A-Line (HIM) – Large Projects (>45 MWh in energy savings)	17	Phone, Census	6	2	11.8%
LED A-Line (HIM) – Small Projects (<45 MWh)	190	Phone, Census	17	20	10.5%
Other LEDs – All Other Projects	63	Phone, Census	8	6	9.5%
Total	**270**		**31**	**28**	**10.4%**

Source: Navigant analysis.

The resulting NTG ratio is applied to the total gross savings for the Midstream Lighting programs. A summary of the NTG results is included below in Table 78.

Table 78: Midstream Lighting Net Impact Evaluation Results

Target Group	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Relative Precision (at 85% CL)
A-Line LEDs	26%	0%	74%	31.9%
Other LEDs – All Other Projects	33%	0%	67%	41.9%
Total	**28%**	**0%**	**72%**	**24.7%**

Source: Navigant analysis.

High Impact Measure Research

Navigant reviewed the PY10 C&I and Midstream Lighting program activities and identified A-Line LED lamps as the measure that provides a large majority of energy savings in the C&I sector. Since an attempted census was completed for the surveys, Navigant focused survey questions on this measure with respondents who installed the measure to obtain statistically significant data relative to this HIM.

In total, 19 participants responded to the battery of free ridership questions specific to the A-Line LED lamps. The NTG results for these respondents are shown in Table 79.

Table 79: PY10 NTG Results – A-Line LED Lamps

Respondents	Number of Respondents	FR	NTG
A-Line LEDs	19	26%	74%

Source: Navigant analysis.

3.7.4 Verified Savings Estimates

In Table 80, Navigant applied the realization rates and NTG ratios to the reported energy and demand savings estimates to calculate the verified savings estimates for Midstream Lighting in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts. Table 80 excludes the unverified PY10 savings from the PYVTD and VTD categories (while the corresponding reported savings are included in the PYRTD and RTD categories). Those unverified savings are 2,671 MWh and 0.47 MW, and Navigant plans to evaluate and record those as Duquesne Light verified achievements during PY11.

Table 80: Midstream Lighting PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	3,968	0.68
PYVTD Gross	2,300	0.37
PYVTD Net	1,646	0.27
RTD	8,384	1.44
VTD Gross	9,603	1.64
VTD Net	8,108	1.38

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report.

3.7.5 Process Evaluation

In PY10, Navigant conducted two research activities for the process evaluation of the Midstream Lighting Program. Navigant's first effort included a survey of a census of PY10 Midstream Lighting program participants, and the second included a survey involving a census of participating and nonparticipating lighting distributors. The following sections summarize the objectives and results of each survey. For additional details on the research methodology and findings of this research, reference the separate PY10 C&I Program Evaluation Report.

Participant Survey
Navigant conducted process evaluation and NTG survey for an attempted census of 270 PY10 participants in the C&I Midstream Lighting program. The objective of this survey was to obtain feedback from participating customers about their experience and satisfaction with the program, gauge the influence of incentives on their decisions, collect inputs to estimate the NTG ratios and identify areas of success and challenges. The team achieved 28 completed surveys via phone interviews. Table 77 summarizes the sample design and achieved survey completes of this research.

Distributor Interviews
Navigant conducted interviews with Midstream Lighting active distributors and nonparticipating, inactive distributors as part of the PY10 process evaluation. Qualified active distributors included representatives from the distributor organizations that participated in the Midstream Lighting program in PY10. Qualified inactive distributors included representatives from the distributor organizations that previously enrolled in the program, but who are not currently active or distributors who have never enrolled in the program.

These interviews aimed to obtain feedback from distributors about their experience and satisfaction with this program, program delivery processes, participation levels, barriers to participation, customer satisfaction, and opportunities for program improvement.

Duquesne Light provided a list of 21 active and 11 nonparticipating, inactive distributors with phone and/or email contact information for representatives within each organization. The team completed 14 interviews with representatives by contacting the distributers via phone and/or email, depending on available contact information for each representative. Table 81 summarizes the distributor population and the total targeted and completed interviews.

Table 81: C&I Midstream Lighting Distributor Interview Sample Targets and Completes

Distributor Survey	Population	Survey Approach	Targeted Sample Completes	Achieved Sample Completes	Response Rates
Active Distributors	21	Phone, Census	11	10	45%
Nonparticipating Distributors	11		4	4	36%
Total	**32**		**15**	**14**	**44%**

Source: Navigant analysis.

Survey Findings

The research behind the Midstream Lighting participant and distributer surveys aimed to understand program delivery and influence, satisfaction, program barriers and benefits, program marketing, and assess areas for improvement. The process evaluation findings and details can be found in the PY10 C&I Program Evaluation report that accompanies this report. Highlights of the process evaluation for participant survey are summarized here:

- **Net-to-Gross Ratio:** The NTG ratio was determined to be 72% based on 28 responses from participants; for HIMs specifically, the NTG ratio was calculated as 74% based on 19 responses. This is lower than the NTG value estimated in PY8 (88% based on 25 responses).

- **Satisfaction:** Active distributors rated the program as 7.8 out of 10, with 10 being "very satisfied." The highest ratings were for the program staffs' responsiveness (9.3), training materials and communications about how to participate (8.8), and the website for confirming customer's eligibility (8.8). The lowest satisfaction ratings were for the time required to receive rebates for sold LED bulbs (5.1), the products eligible for incentives (6.7), and the rebate check tracking system (7.2).

- **Program influence:** All distributors who saw an increase in LED product sales attribute this increase to their participation in the Midstream Lighting program. When asked to rate the strength of the program's influence on the observed increase in their sales on a scale of 1 to 5, with 5 being the strongest, the distributors rated it on average with a 4.6 for all types of program-eligible LED bulbs sold.

- **Program influence:** When asked if distributors changed the types of LED products they recommend to customers since they began participating in the program, more than half of the distributors reported they changed their recommendations to LED products that are eligible for incentives provided by the program.

- **Suggested areas for improvement:** The highest priority program improvements that the active and inactive distributors recommended were offering more LED product categories/options, faster processing of rebate checks, reducing minimum cost to participate to customers, and

simplification of the application and rebate processes, including a less sensitive portal for submission of data.

- **Barriers:** The active distributors reported that the biggest barriers to participation lie in program awareness and the perceived notion that the paperwork and documentation are too burdensome. This assumption was supported by the responses from the inactive distributors, who mentioned that they believed the paperwork and administration were too burdensome, especially for out-of-state distributors, and that the process to get customer validation through the portal was too hard and took too long. This indicates that there is an opportunity to improve education and awareness on the program processes, which were perceived as burdensome.

- **Program risks:** When asked about the risks associated with participation in the program, many distributors reported the biggest risk to them is if the customer fails to meet the requirements set forth by the program after they sold the product. Distributors were apprehensive about not receiving the funds from the utility or the customer for the rebate amount in cases of customers' failure to meet the conditions.

- **Marketing:** The best methods to reach out to distributors to increase program awareness and participation is through emails, account representatives, and/or direct/in-person contact.

Highlights of the process evaluation for participating customers are summarized here:

- **Satisfaction:** Respondents reported high satisfaction with program components, where they rated them on average 4.8 or 4.9 out of 5 (very satisfied). The program components included interactions with distributors and contractors, and quality and price of bulbs.

- **Program awareness:** The majority (24 of 28) of surveyed customers reported that they knew about the program prior to participating. Of these customers, most (13 of 24) indicated that they heard about the program from distributors. The remaining participants reported that they heard about the program from other sources (5 of 24), contractors (3 of 24), family or friends (1 of 24), online/website (1 of 24), or a coworker (1 of 24).

- **Program delivery:** The majority of customers (19 of 27) reported that they purchased the bulbs through a distributor. Most of these customers reported that they purchased the bulbs by going to the distributor (12 of 19) rather than the distributor coming to them (7 of 19). The remainder of respondents purchased bulbs through a contractor (6 of 27) or other sources, which they could not recall (2 of 27).

- **Barriers:** A large portion of respondents (7 of 28) stated no significant barriers. Of those that reported barriers, most (15 of 28) stated barriers such as program awareness (7 of 15), costs (4 of 15), paperwork (1 of 15), internal approval (1 of 15), and internal staffing constraints (1 of 15).

3.7.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 82 through Table 85. Small/Medium Midstream and Large Midstream results are shown separately. TRC benefits in Table 82 and Table 84 were calculated using gross verified impacts for Small/Medium Midstream and Large Midstream, respectively. Table 83 and Table 85 present program financials and cost-effectiveness on a net savings basis for both programs, respectively. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 82: Summary of Small/Medium Midstream Program Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$97		$269	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$0		-$3	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$97		$267	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$13
6	Administration, Management, and Technical Assistance [3]	$2	$17	$53	$81
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$32	$84	$56	$79
9	EDC Evaluation Costs	$29		$58	
10	SWE Audit Costs	$12		$42	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$176		$384	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$273		$651	
14	Total NPV Lifetime Electric Energy Benefits	$220		$1,148	
15	Total NPV Lifetime Electric Capacity Benefits	$67		$435	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$213		$573	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$28		-$104	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$472		$2,052	
19	**TRC Benefit-Cost Ratio [8]**	**1.73**		**3.15**	

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 83: Summary of Small/Medium Midstream Program Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$97		$269	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-$28		-$48	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$69		$222	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$13
6	Administration, Management, and Technical Assistance [3]	$2	$17	$53	$81
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$32	$84	$56	$79
9	EDC Evaluation Costs	$29		$58	
10	SWE Audit Costs	$12		$42	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$176		$384	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$245		$606	
14	Total NPV Lifetime Electric Energy Benefits	$157		$983	
15	Total NPV Lifetime Electric Capacity Benefits	$48		$375	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$152		$475	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$20		-$88	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$337		$1,746	
19	**TRC Benefit-Cost Ratio [8]**	**1.37**		**2.88**	

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 84: Summary of Large Midstream Program Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$129		$332	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$2		-$19	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$131		$314	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$30
6	Administration, Management, and Technical Assistance [3]	$7	$41	$98	$195
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$31	$50	$55	$374
9	EDC Evaluation Costs	$69		$138	
10	SWE Audit Costs	$28		$99	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$226		$992	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$357		$1,306	
14	Total NPV Lifetime Electric Energy Benefits	$346		$1,368	
15	Total NPV Lifetime Electric Capacity Benefits	$170		$639	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$242		$664	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$45		-$139	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$714		$2,532	
19	**TRC Benefit-Cost Ratio [8]**	**2.00**		**1.94**	

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 85: Summary of Large Midstream Program Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$129		$332	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-$35		-$19	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$94		$314	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$30
6	Administration, Management, and Technical Assistance [3]	$7	$41	$98	$195
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$31	$50	$55	$374
9	EDC Evaluation Costs	$69		$138	
10	SWE Audit Costs	$28		$99	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$226		$992	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$320		$1,250	
14	Total NPV Lifetime Electric Energy Benefits	$248		$1,159	
15	Total NPV Lifetime Electric Capacity Benefits	$122		$540	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$173		$552	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$32		-$117	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$511		$2,135	
19	**TRC Benefit-Cost Ratio [8]**	**1.60**		**1.71**	

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.7.7 Status of Recommendations

The PY10 impact and process evaluation activities led to the following findings and recommendations, along with a summary of how Duquesne Light plans to address the recommendation in program delivery.

Finding:
For the projects visited during this evaluation year, Navigant found that the preliminary realization rates are much closer to 100 percent than they were in prior years. These particular realization rates will be finalized and conveyed within the PY11 final annual report.

Recommendation:
Duquesne Light and its CSP CLEAResult should continue utilizing the three HOU value bins created for PY10 projects. Current field verification findings suggest that the programmatic changes to reporting HOUs are resulting in a positive impact in reported savings accuracy. Navigant will confirm these initial suggestions with additional verifications in PY11.

Duquesne Light Status Report:
Duquesne Light agrees that the CSP should continue to utilize the three HOU value bins.

Finding:
Navigant estimated a NTG of 72 percent for the C&I Midstream Program, and a NTG of 74 percent for the high impact measure A-Line LEDs, based on 28 responses from participants. This is lower than the NTG value of 88 percent estimated in PY8, based on 25 responses.

Recommendation:
Duquesne Light should continue exploring midstream implementation opportunities. Relative to other C&I programs, the C&I Midstream programs generally experience lower free ridership rates. This is likely related to the distributors' involvement and recommendations being made to customers.

Duquesne Light Status Report:
Duquesne will continue to explore midstream implementation opportunities, particularly as Phase IV programs are designed.

Finding:
The highest priority program improvements that the active and inactive distributors recommended were offering a greater variety of lighting products. Additionally, when asked if distributors changed the types of LED products they recommend to customers since they began participating in the program, more than half of the distributors reported they changed their recommendations to LED products that are eligible for incentives provided by the program.

Recommendation:
Duquesne Light should offer a greater variety of lighting products to influence distributors to recommend their customers to upgrade to higher efficiency technologies, leading to greater program participation and increased energy savings. Additionally, several lighting varieties should not be susceptible to changing baselines in PY12 or Phase IV. Duquesne Light should also complete additional cost-benefit research to determine if any of the additional lighting product measures recommended by distributers should be added to the program, such as greater variety of pin-based LEDs, MR16s, HID lamps, GX-24 base bulbs, self-contained LED fixtures, high bay LEDs, linear LED tubes and fixtures, exterior LEDs, and controls-based LEDs.

Duquesne Light Status Report:
Duquesne will continue to explore midstream implementation opportunities, particularly as Phase IV programs are designed.

Finding:
Active distributors rated the program as 7.8 out of 10, with 10 being "very satisfied." Satisfaction ratings were high for several program aspects. However, Navigant learned that the lowest satisfaction ratings were for the time required to receive rebates for sold LED bulbs (5.1), the products eligible for incentives (6.7), and the rebate check tracking system (7.2).

Recommendation:
In addition to exploring other lighting products to include in the program (see previous recommendations), Duquesne Light should investigate opportunities to reduce processing time for distributors' rebate checks to under 30 days from the point of sale.

Duquesne Light Status Report:
Duquesne Light will take this under advisement for Phase IV.

Finding:
Active distributors reported that the largest barriers to participation lie in program awareness and the perceived notion that the paperwork and documentation are too burdensome. This assumption was also supported by the responses from the inactive distributors, especially out-of-state distributors, who also indicated that the process to get customer validation through the portal was too hard and took too long. This indicates that there is an opportunity to improve education and awareness of the program processes.

Recommendation:
If increased participation is desired for C&I programs, Navigant recommends that Duquesne Light improve program awareness and educate inactive distributors on program processes to reduce these perceived notions. This can be done by utilizing emails, newsletters, and direct personal outreach by account representatives to regularly communicate program updates and offerings. Additionally, Duquesne Light could develop informational materials and tools for customers to use with their internal teams. These materials should include information to assist customer decision making and understanding of the program process.

Duquesne Light Status Report:
Duquesne Light will consider these midstream program refinements as needed and if needed to increase participation in Phase III. This finding and recommendation also inform Phase IV planning.

3.8 Small Commercial Direct Install Program

The SCDI Program offers no-cost direct installation of energy efficient measures at small and medium C&I customer locations. This program targets Duquesne Light C&I customers with monthly demand less than 300 kW, addressing small and medium C&I customer sector-specific barriers. Customers in these segments are often subject to split incentives, where electric bill paying customers are tenants but not the owners of the properties where they conduct their businesses. Building owners do not pay the electric bills, so they are not motivated to upgrade equipment to save energy, and the electric bill-paying tenants are not motivated to upgrade properties they do not own. The program addresses these barriers by providing no-cost efficiency upgrades, whereby landlords received no-cost building upgrades and small business tenants benefit from lower electric bills. While others are eligible, the program is targeting primarily independent small commercial customers (typically convenience stores and restaurants) with some refrigeration measures which contribute to more cost-effective projects.

The SCDI is implemented by CLEAResult with support from a sub-contractor, Three Rivers Electric, who is responsible for identifying eligible customers and installing measures. CLEAResult is responsible for developing program marketing materials, customer engagement, oversight of direct installation of program measures, verification of project details, and uploading project files to Duquesne Light and to PMRS.

A participant is a customer participating in the program within a given reporting year (e.g., Q1 through Q4 for PY10), represented by a unique participant account number within the tracking system. Customers participating in a program more than once within a reporting year (i.e., PYRTD) are counted once; customers participating more than once but in different years or programs are counted more than once (once in each year and/or program).

3.8.1 Participation and Reported Savings by Customer Segment

Table 86 presents the participation counts, reported energy and demand savings, and incentive payments for the SCDI program in PY10 by customer segment. Navigant notes that the program saw limited participation and savings in PY10 because the Phase III targeted savings had been achieved during the program year. Given the achievement of planned goals, Duquesne Light reduced program activities in June and reported final project activities in that month.

Table 86: SCDI Program Participation and Reported Impacts

Parameter	Small C&I (Non-GNI)
PYTD # Participants	8
PYRTD MWh/yr	1,045
PYRTD MW/yr	0.12
PY10 Incentives ($1,000)	$159

Source: Navigant analysis.

3.8.2 Gross Impact Evaluation

Navigant did not evaluate the SCDI program in PY10, as detailed in the Evaluation Plan approved by the SWE. For PY10, Navigant used the verification results from PY8 and applied them to the PY10 ex ante numbers. Table 87 provides the resulting population and sampling sizes, conveying that no sampling occurred in PY10. Table 88 and Table 89 show the gross energy and demand results for SCDI.

Table 87: SCDI Gross Impact Sample Design for PY10

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
SCDI - Large	4	N/A	Apply PY8 realization rates
SCDI - Medium	1	N/A	Apply PY8 realization rates
SCDI - Small	3	N/A	Apply PY8 realization rates
Total	**8**		

Source: Navigant analysis.

Table 88: SCDI Program Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
SCDI - Large	877	99%	0.12	15.3%
SCDI - Medium	72	96%	0.05	13.8%
SCDI - Small	96	96%	0.12	9.3%
Program Total	**1,045**	**99%**		**12.9%**

Source: Navigant analysis.

Table 89: SCDI Program Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
SCDI - Large	0.10	102%	0.05	6.9%
SCDI - Medium	0.01	103%	0.02	4.9%
SCDI - Small	0.01	99%	0.01	1.0%
Program Total	**0.12**	**102%**		**5.8%**

Source: Navigant analysis.

Factors affecting the SCDI realization rates are detailed in Navigant's PY8 report.

3.8.3 Net Impact Evaluation

Based on the Phase III evaluation plan, NTG and process evaluation research was scheduled for the SCDI program in PY9. However, this program was set to meet its targets and during PY9. Some projects were reported in Q1 of PY10, but activities discontinued during that quarter. Since NTG and process research is focused primarily on providing observations and recommendations that feed into program planning, and the program will not be offered moving forward in Phase III, this research was not completed for SCDI in PY9 or PY10. As a result, NTG values reported from PY6 research are used here.[25]

The resulting overall NTG ratio from PY6 is applied to the total gross savings for the SCDI program. A summary of the PY6 NTG results is included in Table 90.

[25] No NTG research for this program was conducted in PY7, either, because the program had achieved its goals by the end of PY6.

Table 90: SCDI Program Net Impact Results

Target Group	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Relative Precision (at 85% CL)
SCDI Total	**1%**	**0%**	**99%**	**1.9%**

Source: Navigant analysis.

See Navigant's PY6 final report for Duquesne Light for more detail regarding the PY6 NTG analysis.

High Impact Measure Research
Navigant did not conduct research for HIMs for SCDI in PY10.

3.8.4 Verified Savings Estimates

In Table 91, Navigant applied the realization rates and NTG ratios to the reported energy and demand savings estimates to calculate the verified savings estimates for the SCDI program in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 91: SCDI PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	1,045	0.12
PYVTD Gross	1,033	0.12
PYVTD Net	1,026	0.12
RTD	10,934	1.36
VTD Gross	10,688	1.39
VTD Net	10,613	1.38

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report.

3.8.5 Process Evaluation

A detailed process evaluation was planned for the SCDI program in PY9. However, this program was set to meet its targets during PY9 and that activity ultimately extended into part of PY10. Since process evaluation research is focused primarily on providing observations and recommendations, which feed into program planning, and the program saw no projects after Q1 of PY10 in Phase III, this research was not completed.

3.8.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 92. TRC benefits in Table 92 were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 92: Summary of SCDI Program Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
1	EDC Incentives to Participants [1]	$0	$0

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$0		$0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**$0**		**$0**	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$21
6	Administration, Management, and Technical Assistance [3]	$4	$29	$73	$135
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$29	$557	$52	$2,659
9	EDC Evaluation Costs	$48		$97	
10	SWE Audit Costs	$19		$68	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$686		$3,108	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$686		$3,108	
14	Total NPV Lifetime Electric Energy Benefits	$453		$4,417	
15	Total NPV Lifetime Electric Capacity Benefits	$133		$1,466	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0		$12	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$11		-$259	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$575		$5,636	
19	**TRC Benefit-Cost Ratio [8]**	**0.84**		**1.81**	

[1] Includes direct install equipment costs.
[2] Includes direct costs attributable to plan and to advance the programs.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 93 presents program financials and cost-effectiveness on a net savings basis.

Table 93: Summary of SCDI Program Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
1	EDC Incentives to Participants [1]	$0	$0

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$0		$0	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	**$0**		**$0**	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$21
6	Administration, Management, and Technical Assistance [3]	$4	$29	$73	$135
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$29	$557	$52	$2,659
9	EDC Evaluation Costs	$48		$97	
10	SWE Audit Costs	$19		$68	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$686		$3,108	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$686		$3,108	
14	Total NPV Lifetime Electric Energy Benefits	$450		$4,386	
15	Total NPV Lifetime Electric Capacity Benefits	$132		$1,455	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0		$12	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$11		-$257	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$571		$5,596	
19	**TRC Benefit-Cost Ratio [8]**	**0.83**		**1.80**	

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.8.7 Status of Recommendations

Navigant limited its impact and process evaluation activities for SCDI in PY10 and has no recommendations at this time.

3.9 Multifamily Housing Retrofit Program

MFHR targets multifamily housing for income-qualified occupants and provides a one-stop shop, simplifying program participation and energy efficiency measure adoption. The program assists its customers in improving the efficiency of common area spaces in master metered multifamily buildings serving low income households. However, the program will serve the dwelling units of a qualified building if they are also served by a master meter.

MFHR is delivered by a core team of DLC staff supported by MCR Performance Solutions (MCR) staff. Program services include the administration of energy efficiency audits, technical assistance for measure-level project review and bundling, property aggregation, contractor negotiation, and equipment bulk purchasing. Services also include processing rebate applications and other funding source documentary requirements.

A participant is a customer participating in the given program within a given reporting year (e.g., Q1 through Q4 for PY10), represented by a unique participant account number within the tracking system. Customers participating in a program more than once within a reporting year (i.e., PYRTD) are counted once; customers participating more than once but in different years or programs are counted more than once (once in each year and/or program).

3.9.1 Participation and Reported Savings by Customer Segment

Table 94 presents the participation counts, reported energy and demand savings, and incentive payments for MFHR program in PY10, by customer segment.

Table 94: MFHR Program Participation and Reported Impacts

Parameter	Small C&I (Non-GNI)*
PYTD # Participants	18
PYRTD MWh/yr	1,376
PYRTD MW/yr	0.14
PY10 Incentives ($1,000)	$163

*While this program falls under the small C&I sector, a percentage of its savings are counted toward the low income compliance target. See discussion of LIEEP at Section 3.5 for more information.

Source: Navigant analysis.

3.9.2 Gross Impact Evaluation

Similar to PY9, Navigant did not evaluate MFHR in PY10. For PY10, Navigant used the verification results from PY8 and applied them to the PY10 ex ante numbers for MFHR as detailed in the Evaluation Plan approved by the SWE. Table 95 provides the resulting population and sampling sizes, conveying that no sampling occurred in PY10. Table 96 and Table 97 show the gross energy and demand results for MFHR.

Table 95: MFHR Gross Impact Sample Design for PY10

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
MFHR	25	N/A	Apply PY8 realization rates
Total	**25**	N/A	

Source: Navigant analysis.

Table 96: MFHR Program Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
MFHR	1,376	95%	0.00	0.0%
Total	**1,376**	**95%**		**0.0%**

Source: Navigant analysis.

Table 97: MFHR Program Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
MFHR	0.14	93%	0.00	0.0%
Total	**0.14**	**93%**		**0.0%**

Source: Navigant analysis.

3.9.3 Net Impact Evaluation

Navigant did not conduct an NTG evaluation for MFHR in PY10. Per Navigant's Evaluation Plan, the team relied on PY9 results for the estimates of participant free ridership and spillover. Navigant plans to conduct NTG research in PY11 to update these estimates.

Navigant applied the NTG factor for MFHR using the results from the PY9 telephone survey of program participants. Navigant attempted a census of all decision makers across MFHR, PAPP, and the Community Education Energy Efficiency Program (CEEP) in PY9, achieving 16 survey completes, where each decision maker was asked about one project and up to three measures. Similar to PY9, the team used a single, combined NTG ratio of 0.45 for these three programs and applied it to all programs and strata as shown in Table 98.

Table 98: MFHR Program Net Impact Evaluation Results

Target Group	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Relative Precision (at 85% CL)
MFHR/CEEP/PAPP	0.55	0.00	0.45	32.8%

Source: Navigant analysis.

See Navigant's PY9 final report for Duquesne Light for more detail regarding the PY9 NTG analysis.

High Impact Measure Research
Navigant did not conduct research for HIMs for MFHR in PY10.

3.9.4 Verified Savings Estimates

In Table 99, Navigant applied the realization rates and NTG ratios to the reported energy and demand savings estimates to calculate the verified savings estimates for the MFHR Program in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 99: MFHR PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	1,376	0.14
PYVTD Gross	1,308	0.13
PYVTD Net	595	0.06
RTD	1,641	0.17
VTD Gross	1,561	0.16
VTD Net	749	0.07

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report.

3.9.5 Process Evaluation

Navigant did not conduct a process evaluation for MFHR in PY10. Per Navigant's Evaluation Plan, Navigant completed in-depth process evaluation research in PY9. The team plans to conduct process evaluation research in PY11 to update NTG estimates, determine customer satisfaction rates, and develop recommendations for program improvements.

3.9.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 100. TRC benefits in Table 100 were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 100: Summary of MFHR Program Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$322		$331	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$490		$481	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$812		$812	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$5	$19
6	Administration, Management, and Technical Assistance [3]	$4	$26	$69	$123
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$30	$205	$52	$474
9	EDC Evaluation Costs	$44		$89	
10	SWE Audit Costs	$18		$64	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$327		$895	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$1,139	$1,706
14	Total NPV Lifetime Electric Energy Benefits	$523	$530
15	Total NPV Lifetime Electric Capacity Benefits	$128	$130
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0	$0
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0	$0
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$652	$660
19	**TRC Benefit-Cost Ratio [8]**	**0.57**	**0.39**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 101 presents program financials and cost-effectiveness on a net savings basis.

Table 101: Summary of MFHR Program Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$322		$331	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$47		$56	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$369		$387	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$5	$19
6	Administration, Management, and Technical Assistance [3]	$4	$26	$69	$123
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$30	$205	$52	$474
9	EDC Evaluation Costs	$44		$89	
10	SWE Audit Costs	$18		$64	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$327		$895	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0	$0
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$696	$1,281
14	Total NPV Lifetime Electric Energy Benefits	$238	$248
15	Total NPV Lifetime Electric Capacity Benefits	$58	$61
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0	$0
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0	$0
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$296	$309
19	**TRC Benefit-Cost Ratio [8]**	**0.43**	**0.24**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.9.7 Status of Recommendations

Navigant limited its impact and process evaluation activities for MFHR in PY10 and has no recommendations at this time.

3.10 Industrial Efficiency Program

Similar to the EXP and CEP, IEP provides rebates to offset the higher cost of high efficiency equipment when compared to standard efficiency equipment. Program incentives promote customer indifference to the higher cost and increase customer adoption of high efficiency equipment. The IEP also includes energy assessments, energy manager walkabouts, system optimization studies, consultations, and project reviews at no cost to the customer.

The IEP provides assistance to eligible industrial customers by identifying and pursuing energy management and energy efficiency improvements in their facilities. Industrial facilities in DLC's service territory with monthly electric demand greater than 300 kW are eligible to participate in the IEP.

A participant is a customer participating in the given program within a given reporting year (e.g., Q1 through Q4 for PY10), represented by a unique participant account number within the tracking system. Customers participating in a program more than once within a reporting year (i.e., PYRTD) are counted once; customers participating more than once but in different years or in different programs are counted more than once (once in each year and/or program).

3.10.1 Participation and Reported Savings by Customer Segment

Table 102 presents the participation counts, reported energy and demand savings, and incentive payments for the IEP in PY10 by customer segment.

Table 102: Industrial Efficiency Program Participation and Reported Impacts

Parameter	Large C&I (Non-GNI)
PYTD # Participants	30
PYRTD MWh/yr	5,682
PYRTD MW/yr	0.84
PY10 Incentives ($1,000)	$238

Source: Navigant analysis.

3.10.2 Gross Impact Evaluation

Navigant completed onsite verifications for the IEP PY10 projects. Because of the size and complexity of industrial projects, which often consist of large numbers of line items, Navigant samples the IEP at the measure level rather than at the project level.

For the PY10 evaluation and as described in the Evaluation Plan, Navigant relied on measures previously sampled and verified from PY9 and combined those with additional sampled measures from PY10. Navigant used this rolling, 2-year verification approach to estimate the realization rate for PY10. Navigant will use a similar method for PY11 where a combination of these PY10 measures will be combined with PY11 measures to create a new realization rate for PY11 activities.

Table 103 provides the resulting population and sampling sizes. Table 104 and Table 105 show the gross energy and demand results for IEP, respectively.

Table 103: Industrial Efficiency Gross Impact Sample Design for PY9 and PY10

Stratum	Population Size[26]	Achieved Sample Size (PY9/PY10 Combined)	Evaluation Activity
Industrial - Large[27]	0	2	Verification and Trending Visit
Industrial - Medium	15	10	Verification Only Visit, Verification and Trending Visit
Industrial - Small	160	11	Verification Only Visit, Verification and Trending Visit, Phone Verification
Total	**175**	**23**	

Source: Navigant analysis.

Table 104: Industrial Efficiency Program Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate (PY9/PY10 Combined)	Sample C_v or Error Ratio	Relative Precision at 90% C.L.*
Industrial - Large	0	95%	0.00	0.0%
Industrial - Medium	3,038	89%	0.19	11.0%
Industrial - Small	2,644	103%	0.29	16.1%
Program Total	**5,682**	**96%**		**9.2%**

*IEP was sampled targeting 90/15 for PY10.
Source: Navigant analysis.

Table 105: Industrial Efficiency Program Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate (PY9/PY10 Combined)	Sample C_v or Error Ratio	Relative Precision at 90% C.L.
Industrial - Large	0.00	100%	0.00	0.0%
Industrial - Medium	0.35	79%	0.45	26.3%
Industrial - Small	0.49	99%	0.05	2.7%
Program Total	**0.84**	**91%**		**9.1%**

Source: Navigant analysis.

Factors affecting the PY10 realization rates for IEP (which include measures reported in both PY9 and PY10) were:

- For several sites (n=4, representing 5 sample points), the verified HOU differed from the values used in the ex ante savings calculations.
- For one air compressor measure, the CSP used a generic efficiency curve rather than using the Compressed Air and Gas Institute (CAGI) sheet data provided for the baseline compressor. This, together with an error in rated discharge pressure, led to a low realization rate for the site associated with the measure.

[26] Participant counts when sampling reflect the total number of measures rather than the total number of participants.

[27] There were no measures in the Industrial – Large stratum in PY10. However, Navigant is showing this stratum here because there are PY9 measures within this stratum informing these results.

- One sampled measure misidentified the baseline fixture as a 400 W fixture instead of a 250 W, leading to reduced savings for that measure.
- Navigant received additional trend data for one custom project, which allowed a more detailed seasonal analysis of the data. This increased savings slightly.

3.10.3 Net Impact Evaluation

Navigant did not conduct an NTG evaluation for IEP in PY10. Per Navigant's Evaluation Plan, the team relied on PY9 results for the estimates of participant free ridership and spillover. Navigant plans to conduct NTG research in PY11 to update these estimates.

Navigant applied the NTG factor for IEP using the results from the PY9 telephone survey of program participants. Navigant attempted a census of all decision makers across the program in PY9, achieving six survey completes, where each decision maker was asked about one project and up to three measures. Similar to PY9, the team used a single combined NTG ratio of 0.31 for IEP and applied it to all strata as shown in Table 106.

Table 106: Industrial Efficiency Program Net Impact Evaluation Results

Target Group	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Relative Precision (at 85% CL)
Industrial	69%	0%	31%	6.0%

Source: Navigant analysis.

See Navigant's PY9 final report for Duquesne Light for more detail regarding the PY9 NTG analysis.

High Impact Measure Research
Navigant did not conduct research for HIMs for IEP in PY10.

3.10.4 Verified Savings Estimates

In Table 107, the realization rates and NTG ratios determined by Navigant are applied to the reported energy and demand savings estimates to calculate the verified savings estimates for IEP in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 107: IEP PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	5,682	0.84
PYVTD Gross	5,431	0.76
PYVTD Net	1,662	0.23
RTD	26,383	2.59
VTD Gross	26,549	2.63
VTD Net	9,875	1.02

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report.

3.10.5 Process Evaluation

Navigant did not conduct a process evaluation for IEP in PY10. Per Navigant's Evaluation Plan, Navigant completed in-depth process evaluation research in PY9, and the team relied on PY9 results for the estimates of participant free ridership and spillover this year. Navigant plans to conduct NTG and process evaluation research in PY11 to update NTG estimates, determine customer satisfaction rates, and develop recommendations for program improvements.

3.10.6 Cost-Effectiveness Reporting

Table 108 presents a detailed breakdown of program finances and cost-effectiveness. TRC benefits in Table 108 were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 108: Summary of IEP Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$238		$1,073	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$384		$767	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$622		$1,841	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$4	$69
6	Administration, Management, and Technical Assistance [3]	$15	$93	$193	$441
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$31	$908	$55	$1,476
9	EDC Evaluation Costs	$156		$315	
10	SWE Audit Costs	$62		$222	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$1,265		$2,775	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$1,887		$4,615	
14	Total NPV Lifetime Electric Energy Benefits	$2,883		$12,470	
15	Total NPV Lifetime Electric Capacity Benefits	$924		$2,867	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$91		$195	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$241		-$501	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$3,657		$15,031	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
19	**TRC Benefit-Cost Ratio [8]**	**1.94**	**3.26**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 109 presents program financials and cost-effectiveness on a net savings basis.

Table 109: Summary of IEP Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$238		$1,073	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-$48		-$427	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$190		$646	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$4	$69
6	Administration, Management, and Technical Assistance [3]	$15	$93	$193	$441
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$31	$908	$55	$1,476
9	EDC Evaluation Costs	$156		$315	
10	SWE Audit Costs	$62		$222	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$1,265		$2,775	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$1,455		$3,421	
14	Total NPV Lifetime Electric Energy Benefits	$882		$4,673	
15	Total NPV Lifetime Electric Capacity Benefits	$283		$1,124	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$28		$71	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$74		-$153	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$1,119		$5,714	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
19	**TRC Benefit-Cost Ratio [8]**	**0.77**	**1.67**

[1] Includes direct install equipment costs.
[2] Includes direct costs attributable to plan and to advance the programs.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.10.7 Status of Recommendations

The PY10 impact and process evaluation activities led to the following finding and recommendation, along with a summary of how Duquesne Light plans to address the recommendation in program delivery.

Finding:
In both PY9 and PY10, air compressor projects had a large, negative effect on the realization rate. These projects utilize a custom calculator that can be difficult to implement and difficult for the evaluator to review.

Recommendation:
Navigant recommends that Duquesne Light, its CSP, and Navigant conduct a joint and thorough review of the custom air compressor calculator. The goal of such an effort should be to identify opportunities to make the calculator more robust (i.e., less prone to input and execution errors), easier to implement by individuals with varying skillsets and technical training, and simpler to review. A joint effort can also ensure that all stakeholders involved in the program are aligned with the appropriate use of the custom calculator.

Duquesne Light Status Report:
Duquesne Light supports Navigant's efforts to make this happen.

3.11 Public Agency Partnership Program

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

PAPP is run by MCR, and MCR support for the program includes initial outreach to customers, the administration of energy efficiency audits, technical assistance for measure level project review and bundling, property aggregation, contractor negotiation, and equipment bulk purchasing. MCR integrates funding sources to include program and agency co-funding, performance contracting, grant funding, and available financing options.

A participant is a customer participating in the given program within a given reporting year (e.g., Q1 through Q4 for PY10), represented by a unique participant account number within the tracking system. Customers participating in a program more than once within a reporting year (i.e., PYRTD) are counted once; customers participating more than once but in different years or in different programs are counted more than once (once in each year and/or program).

3.11.1 Participation and Reported Savings by Customer Segment

Table 110 presents the participation counts, reported energy and demand savings, and incentive payments for PAPP in PY10 by customer segment.

Table 110: PAPP Participation and Reported Impacts

Parameter	PAPP (GNI)
PYTD # Participants	107
PYRTD MWh/yr	10,207
PYRTD MW/yr	1.60
PY10 Incentives ($1,000)	$769

Source: Navigant analysis.

3.11.2 Gross Impact Evaluation

Navigant completed onsite verifications for PAPP PY10 projects. As described in the Evaluation Plan, Navigant relied on projects previously sampled and verified from PY9 and combined those with additional sampled measures from PY10. Navigant used this rolling, 2-year verification approach to estimate the realization rate for PY10. Navigant will use a similar method for PY11 where a combination of these PY10 measures will be combined with PY11 measures to create a new realization rate for PY11 activities.

Table 111 provides the resulting population and sampling sizes. Table 112 and Table 113 show the gross energy and demand results for PAPP.

Table 111: PAPP Gross Impact Sample Design for PY9 and PY10

Stratum	Population Size	Achieved Sample Size (PY9/PY10 Combined)	Evaluation Activity
PAPP - Large	24	7	Verification Only Visit, Verification and Trending Visit
PAPP - Small	107	14	Verification Only Visit, Phone Verification
Total	**131**	**21**	

Source: Navigant analysis.

Table 112: PAPP Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate (PY9/PY10 Combined)	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
PAPP - Large	8,247	94%	0.27	16.7%
PAPP - Small	1,960	107%	0.25	10.3%
Program Total	**10,207**	**97%**		**12.2%**

Source: Navigant analysis.

Table 113: PAPP Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate (PY9/PY10 Combined)	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
PAPP - Large	1.27	41%	2.16	134.7%
PAPP - Small	0.32	123%	0.49	20.2%
Program Total	**1.60**	**57%**		**69.8%**

Source: Navigant analysis.

Factors affecting the PAPP realization rates for PY10 (which include projects reported in both PY9 and PY10) are:

- Several projects (n=7) had HOU, confirmed either via customer interview or energy management system (EMS) settings, that were different than the HOU used to calculate ex ante savings.
- Navigant used customer-provided trend data to calculate savings for one large HVAC system project, where the CSP used billing data. This led to a slight increase in energy savings, but a decrease in overall demand savings for that project.
- One project had fewer fixtures installed than reported in the project files.
- One project had retrofit fixtures that were more efficient than was stated in the project files.

3.11.3 Net Impact Evaluation

Navigant did not conduct NTG evaluation for PAPP in PY10. Per Navigant's Evaluation Plan, the team relied on PY9 results for the estimates of participant free ridership and spillover. Navigant plans to conduct NTG research in PY11 to update these estimates.

Navigant applied the NTG factor for PAPP using the results from the PY9 telephone survey of program participants. Navigant attempted a census of all unique decision makers across PAPP, CEEP, and MFHR in PY9, achieving 16 survey completes, where each unique decision maker was asked about one project and up to three measures. Similar to PY9, the team used a single, combined NTG ratio of 0.45 for these three programs and applied it to all programs and strata as shown in Table 114.

Table 114: PAPP Net Impact Evaluation Results

Target Group	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Relative Precision (at 85% CL)
PAPP/CEEP/MFHR	0.55	0.00	0.45	32.8%

Source: Navigant analysis.

See Navigant's PY9 final report for Duquesne Light for more detail regarding the PY9 NTG analysis.

High Impact Measure Research
Navigant did not conduct research for HIMs for PAPP in PY10.

3.11.4 Verified Savings Estimates

In Table 115, Navigant applied the realization rates and NTG ratios to the reported energy and demand savings estimates to calculate the verified savings estimates for PAPP in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 115: PAPP PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	10,207	1.60
PYVTD Gross	9,856	0.92
PYVTD Net	4,484	0.42
RTD	19,600	2.61
VTD Gross	19,333	1.80
VTD Net	10,139	0.93

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report.

3.11.5 Process Evaluation

In PY10, Navigant conducted two surveys for process evaluation of PAPP. The first survey included a census attempt of the largest PAPP participants, and the second survey targeted all PAPP-eligible, but nonparticipating public agencies. The following sections summarize the objectives and results of each survey. For additional details on the research methodology and findings, please refer to the separate PY10 C&I Program Evaluation Report.

PAPP Participant Survey
Navigant conducted a survey for a census attempt of the largest public agencies that participated throughout PY9 and PY10 in PAPP. The objective of the survey was to obtain feedback from these customers about their experience and satisfaction with the PAPP program, gauge the influence of the program's incentives in their decision, and assess what kind of additional support they may find valuable from this program. The intent of the survey was to specifically evaluate the largest public agencies, which

were identified as public sector customers who had an annual energy consumption of over 400 MWh in the most recent year of available energy use data.

Navigant attempted to contact 51 decision makers of the PAPP largest participating agencies via email and phone. The team achieved a response rate of 24%, with 12 out of 51 participants completing the survey. Table 116 summarizes PAPP's population of the largest public agency decision makers participating during PY9 and PY10, and the targeted and achieved samples.

Table 116: PAPP Process Evaluation Sample Design

PAPP Participants Survey	Unique Decision Makers (Population)	Approach	Targeted Sample Completes	Achieved Sample Completes	Response Rates
Online/email survey	24	Email, Census	8	5	21%
Phone survey	27	Phone, Census	8	7	26%
Total	**51**		**16**	**12**	**24%**

Source: Navigant analysis.

PAPP Nonparticipant Survey

Navigant conducted a survey with qualified customers who were determined to be eligible for participation in PAPP, but who have not previously participated in this program during Phase III. This survey aimed to obtain feedback from nonparticipants about their awareness and understanding of the PAPP offerings and to gain insight into how Duquesne Light can increase participation for this program in the future. Specifically, the survey inquired about program awareness, program offerings, energy-related decision-making, barriers to participation, and customer perceptions of the utility.

The survey was conducted for a simple random sample of 3,428 PAPP-eligible public agencies via email or phone depending on the available contact information. The team was able to achieve 59 completed surveys and 84 additional partially completed surveys. Table 117 outlines the number of decision makers with PAPP-eligible agencies, targeted sample completes, and the total number of completes that was achieved for customers with available email and phone contact information.

Table 117. PAPP-Eligible Nonparticipant Survey Design

PAPP Nonparticipants Survey	Unique Decision Makers (Population)	Approach	Targeted Sample Completes	Achieved Sample Completes	Response Rates*
Agencies with email contacts	1,253	Email survey	35	38	3%
Agencies with phone contacts only	2,175	Phone survey	25	21	1%
Agencies without email or phone	937	N/A			0%
Total	**4,365**		**60**	**59**	**1%**

*Note: the response rate is calculated based on the full population, however, not all unique decision makers were contacted to achieve the required sample completes because a random sample was used.

Source: Navigant analysis.

Survey Findings

The research of the PAPP participant and nonparticipant surveys discussed above aimed to understand program delivery, satisfaction, energy decision-making, program marketing, and assess areas for improvement. The process evaluation findings and details can be found in the PY10 C&I Program

Evaluation report that accompanies this report. Highlights of the process evaluation for PAPP participant surveys are summarized here:

- **Satisfaction:** Respondents felt highly satisfied with the program, rating various aspects of the program an average of 3.7 to 4.6 out of 5. They provided the highest rating for their experience with the equipment installed through the program (4.6) and their initial contact with the Duquesne Light contractor (4.5). They rated their satisfaction with the installation process the lowest (3.7).

- **Outreach:** The survey asked customers their thoughts on the best way to reach out to get them to participate in the program in the future. Most cited that the best method of outreach is through account representatives, distributors/manufacturers, and through in-person/personal contact.

- **Marketing:** A third of participants (4 of 12) had not seen the website or any marketing materials. A few respondents first heard about the program through word of mouth (2 of 12), previous knowledge (2 of 12), or their contractor (5 of 12). When asked how the materials could be made more useful, public agency representatives provided a variety of responses, including adding more sources of information, more detailed information, and information on their specific type of organizations to can take advantage of the program. These findings indicate that Duquesne Light has strong networks. However, it can further increase its marketing and outreach efforts (and improve the marketing materials) to further increase awareness of PAPP.

Highlights of the process evaluation for PAPP nonparticipant surveys are summarized as follows:

- **Satisfaction:** Public agency respondents felt highly satisfied with Duquesne Light, on average rating their satisfaction with the utility as 4.2, program offerings as 3.8, and staff professionalism as 4.3, where 5 represents "very satisfied."

- **Awareness:** The survey responses show that a large majority (73%) of PAPP-eligible public agency representatives, who are responsible for making energy-related decisions in their organization, are unaware of the program.

- **Barriers to participation:** Almost half of respondents (42%) stated a lack of program awareness as one of the barriers, 13% stated "Incentives are not high enough," and 10% said "Other." Five respondents who stated "Other" also specified that lack of knowledge was a barrier to the program. These responses indicate a gap in understanding program offerings and processes and highlight an opportunity to increase program outreach and education to inform public agencies about the program and its processes.

- **Marketing:** Suggestions among nonparticipants, who are responsible for making energy-related decisions at their agency, show that the best methods to increase outreach and promote awareness of the program is for Duquesne Light to reach out to customers via emails (28%), flyers/ads/mailings (21%), and account representatives (12%).[28] Similarly, when asked what would make it easier to stay informed about the program in the future, the top three responses included providing alerts about new programs (30%), providing a single point of contact at the utility (29%), and sending regular program newsletters (23%).

[28] A total of 137 nonparticipants responded to this question (n=137).

3.11.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 118. TRC benefits in Table 118 were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 118: Summary of PAPP Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$769		$1,043	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$2,531		$3,040	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$3,300		$4,082	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$4	$38
6	Administration, Management, and Technical Assistance [3]	$8	$52	$115	$247
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$29	$682	$52	$1,525
9	EDC Evaluation Costs	$86		$174	
10	SWE Audit Costs	$34		$123	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$891		$2,276	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$4,191		$6,359	
14	Total NPV Lifetime Electric Energy Benefits	$4,693		$8,403	
15	Total NPV Lifetime Electric Capacity Benefits	$1,091		$1,931	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$301		$458	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$139		-$256	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$5,946		$10,536	
19	**TRC Benefit-Cost Ratio [8]**	**1.42**		**1.66**	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 119 presents program financials and cost-effectiveness on a net savings basis.

Table 119: Summary of PAPP Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$769		$1,043	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$732		$1,016	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$1,501		$2,059	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$4	$38
6	Administration, Management, and Technical Assistance [3]	$8	$52	$115	$247
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$29	$682	$52	$1,525
9	EDC Evaluation Costs	$86		$174	
10	SWE Audit Costs	$34		$123	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$891		$2,276	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$2,392		$4,335	
14	Total NPV Lifetime Electric Energy Benefits	$2,135		$4,432	
15	Total NPV Lifetime Electric Capacity Benefits	$496		$1,002	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$137		$237	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$63		-$116	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$2,705		$5,555	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
19	**TRC Benefit-Cost Ratio [8]**	**1.13**	**1.28**

[1] Includes direct install equipment costs.
[2] Includes direct costs attributable to plan and to advance the programs.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.11.7 Status of Recommendations

The PY10 impact and process evaluation activities led to the following findings and recommendations, along with a summary of how Duquesne Light plans to address the recommendation in program delivery.

Finding:
For one verified project, the CSP utilized billing data regression analysis to estimate energy savings that represented roughly only 3.5 percent of the total site usage. This led to a high degree of uncertainty in the reported savings values.

Recommendation:
Navigant recommends that CSPs not use billing data analysis until the expected savings approaches 10 percent or more of site usage. Adhering to this threshold rule-of-thumb will help analysts distinguish savings, with more confidence, from other variations in energy use. For projects that have small savings in relation to overall energy use, Navigant recommends using metered data and metering prior to the retrofit activities. Navigant directs this recommendation to PAPP and notes that it is applicable to most of Duquesne Light's C&I programs.

Duquesne Light Status Report:
Duquesne Light will convey this guidance to its CSPs.

Finding:
From Navigant's survey efforts, suggestions among nonparticipants, who are in charge of making energy-related decisions and energy efficiency improvements at their agencies, show that the best methods to increase outreach and promote awareness of the program for customers include emails and through account representatives so that decision-makers are reached directly. When asked what would make it easier to stay informed about PAPP in the future, the top three responses called for alerts about new programs, a single point of contact at Duquesne Light, and regular program newsletters. Additionally, PAPP participants stated that the best way to recruit them back to the program is through account representatives, distributors/manufacturers, and through in-person/personal contact.

Recommendation:
If Duquesne Light desires to increase participation in the program, Navigant recommends it grows awareness by increasing outreach and frequency of program marketing through emails and direct outreach methods. These materials should include information about Duquesne Light's programs as well as any changes or new program offerings. The content should also emphasize cost savings opportunities and case study examples. Additionally, Duquesne Light should continue program marketing that leverages various channels of distributors, contractors, industry events, and in-person contact.

Duquesne Light Status Report:
Duquesne Light will investigate these outreach methods and materials as needed for participation for the remainder of Phase III.

Finding:
Navigant learned that customers are mainly concerned with the financial and time commitment aspects of participating. As an example, when asked about barriers to participating in the program, roughly half of the respondents (5 of 11) provided examples: e.g., paperwork is too burdensome, participating is too time-consuming, equipment and initial costs are too high, and incentives are too low. Navigant also learned that respondents typically face the most difficulty with finding funding and obtaining internal approval to proceed with the project. Conversely, identifying energy efficiency opportunities and installing equipment is easier. These responses demonstrated critical challenges toward the beginning of projects.

Recommendation:
Duquesne Light and its CSP should convey the services it offers to assist customers. That assistance is provided to help decision-makers obtain internal buy-in and secure required funding to participate in the program; the barriers respondents felt were the most difficult aspects in their decision-making process. For example, the utility can provide educational materials, including facts and figures, for potential participants to use and share. Additionally, Duquesne Light should consider offering additional support services and/or reducing potential time constraints to enhance customers' experience in the program.

Duquesne Light Status Report:
Current actions to implement PAPP include the following: signing memoranda of understanding, creating energy efficiency action plans, assigning staff members, developing projects, working down through applicable jurisdictional agencies, and providing engineering project support. In consideration of this customer feedback, Duquesne Light will explore ways to convey these benefits provided to customers with the goal of linking them directly to the barriers they are designed to mitigate. Duquesne Light will also consider creating new materials and support offerings if it is determined they are needed to achieve Phase III participation goals.

3.12 Community Education Program

CEEP launched in PY8 and is designed to prepare middle school and high school students to become energy efficiency auditors and provide hands-on training while they perform energy audits at their schools. The objective is to build the community capacity and early workforce development. Follow-on objectives will be to grow the program so that student energy auditors can fan out into their communities, performing energy audits at small businesses and residential energy audits for income qualified populations. The program is delivered by MCR, which is responsible for developing program marketing materials, enrolling schools in the program, providing training and materials to schools, evaluating the resulting action plans, and entering project information into PMRS.

The program is designed to first target the schools where the students complete the training but eventually will branch out to additional buildings. With support from MCR, students will develop a Conservation Action Plan that identifies additional school district buildings in which students plan to complete audits, eventually these plans will also identify other community buildings.

The program also involves a competition. Participating schools are automatically enrolled in the competition and prizes are awarded based on the energy savings achieved (based on a percent of original energy consumption) and on the content of the Conservation Action Plan.

Schools which do not participate in the training or Conservation Action Plan portion of the program may also participate by having rebated equipment installed or custom projects developed and deployed.

A participant is a customer participating in the given program within a given reporting year (e.g., Q1 through Q4 for PY10), represented by a unique participant account number within the tracking system. Customers participating in a program more than once within a reporting year (i.e., PYRTD) are counted once; customers participating more than once but in different year or in different programs are counted more than once (once in each year and/or program).

3.12.1 Participation and Reported Savings by Customer Segment

Table 120 presents the participation counts, reported energy and demand savings, and incentive payments for CEEP in PY10 by customer segment.

Table 120: CEEP Participation and Reported Impacts

Parameter	CEEP (GNI)
PYTD # Participants	44
PYRTD MWh/yr	2,883
PYRTD MW/yr	0.54
PY10 Incentives ($1,000)	$262

Source: Navigant analysis.

3.12.2 Gross Impact Evaluation

As detailed in Navigant's PY10 evaluation plan, Navigant evaluated CEEP in PY10, with the goal of updating the numbers reported in PY8. These numbers are applied to the PY10 population and will also be applied to the PY11 population in accordance with the evaluation plan.

Table 121 provides the resulting population and sampling sizes. Table 122 and Table 123 show the gross energy and demand results for CEEP.

Table 121: CEEP Gross Impact Sample Design for PY10

Stratum	Population Size	Achieved Sample Size	Evaluation Activity
Community Ed- Large	7	3	Verification Only Visit
Community Ed - Small	46	4	Verification Only Visit, Phone Verification
Total	**53**	**7**	

Source: Navigant analysis.

Table 122: CEEP Gross Impact Results for Energy

Stratum	PYRTD MWh/yr	Energy Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
Community Ed- Large	1,519	94%	0.08	11.0%
Community Ed - Small	1,364	114%	0.26	25.1%
Program Total	**2,883**	**103%**		**11.8%**

Source: Navigant analysis.

Table 123: CEEP Gross Impact Results for Demand

Stratum	PYRTD MW/yr	Demand Realization Rate	Sample C_v or Error Ratio	Relative Precision at 85% C.L.
Community Ed- Large	0.30	99%	0.01	1.4%
Community Ed - Small	0.23	115%	0.36	34.5%
Program Total	**0.54**	**106%**		**14.0%**

Source: Navigant analysis.

Factors affecting the CEEP realization rates are:

- For one site, the HOU reported by the customer during the verification was much higher than the deemed HOU, increasing both energy and demand savings for that site.
- A second site reported that the heating type for the school was electric, rather than the unknown value used in the ex ante calculations. The resulting change in Interactive Factor (IF) lowered the energy savings but did not affect the demand savings.

3.12.3 Net Impact Evaluation

Navigant did not conduct an NTG evaluation for CEEP in PY10. Per Navigant's Evaluation Plan, the team relied on PY9 results for the estimates of participant free ridership and spillover. Navigant plans to conduct NTG research in PY11 to update these estimates.

Navigant applied the NTG factor for CEEP using the results from the PY9 telephone survey of program participants. Navigant attempted a census of all decision makers across CEEP, MFHR, and PAPP in PY9, achieving 16 survey completes, where each decision maker was asked about one project and up to three measures. Similar to PY9, the team used a single, combined NTG ratio of 0.45 for these three programs and applied it to all programs and strata, as shown in Table 124.

Table 124: CEEP Net Impact Evaluation Results

Target Group	Estimated Free Ridership	Estimated Participant Spillover	NTG Ratio	Relative Precision (at 85% CL)
CEEP/MFHR/PAPP	0.55	0.00	0.45	32.8%

Source: Navigant analysis.

See Navigant's PY9 final report for Duquesne Light for more detail regarding the PY9 NTG analysis.

High Impact Measure Research
Navigant did not conduct research for HIMs for CEEP in PY10.

3.12.4 Verified Savings Estimates

In Table 125, Navigant applied the realization rates and NTG ratios to the reported energy and demand savings estimates to calculate the verified savings estimates for CEEP in PY10. These totals are added to the verified savings achieved in previous program years to calculate the P3TD program impacts.

Table 125: CEEP PYTD and P3TD Savings Summary

Savings Type	Energy (MWh/yr)	Demand (MW/yr)
PYRTD	2,883	0.54
PYVTD Gross	2,973	0.57
PYVTD Net	1,353	0.26
RTD	5,338	0.94
VTD Gross	5,514	0.96
VTD Net	2,898	0.52

Source: Navigant analysis.

The VTD savings contribution from prior years remains unchanged since the PY9 final annual report.

3.12.5 Process Evaluation

Navigant did not conduct a process evaluation for CEEP in PY10. Per Navigant's Evaluation Plan, Navigant completed in-depth process evaluation research in PY9. The team plans to conduct process evaluation research in PY11 to update NTG estimates, determine customer satisfaction rates, and develop recommendations for program improvements.

3.12.6 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 126. TRC benefits in Table 126 were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 126: Summary of CEEP Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
1	EDC Incentives to Participants [1]	$262	$390
2	EDC Incentives to Trade Allies	$0	$0

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
3	Participant Costs (net of incentives/rebates paid by utilities)	$1,766		$1,990	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$2,028		$2,380	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$9
6	Administration, Management, and Technical Assistance [3]	$2	$12	$26	$58
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$10	$235	$16	$597
9	EDC Evaluation Costs	$20		$40	
10	SWE Audit Costs	$8		$29	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$287		$780	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$2,315		$3,160	
14	Total NPV Lifetime Electric Energy Benefits	$1,685		$2,696	
15	Total NPV Lifetime Electric Capacity Benefits	$688		$1,027	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$416		$536	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$143		-$202	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$2,645		$4,057	
19	**TRC Benefit-Cost Ratio [8]**	**1.14**		**1.28**	

[1] Includes direct install equipment costs.
[2] Includes direct costs attributable to plan and to advance the programs.
[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.
[4] Includes the marketing CSP and marketing costs by program CSPs.
[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.
[6] Total TRC Costs includes Total EDC Costs and Participant Costs.
[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.
[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 127 presents program financials and cost-effectiveness on a net savings basis.

Table 127: Summary of CEEP Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
1	EDC Incentives to Participants [1]	$262	$390

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	$661		$858	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$923		$1,247	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$3	$9
6	Administration, Management, and Technical Assistance [3]	$2	$12	$26	$58
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$10	$235	$16	$597
9	EDC Evaluation Costs	$20		$40	
10	SWE Audit Costs	$8		$29	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$287		$780	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	**$0**		**$0**	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$1,210		$2,027	
14	Total NPV Lifetime Electric Energy Benefits	$766		$1,419	
15	Total NPV Lifetime Electric Capacity Benefits	$313		$552	
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$189		$289	
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	-$65		-$92	
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$1,204		$2,169	
19	**TRC Benefit-Cost Ratio [8]**	**0.99**		**1.07**	

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.12.7 Status of Recommendations

Navigant limited its impact and process evaluation activities for MFHR in PY10 and has no recommendations at this time.

3.13 Large Curtailable Load Program

The Duquesne Large Curtailable Load (LCL) program is a C&I DR program designed to engage large Duquesne Light C&I customers in demand reduction during the utility system's peak hours. Enerlogics, Duquesne's CSP, contracts with individual businesses located in the Duquesne Light territory to provide DR when Act 129 events are called. Act 129 DR events are triggered by PJM's day-ahead load forecast. When the day-ahead forecast is above 96% of the peak load forecast for the year, a DR event is initiated for the following day. Participating customers contracted by the CSP may choose to opt out of some events or some hours of events.

There are specific conditions that will trigger DR events during Phase III. The Phase III Implementation Order and subsequent Clarification Order provided clear instructions to EDCs about which hours would be used to measure DR performance (i.e., when to call DR events):

1. Curtailment events shall be limited to the months of June through September.

2. Curtailment events shall be called for the first 6 days in which the peak hour of PJM's day-ahead forecast for the PJM RTO is greater than 96% of the PJM RTO summer peak demand forecast for the months of June through September each year of the program.

3. Each curtailment event shall last 4 consecutive hours.

4. Each curtailment event shall be called such that it will occur during the day's forecasted peak hour(s) above 96% of PJM's RTO summer peak demand forecast.

5. Once six curtailment events have been called in a program year, the peak demand reduction program shall be suspended for that program year.

6. The reductions attributable to a 4-consecutive-hour curtailment event will be based on the average megawatt reduction achieved during each hour of an event.

7. Compliance will be determined based on the average megawatt reductions achieved from events called in the last 4 years of the Phase III program.

8. In their plans, the EDCs must demonstrate that the EDC program cost to acquire megawatts from customers who participate in PJM's Emergency Load Reduction Program (ELRP) is no more than half the cost to acquire megawatts from customers in the same rate class that are not participating in PJM's ELRP.

There were several important operational details that were not addressed explicitly in the Phase III Implementation Order or the Clarification Order. The SWE, TUS, and EDCs have discussed these issues collectively and reached consensus on the following clarifications:

- To support wholesale energy market operations, PJM provides an hourly load forecast online that is updated every 15 minutes.[29] A subset of the 96 daily forecasts are archived by PJM.[30] EDCs should use the 9:45 a.m. forecast as the forecast of record when determining whether the following day will be an Act 129 DR event or not.

[29] http://www.pjm.com/markets-and-operations/energy/real-time/7-day-load-forecast.aspx

[30] http://www.pjm.com/markets-and-operations/ops-analysis/historical-load-forecasts.aspx

- The 96% threshold and resulting Act 129 event dispatch determinations will rely solely on Table B-1 of the January PJM Load Forecast Report called for in the Phase III Clarification Order.

- Act 129 DR events are limited to non-holiday weekdays.

Compliance targets for DR programs were established at the system level, which means the load reductions measured at the customer meter must be escalated to reflect transmission and distribution losses. The peak demand impacts presented in this section have been adjusted for line losses.

3.13.1 Participation and Reported Savings by Customer Segment

Table 128 presents the participation counts, reported peak demand savings, and EDC expenditures for the LCL program in PY10 by customer segment.

Table 128: LCL Participation and Reported Impacts

Parameter	Small C&I (Non-GNI)	Large C&I (Non-GNI)	GNI	Total
PYTD # Participants	19	76	23	118
PYRTD MW/yr	0.64	48.35	2.34	51.34
PY10 Incentives ($1,000)	$15	$897	$48	$960

Source: Navigant analysis.

3.13.2 Gross Impact Evaluation

This section of the report provides a summary of Navigant's approach for evaluating impacts in PY10, and some interim outputs (i.e., impacts by strata).

Navigant used two different approaches for estimating program impacts on a customer-by-customer basis:

- **CBL:** The standard 4-of-5 CBL with an optional weather sensitivity adjustment (WSA).[31] This is the approach used by the CSP for determining settlement.

- **Regression:** A single-customer linear regression, selected from a set of 33 model specifications estimated on five datasets.

The approach selected for each customer was determined based on the testing procedure described in the evaluation plan and approved by the SWE. This is also described below.

The remainder of this section is divided into the following three subsections:

- **Testing and Selection of Appropriate Impact Estimation Approach.** A summary of the test regime used by Navigant to determine which of two potential evaluation approaches is most appropriate for each participating customer.

- **Impact Estimation.** Details of the two approaches to be used for estimating impacts.

[31] PJM, *Weather Sensitive Adjustment Using the WSA Factor Method.*
See "Example 3" in this document for a detailed example of how the factors are applied.

- **Impact Findings and Lessons.** Summary tables of impacts by approach type, lessons learned, and additional actions to be taken for the next year's program evaluation.

Testing and Selection of Appropriate Impact Estimation Approach
Navigant selected hold-out test (HOT) or simulated event dates. The testing protocol ranks the accuracy of the alternative approaches based on how accurately those approaches can predict baseline demand on days when baseline demand is observed—days on which no Act 129 events take place. The approach that most successfully predicts actual customer demand during HOT dates was the one applied to that customer for the evaluation of PY10 impacts.

The test procedure is as follows:

Step 1: Select HOT Event Dates
HOT event days will be selected based on the PJM day-ahead forecast in consultation with the SWE. The HOT event days are the 3 days in the given summer:

- With the highest day-ahead PJM demand forecast
- In which the given participant did not participate in PJM Economic or Emergency DR
- In which there is no apparent response to PJM 5CP pricing[32]
- Excluding days in which participants received notification of a true Act 129 event

The purpose of these exclusions is to remove the potential confounding effects of other non-baseline customer behavior in reaction to market or program signals. The HOT days selected for one participant may be very different from those selected for another participant (e.g., one participant may participate in PJM DR, and another may not).

Step 2: Estimate Baselines Using CBL
For each HOT event and participant pair, a baseline is estimated using the 4-of-5 CBL with and without the WSA. For the purposes of this testing, only the HOT event day for which the baseline is being calculated is considered an event for the purposes of the qualification rules. This allows the CBL being tested to still take advantage of the information in proximate, similar non-event days to help develop the baseline.

Step 3: Estimate Baselines Using Regression
For each HOT event and participant pair, a baseline[33] is estimated using each of the regression specifications nominated for testing. Each regression will be re-estimated 3 times for each customer, once for each HOT event.

A HOT event will only be considered an event for testing purposes if it is the accuracy of the regression's prediction for that event that is being tested. For example: if July 12 and July 13 both qualify as HOT events, the regression equation estimated in order to predict the July 12 baseline will not exclude or dummy-out the event on July 13. Likewise, the regression equation estimated to predict the July 13 HOT

[32] Determined through visual inspection and comparison of the candidate day load-profile with proximate day profiles, in consultation with the SWE. Although 5CP days are not explicitly dropped when estimating regressions, it is important that they be dropped from HOT event days since leaving them in may bias the model testing process toward a lower, less accurate, baseline.

[33] In this case the baseline is defined by the predicted values output by the estimated equation when the variable values for the event dummy variables $C_{c,t}$ are set to zero.

event will not exclude or dummy-out the July 12 HOT event. This allows the regression being tested to still take advantage of the information in proximate, similar non-event days to help develop the baseline.

Step 4: Calculate Mean Absolute Error by Approach and Customer and Select Approach
For a given customer, the mean absolute error is calculated for the simulated event period on the HOT event day. The approach (CBL or regression) that delivers the lowest mean absolute error for a given customer will be selected as the approach used to estimate that customer's DR impacts.

Impact Estimation
This section outlines the impact estimation approach. Navigant uses one of two approaches for estimating impacts for each customer (selected based on the testing procedure above): either the 4-of-5 CBL with optional WSA, or an individual customer regression.

CBL
The CSP CBL that was tested is a standard 4-of-5 CBL supplemented with an optional WSA factor to account for differences in weather on the event days and on the days included in the CBL look-back window. The baseline is estimated in following fashion:

1. **Remove Non-Qualifying Days.** Remove all weekends and public holidays, Act 129 event days, and, as per Section 6.2.2.1.5 of the Phase III Evaluation Framework, all PJM Emergency and Economic events.

2. **Identify Look-Back Window.** Identify the 5-day window of qualifying days preceding the event.

3. **Calculate Non-Event Day Demand in Event Window.** Calculate the average participant demand during the event window (e.g., 1 p.m. to 5 p.m.) for each of the 5 qualifying non-event days in the look-back window. This delivers five averages, one for each day.

4. **Drop Low Day**. Drop the non-event day with the lowest average event window demand.

5. **Calculate Unadjusted CBL.** The event-specific CBL—the baseline—values are estimated to be the average demand, by hour of day, in the 4 non-event days not dropped from within the look-back window.

6. **Apply WSA Factors and Adjust Baseline**. Use the approach outlined in detail in Example 2 of the PJM WSA document to account for differences between average non-event-day look-back window temperature and event-day temperature.

7. **Calculate Impacts**. Impacts are the difference between the adjusted baseline and the actual demand during the event hours in which the given customer participated (i.e., did not opt out).

Linear Regression
Navigant used hourly meter-level data for all participants.[34] Where multiple meters were provided for a single customer, data were aggregated to a single time-series. The estimation set included only demand observations on non-holiday weekdays in the months of April through September. Each event's notification day was also filtered out of the data. None of the LCL participants were also participants in the PJM Economic DR program in PY10, but had some been subject to these events, the days on which those events occurred (for the given customer) would also have been dropped.

[34] Data were provided at quarter-hour frequency, but to match the frequency of the impacts reported by the CSP all of the analysis took place at the hourly level.

Navigant tested 33 regression model specifications on five datasets and selected the model and data that provided the most accurate baseline for each customer. All regression model specifications build upon a base regression model, shown in Equation 4 :

Equation 4: LCL Base Regression

$$y_t = \alpha + \sum_{h=1}^{24} \beta_{h,1} hour_{h,t} + \sum_{m=4}^{9} \sum_{h=1}^{24} \beta_{h,m,2} hour_{h,t} month_{m,t} + \sum_{d=1}^{5} \sum_{h=1}^{24} \beta_{h,d,3} hour_{h,t} DoW_{d,t} + \sum_{c=1}^{C} \gamma_c C_{c,t} + \varepsilon_t$$

Where:

y_t = The given customer's demand in hour of sample *t*.

$hour_{h,t}$ = Twenty-four dummy variables capturing the hours of the day. Equal to one where hour *t* is the *q*-th hour of the day, and zero otherwise.

$month_{m,t}$ = Six dummy variables capturing the month. Equal to one when hour of sample *t* falls in month *m*, and zero otherwise.

$DoW_{d,t}$ = Five dummy variables capturing the day of the week. Equal to one when hour of sample *t* falls in day of the week *d* and zero otherwise.

$C_{c,t}$ = C number of dummy variables that capture the individual event periods for which the given customer meter participated.[35] The number of variables is equal to the number of hourly periods in which the given participant meter elected to participate in Act 129 events.
Equal to one when hour of sample *t* falls in the *c*-th event hour of the summer of 2019 and zero otherwise. Each dummy variable takes a value of one only once in the time series.

α, β, γ = Are all uniquely estimable parameters of the regression equation estimating (in each case) the conditional mean effect of the variable to which it is attached on the dependent variable y_t.

Additional Variables

Navigant tested specifications that include the following additional variables.

cdh_t = Cooling degree hours (base – 65 F) observed in the hour in which hour *t* falls. This variable is represented as "cdh" in the table below.

$spline_{s,t}$ = A set of *S* dummy variables acting as a temperature spline to be applied in a manner similar to that outlined in PJM Manual 19.[36] The cdh_t value interacted with the spline (see table below) in the equation is the difference between the observed CDH and the lower threshold of the given spline, or zero (whichever is higher).

For example, where *S* is equal to two, cdh_t is equal to 30 and the spline threshold is equal to 20, $spline_{1,t}$ would take a value of one (dummy) and be multiplied by 20, and $spline_{2,t}$ would also take a value of one (dummy) and be multiplied by 10 (30 minus 20). Spline breaks are determined based on the distribution of average event-window

[35] As per the memorandum from the Phase III SWE team of 2017-04-26 ("Frequently Asked Questions Regarding Act 129 Demand Response"), participating meters may elect to participate for only some of the event hours, providing they submit their planned participation prior to the beginning of an event.

[36] PJM Manual 19, *Load Forecasting and Analysis Revision 32*, Section 3.4
https://www.pjm.com/-/media/documents/manuals/m19.ashx

cdh_t values observed in summer under analysis. This variable is represented as "spline" in the table below.

$EMA6cdh_t$ = An exponential moving average of cdh_t observed in the six-hour period leading up to, and including, hour *t*. This variable is represented as "ema_6_cdh" in the table below.

$EMA24cdh_t$ = Identical to $EMA6cdh_t$, except for 24, instead of, six hours. This variable is represented as "ema_24_cdh" in the table below.

$daLMP_t$ = The day-ahead PJM forecast of the locational marginal price (LMP) of power for hour *t*. This variable is represented as "da_lmp" in the table below.

$rtLMP_t$ = The real-time PJM LMP for hour *t*. This variable is represented as "rt_lmp" in the table below.

Table 129 provides the 32 model specifications that are tested for each participant, in addition to the core "base" model shown in Equation 4. All variables shown in Table 129 are added to the base model for testing.[37] Interactions of multiple variables are represented as multiplications (e.g., "cdh*hour").

[37] For example, Spec #1 would include all the variables listed in Equation 4, but would also include an interaction between the hourly dummies and the cooling degree hour term.

Table 129: Incremental Variables to be Tested

Spec #	Var1	Var2	Var3	Var4
1	cdh*hour			
2	cdh*hour*spline			
3	cdh*hour	ema_6_cdh*hour		
4	cdh*hour*spline	ema_6_cdh*hour		
5	cdh*hour*spline	ema_6_cdh*spline		
6	cdh*hour	ema_24_cdh*hour		
7	cdh*hour*spline	ema_24_cdh*hour		
8	cdh*hour*spline	ema_24_cdh*hour*spline		
9	cdh*hour		hour*month*cdh	hour*dow*cdh
10	cdh*hour*spline		hour*month*cdh	hour*dow*cdh
11	cdh*hour	ema_6_cdh*hour	hour*month*cdh	hour*dow*cdh
12	cdh*hour*spline	ema_6_cdh*hour	hour*month*cdh	hour*dow*cdh
13	cdh*spline*hour	ema_6_cdh*spline	hour*month*cdh	hour*dow*cdh
14	cdh*hour	ema_24_cdh*hour	hour*month*cdh	hour*dow*cdh
15	cdh*hour*spline	ema_24_cdh*hour	hour*month*cdh	hour*dow*cdh
16	cdh*hour*spline	ema_24_cdh*hour*spline	hour*month*cdh	hour*dow*cdh
17	cdh*hour		hour*month*cdh*spline	hour*dow*cdh*spline
18	cdh*hour*spline		hour*month*cdh*spline	hour*dow*cdh*spline
19	cdh*hour	ema_6_cdh*hour	hour*month*cdh*spline	hour*dow*cdh*spline
20	cdh*hour*spline	ema_6_cdh*hour	hour*month*cdh*spline	hour*dow*cdh*spline
21	cdh*spline*hour	ema_6_cdh*spline	hour*month*cdh*spline	hour*dow*cdh*spline
22	cdh*hour	ema_24_cdh*hour	hour*month*cdh*spline	hour*dow*cdh*spline
23	cdh*hour*spline	ema_24_cdh*hour	hour*month*cdh*spline	hour*dow*cdh*spline
24	cdh*hour*spline	ema_24_cdh*hour*spline	hour*month*cdh*spline	hour*dow*cdh*spline
25	da_lmp*hour			
26	da_lmp*hour	cdh*hour		
27	da_lmp*hour	cdh*hour	ema_6_cdh*hour	
28	da_lmp*hour	cdh*hour	ema_24_cdh*hour	
29	rt_lmp*hour			
30	rt_lmp*hour	cdh*hour		
31	rt_lmp*hour	cdh*hour	ema_6_cdh*hour	
32	rt_lmp*hour	cdh*hour	ema_24_cdh*hour	

Source: Navigant analysis.

Data Exclusions

All 33 model specifications above (the core/base model and 32 additions) exclude from the estimation dataset:

- Weekends and holidays
- Days in which the given participant also participated in PJM's Economic or Emergency DR events
- Days on which participants are notified of Act 129 events

Data from the months April through September are included in the regression.

In addition to the exclusions above, Navigant tested the following exclusions for all model specifications:

- Excluding all non-event days in which the average customer demand during the typical event window (12 p.m.–8 p.m., EDT) is in the bottom:
    - 10% of the distribution
    - 20% of the distribution
    - 30% of the distribution
    - 40% of the distribution

Each of these exclusions is applied after the other exclusions. For example, if there are 140 days in the period of interest, and 40 are dropped due to the exclusion rules that apply to all regressions, then the sub-set in the first sub-bullet immediately above (bottom 10% of days dropped) that is included in the estimation will be 90 days (90% of 140 minus 40).

For every customer, 165 different sets of parameters are estimated—33 specifications, once with no additional exclusions, and 4 times with different exclusion rules.

Impact Findings and Lessons Learned
The reported and verified impacts grouped by the two approaches are summarized in Table 130 and Table 131. These are followed by a discussion of the factors driving the realization rate. Navigant recommends using the same evaluation methodology for the PY11 evaluation.

Table 130: Large Curtailable Load Program Gross Impact Evaluation Design for PY10

Stratum	Population Size	PYRTD MW	Evaluation Approach
CBL	11	16.97	4-of-5 CBL with optional WSA Adjustment
Regression[38]	107	34.37	Linear regression
Program Total	**118**	**51.34**	

Source: Navigant analysis.

Table 131: LCL Gross Impact Results for Demand

Stratum	PYRTD MW	Demand Realization Rate	PYVTD MW	Relative Precision at 90% C.L.
CBL	16.97	101%	17.12	26.0%
Regression[39]	34.37	103%	35.53	5.8%
Program Total	**51.34**	**103%**	**52.65**	**9.3%**

*This represents the error from the baseline uncertainty of the DR analysis. This does not represent sampling error.
Source: Navigant analysis.

The difference between the reported and verified impacts is driven by two key factors. First, reported impacts are based on the CSP calculations, using a 4-of-5 CBL with optional WSA, whereas Navigant tested a set of regression models in addition to the two CBLs and selected the method providing the most

[38] The strata were defined by Navigant based on the testing protocol above. Reported impacts, calculated by Duquesne Light's CSP are all estimated using a 4-of-5 CBL (most with a WSA adjustment). The CSP did not estimate impacts using regression analysis.
[39] See previous footnote.

accurate baseline. In cases when a CBL was the winning method, Navigant's impacts prior to adjusting for line losses were 0.5% lower than CSP-reported impacts. This difference occurs when the most accurate baseline included the WSA and the CSP baseline did not, or vice versa. In cases when a regression was the winning method, Navigant's impacts prior to adjusting for line losses were 2.5% lower than CSP-reported impacts. In aggregate, the regression-based baselines were slightly lower than the baselines used by the CSP.

The second factor driving differences between the reported and verified impacts is the application of line loss factors (LLFs). The CSP-reported impacts do not include line losses. Navigant applied a commercial LLF of 1.0741 and an industrial LLF of 1.0081, depending on the participant. Verified impacts increased by approximately 4.5% after applying the LLFs.

3.13.3 Process Evaluation

Navigant did not conduct process evaluation research for LCL during PY10.

3.13.4 Cost-Effectiveness Reporting

A detailed breakdown of program finances and cost-effectiveness is presented in Table 132. TRC benefits in Table 132 were calculated using gross verified impacts. NPV PYTD costs and benefits are expressed in 2018 dollars. NPV costs and benefits for P3TD financials are discounted back to 2016.

Table 132: Summary of LCL Finances – Gross Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$960		$1,449	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-$240		-$362	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$720		$1,087	
		EDC	**CSP**	**EDC**	**CSP**
5	Design & Development [2]	$0	$0	$5	$44
6	Administration, Management, and Technical Assistance [3]	$11	$59	$114	$282
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$10	$850	$16	$1,695
9	EDC Evaluation Costs	$100		$201	
10	SWE Audit Costs	$40		$142	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$1,070		$2,499	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$1,790		$3,586	
14	Total NPV Lifetime Electric Energy Benefits	$0		$0	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
15	Total NPV Lifetime Electric Capacity Benefits	$5,611	$9,820
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0	$0
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0	$0
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$5,611	$9,820
19	**TRC Benefit-Cost Ratio [8]**	**3.13**	**2.74**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

Table 133 presents program financials and cost-effectiveness on a net savings basis.

Table 133: Summary of LCL Finances – Net Verified

Row #	Cost Category	PYTD ($1,000)		P3TD ($1,000)	
1	EDC Incentives to Participants [1]	$960		$1,449	
2	EDC Incentives to Trade Allies	$0		$0	
3	Participant Costs (net of incentives/rebates paid by utilities)	-$240		-$362	
4	**Incremental Measure Costs (Sum of rows 1 through 3)**	$720		$1,087	
		EDC	**EDC**	**CSP**	**EDC**
5	Design & Development [2]	$0	$0	$5	$44
6	Administration, Management, and Technical Assistance [3]	$11	$59	$114	$282
7	Marketing [4]	$0	$0	$0	$0
8	Program Delivery [5]	$10	$850	$16	$1,695
9	EDC Evaluation Costs	$100		$201	
10	SWE Audit Costs	$40		$142	
11	**Program Overhead Costs (Sum of rows 5 through 10)**	$1,070		$2,499	
12	NPV of increases in costs of natural gas (or other fuels) for fuel switching programs	$0		$0	
13	**Total NPV TRC Costs [6] (Net present value of sum of rows 4, 11, and 12)**	$1,790		$3,586	

Row #	Cost Category	PYTD ($1,000)	P3TD ($1,000)
14	Total NPV Lifetime Electric Energy Benefits	$0	$0
15	Total NPV Lifetime Electric Capacity Benefits	$5,611	$9,820
16	Total NPV Lifetime Operation and Maintenance (O&M) Benefits	$0	$0
17	Total NPV Lifetime Non-Electric Benefits (Fossil Fuel, Water)	$0	$0
18	**Total NPV TRC Benefits [7] (Sum of rows 14 through 17)**	$5,611	$9,820
19	**TRC Benefit-Cost Ratio [8]**	**3.13**	**2.74**

[1] Includes direct install equipment costs.

[2] Includes direct costs attributable to plan and to advance the programs.

[3] Includes rebate processing, tracking system, general administration, program management, general management and legal, and technical assistance. Any common portfolio costs that are allocated across programs should be shown in this row.

[4] Includes the marketing CSP and marketing costs by program CSPs.

[5] Direct program implementation costs. Labor, fuel, and vehicle operation costs for appliance recycling and direct install programs.

[6] Total TRC Costs includes Total EDC Costs and Participant Costs.

[7] Total TRC Benefits equals the sum of Total Lifetime Electric and Non-Electric Benefits. Benefits include: avoided supply costs, including the reduction in costs of electric energy, generation, transmission, and distribution capacity, and natural gas valued at marginal cost for periods when there is a load reduction. NOTE: Savings carried over from Phase II are not to be included as a part of Total TRC Benefits for Phase III.

[8] TRC Ratio equals Total NPV TRC Benefits divided by Total NPV TRC Costs.

Source: Navigant analysis.

3.13.5 Status of Recommendations

The PY10 impact evaluation activities led to the following finding and recommendation, along with a summary of how Duquesne Light plans to address the recommendation in program delivery.

Finding:
A single customer provided 29 percent of the achieved DR in PY10. This means that DR program impacts will be very sensitive to the performance of this single customer, potentially exposing Duquesne Light to risk; should this participant exit the program Duquesne Light may have difficulty reaching its annual Act 129 target. Navigant made a similar recommendation during PY9 where a single customer provided over half of the achieved DR for that year.

Recommendation:
Navigant makes a recommendation similar to the one made in PY9 to Duquesne Light: either continue to satisfy itself that the risk of changing operations by a very large program contributor is very small, or actively recruit additional participants to assure itself of a more diverse portfolio of large power users contributing DR. Navigant makes this recommendation while also acknowledging that the risk identified in PY9 has been mitigated (i.e., the single largest participant's contribution reduced from over half to 29 percent of DR annual achievements and participation increase from 74 to 118 customers).

Duquesne Light Status Report:
As seen by the results, Duquesne Light took PY9 recommendation for PY10. Duquesne Light continues to monitor this program's performance.

4. PORTFOLIO FINANCES AND COST RECOVERY

This section provides an overview of the expenditures associated with Duquesne Light's portfolio and the recovery of those costs from ratepayers.

4.1 Program Finances

Program-specific and portfolio total finances for PY10 are shown in Table 134. The columns in Table 134 and Table 135 are adapted from the Direct Program Cost categories in the Commission's EE&C Plan template[40] for Phase III. EDC Materials, Labor, and Administration includes costs associated with Duquesne Light's own employees. Implementation Conservation Service Provider (ICSP) Materials, Labor, and Administration includes both the program implementation contractor and the costs of any other outside vendors employed by Duquesne Light to support program delivery. The dollar figures shown in Table 134 and Table 135 are based on Duquesne Light tracking of expenditures with no adjustments to account for inflation.[41]

Table 134: PY10 Program and Portfolio Total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
REEP: Residential Energy Efficiency[42]	$1,083	$92	$2,175	$151	$3,500
Residential Appliance Recycling	$90	$31	$353	$13	$487
Residential Behavioral Savings	$0	$36	$41	$20	$97
Residential Whole House Retrofit	$0	$35	$33	$12	$80
Low-Income Energy Efficiency	$633	$40	$735	$62	$1,470
Express Efficiency	$812	$43	$771	$91	$1,718
Small/Medium Midstream Lighting	$97	$34	$101	$29	$261
Small Commercial Direct Install*	$0	$33	$557	$48	$667
Multifamily Housing Retrofit*	$332	$34	$231	$44	$631
Commercial Efficiency	$1,045	$40	$976	$94	$2,155
Large Midstream Lighting	$129	$38	$91	$69	$327
Industrial Efficiency	$238	$46	$1,001	$156	$1,441
Public Agency Partnership	$769	$37	$734	$86	$1,626

[40] http://www.puc.pa.gov/pcdocs/1372426.doc Section 10

[41] The cost-recovery of program expenses through riders generally happens promptly so that costs are being recovered from ratepayers in the same dollars that they are incurred.

[42] Duquesne Light combines financial related information here for the two programs 1) REEP: Residential Energy Efficiency and 2) REEP: Residential Energy Efficiency (Upstream Lighting) under REEP: Residential Energy Efficiency. Otherwise, energy and demand impacts are reported separately for these two programs.

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Community Education	$262	$12	$247	$20	$541
Large C&I DR Curtailable	$960	$21	$909	$100	$1,990
Common Portfolio Costs[43]					
Portfolio Total	**$6,440**	**$572**	**$8,984**	**$995**	**$16,991**
SWE Costs[44]	**N/A**	**N/A**	**N/A**	**N/A**	**$400**
Total	**$6,440**	**$572**	**$8,984**	**$995**	**$17,391**

*In the July 15, 2019 Preliminary Annual Report, $159 of incentives were incorrectly allocated to SCDI. These costs are moved and added to MFHR incentives.

Source: Navigant analysis.

Program-specific and portfolio total finances since the inception of Phase III are shown in Table 135.

Table 135: PY3TD Program and Portfolio Total Finances ($1,000)

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
REEP: Residential Energy Efficiency[45]	$4,054	$455	$7,381	$330	$12,220
Residential Appliance Recycling	$221	$99	$892	$30	$1,242
Residential Behavioral Savings	$0	$116	$515	$44	$675
Residential Whole House Retrofit	$0	$113	$230	$27	$370
Low-Income Energy Efficiency	$633	$182	$2,028	$137	$2,980
Express Efficiency	$1,621	$595	$1,839	$217	$4,272
Small/Medium Midstream Lighting	$288	$120	$188	$63	$659
Small Commercial Direct Install*	$0	$137	$2,984	$106	$3,227
Multifamily Housing Retrofit*	$372	$136	$661	$97	$1,266
Commercial Efficiency	$1,677	$197	$2,056	$208	$4,138
Large Midstream Lighting	$356	$168	$627	$151	$1,302
Industrial Efficiency	$1,152	$271	$2,146	$344	$3,913

[43] Common Portfolio Costs include costs associated with program tracking data management, support (legal, IT), and portfolio level marketing.

[44] Statewide Evaluation costs are outside of the 2% spending cap

[45] Duquesne Light combines financial related information here for the two programs 1) REEP: Residential Energy Efficiency and 2) REEP: Residential Energy Efficiency (Upstream Lighting) under REEP: Residential Energy Efficiency. Otherwise, energy and demand impacts are reported separately for these two programs.

Program	Incentives to Participants and Trade Allies	EDC Materials, Labor, and Administration	ICSP Materials, Labor, and Administration	EM&V	Total Cost
Public Agency Partnership	$1,154	$183	$1,924	$190	$3,451
Community Education	$428	$49	$717	$44	$1,238
Large C&I DR Curtailable	$1,611	$145	$2,192	$220	$4,168
Common Portfolio Costs[46]					
Portfolio Total	**$13,567**	**$2,966**	**$26,380**	**$2,208**	**$45,121**
SWE Costs[47]	**N/A**	**N/A**	**N/A**	**N/A**	**$1,505**
Total	**$13,567**	**$2,966**	**$26,380**	**$2,208**	**$46,626**

*In the July 15, 2019 Preliminary Annual Report, $159 of incentives were incorrectly allocated to SCDI. These costs are moved and added to MFHR incentives.

Source: Navigant analysis.

Act 129 allows Pennsylvania EDCs to recover EE&C Plan costs through a cost-recovery mechanism. Duquesne Light's cost-recovery charges are organized separately by five customer sectors to ensure that the electric rate classes that finance the programs are the rate classes that receive the direct energy and conservation benefits. Cost-recovery is governed by tariffed rate class, so it is necessarily tied to the way customers are metered and charged for electric service. Readers should be mindful of the differences between Table 136 and Section 2.4. For example, the low income customer segment is a subset of Duquesne Light's residential tariff(s) and are not listed in Table 136.

Table 136: EE&C Plan Expenditures by Cost-Recovery Category[48] ($1,000)

Cost Recovery Sector	Rate Classes Included	PYTD Spending	P3TD Spending
Residential	RS, RH, RA	$5,738	$17,865
Small/Medium Commercial	GS, GM, GMH	$3,392	$9,745
Small/Medium Industrial	GM, GMH	$647	$1,427
Large Commercial	GL, GLH, L	$4,110	$8,853
Large Industrial	GL, GLH, L, HVPS	$3,504	$8,736
Portfolio Total		**$17,391**	**$46,626**

Source: Navigant analysis.

Certain PY10 costs are reallocated to reflect the portion of Upstream Lighting program LEDs being installed in non-residential sockets. As a result, Table 134 through Table 136 differ from the versions shown in the July Preliminary Final report. Specifically, $200 were moved from Residential to Small/Medium Commercial. Details are provided in Appendix A.

Additionally, $128 from PY10 were reallocated from Large Industrial to Small/Medium Industrial. Costs from the Large C&I DR Curtailable Load program were initially included in the Large Industrial sector only. Updates were made in Table 134 through Table 136 to align with some participants who are Small C&I.

[46] Common Portfolio Costs include costs associated with program tracking data management, support (legal, IT), and portfolio level marketing.

[47] Statewide Evaluation costs are outside of the 2% spending cap

[48] Includes SWE costs

APPENDIX A. UPSTREAM LIGHTING CROSS SECTOR SALES

Navigant completed in-store intercepts during PY9 to re-evaluate cross sector sales that were last updated during PY7. The results developed and reported during PY9 are also being used in this report for PY10. Based on those PY9 in-store intercept surveys, Navigant estimates that 3.7% of bulbs purchased through the Duquesne Watts Choice program (residential upstream lighting component of REEP) are installed in non-residential locations. This 3.7% estimate is based on a weighted average of responses received for standard bulbs (3.5% cross sector) and specialty bulbs (4.2% cross sector).

Table A-1 shows the results of the cross-sector sales research conducted in PY9 that inform these PY10 verified results.

Table A-1: Estimation of Percentage of LEDs Being Installed in Non-Residential Settings, Based on PY9 Intercept Survey Results

Bulb Type	Total No. of Bulbs	Total No. Respondents	Total Residential Bulbs	Total Non-Residential Bulbs	% Non-Residential
Standard LED	633	120	611	22	3.5%
Specialty LED	599	98	574	25	4.2%

Source: Navigant analysis.

All upstream lighting activities are assigned to REEP by Duquesne Light as reflected in reported savings. Lighting installed in non-residential locations, as verified by Navigant, are reassigned to the C&I Express Efficiency program, as prescribed by Duquesne Light's EE&C Plan. The realization rates in the previous program specific sections (Section 3.1 for REEP and Section 3.6 for Express Efficiency) reflect these lamp reassignments and savings adjustments related to different operating characteristics. Upstream lighting installed in non-residential locations experience higher energy savings and larger demand reductions due to longer HOU and higher coincidence factors, respectively. Table A-2 shows the final allocation of lamps and costs for upstream lighting after cross-sector installations are considered. Table A-3 shows similar allocations for energy and demand savings in addition to adjustments resulting from verification activities.

Table A-2: Final Allocations for Residential Upstream Lighting Lamps and Costs

Program	Bulb Type	Reported: Lamp Counts	Verified: Lamp Counts	Reported: Incentives ($1,000)	Verified: Incentives ($1,000)	Reported: Admin Costs ($1,000)	Verified: Admin Costs ($1,000)
REEP	Standard LED	166,569	160,780	$360	$347	$1,633	$1,466
REEP	Specialty LED	273,054	261,658	$470	$450		
Express Efficiency	Standard LED	0	5,789	$0	$13	$0	$167
Express Efficiency	Specialty LED	0	11,396	$0	$20		
Total		**439,623**	**439,623**	**$830**	**$830**	**$1,633**	**$1,633**

Source: Navigant analysis.

Table A-3: Residential Upstream Lighting Savings Summary

Program	Bulb Type	PYRTD MWh/yr	PYVTD MWh/yr	PYRTD MW/yr	PYVTD MW/yr
REEP	Standard LED	8,044	6,653	0.81	0.67
REEP	Specialty LED	12,313	13,566	1.25	1.37
Express Efficiency	Standard LED	0	1,283	0.00	0.16
Express Efficiency	Specialty LED	0	787	0.00	0.17
Total		**20,357**	**22,290**	**2.06**	**2.37**

Source: Navigant analysis.

APPENDIX B. SITE INSPECTION SUMMARY

Table B-1 provides a summary of the PY10 site visit activities carried out for the evaluation and informing these PY10 verification results.

Table B-1: PY10 Site Visit Summary

Program	Inspection Firm	Number of Inspections Conducted	Number of Sites with Discrepancies from Reported Values	Summary of Common Discrepancies
Low income WHRP	Navigant, Karpinski Engineering	15	6	Bulb and nightlight counts
Commercial Efficiency (Large Commercial)	Navigant, Karpinski Engineering	13	8	Bulb counts, HOU, control type, interaction factor, improper IMP used
Express Efficiency	Navigant, Karpinski Engineering	13	10	Bulb counts, HOU, control type, interaction factor
Industrial Efficiency (Large Industrial)	Navigant, Karpinski Engineering	9	1	Custom compressor data
Public Agency Partnership Program	Navigant, Karpinski Engineering	7	4	HOU, metered data on chiller project
Community Education	Navigant, Karpinski Engineering	7	2	HOU, interactive factor, bulb counts
TOTAL		**64**	**31**	

Source: Navigant analysis.

APPENDIX C. HER IMPACT EVALUATION DETAIL

Table C-1 through Table C-7 show the regression results details for the two waves that compose the HER program and the two waves that compose the LI HER component of LIEEP. The 2018 Low Income wave reported results for the first time in PY10.

Table C-1: Active Participant Counts by Wave

Month	2012 Market Rate	2015 Market Rate	2015 Low Income	2018 Low Income
Jun 2018	14,405	41,382	11,902	N/A
Jul 2018	14,341	41,098	11,765	3,664
Aug 2018	14,273	40,814	11,615	3,564
Sep 2018	14,210	40,494	11,459	3,473
Oct 2018	14,185	40,262	11,365	3,421
Nov 2018	14,131	40,011	11,213	3,342
Dec 2018	14,080	39,791	11,081	3,277
Jan 2019	14,045	39,638	10,997	3,233
Feb 2019	14,013	39,491	10,904	3,194
Mar 2019	13,985	39,362	10,831	3,155
Apr 2019	13,944	39,182	10,739	3,095
May 2019	13,891	38,933	10,635	3,082

Source: Navigant analysis.

Table C-2: Wave Regression Savings Details

Month	2012 Market Rate		2015 Market Rate		2015 Low Income		2018 Low Income	
	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error	Treatment Coefficient	Cluster Robust Standard Error
Jun 2018	-0.42	0.13	-0.39	0.11	-0.41	0.17	N/A	N/A
Jul 2018	-0.37	0.15	-0.44	0.11	-0.58	0.19	0.02	0.20
Aug 2018	-0.39	0.14	-0.45	0.11	-0.60	0.18	-0.02	0.20
Sep 2018	-0.36	0.13	-0.39	0.10	-0.46	0.16	-0.04	0.18
Oct 2018	-0.49	0.10	-0.39	0.08	-0.45	0.15	-0.01	0.18
Nov 2018	-0.57	0.12	-0.38	0.09	-0.54	0.19	0.01	0.25
Dec 2018	-0.76	0.14	-0.41	0.10	-0.41	0.21	0.17	0.26
Jan 2019	-0.77	0.15	-0.41	0.11	-0.44	0.22	0.22	0.27
Feb 2019	-0.68	0.16	-0.41	0.11	-0.54	0.22	0.30	0.28
Mar 2019	-0.60	0.13	-0.38	0.10	-0.67	0.20	0.22	0.24
Apr 2019	-0.53	0.09	-0.38	0.08	-0.49	0.14	-0.15	0.17
May 2019	-0.56	0.10	-0.44	0.08	-0.31	0.14	-0.24	0.15

Source: Navigant analysis.

Table C-3: Wave Regression Savings Percent Details

Month	2012 Market Rate		2015 Market Rate		2015 Low Income		2018 Low Income	
	Treatment Coefficient	Absolute Precision	Treatment Coefficient	Absolute Precision	Treatment Coefficient	Absolute Precision	Treatment Coefficient	Absolute Precision
Jun 2018	1.03%	0.62%	1.21%	0.65%	1.58%	1.28%	N/A	N/A
Jul 2018	0.81%	0.63%	1.25%	0.63%	1.99%	1.26%	-0.08%	1.53%
Aug 2018	0.90%	0.63%	1.32%	0.63%	2.13%	1.26%	0.06%	1.59%
Sep 2018	0.95%	0.65%	1.34%	0.65%	1.89%	1.28%	0.19%	1.58%
Oct 2018	1.69%	0.67%	1.74%	0.68%	2.13%	1.36%	0.05%	1.80%
Nov 2018	1.85%	0.80%	1.65%	0.79%	2.24%	1.55%	-0.05%	2.16%
Dec 2018	2.21%	0.79%	1.62%	0.79%	1.58%	1.58%	-0.69%	2.07%
Jan 2019	2.17%	0.84%	1.58%	0.82%	1.59%	1.59%	-0.83%	2.02%
Feb 2019	2.01%	0.90%	1.64%	0.85%	2.00%	1.62%	-1.14%	2.12%
Mar 2019	2.05%	0.90%	1.76%	0.90%	2.87%	1.70%	-1.01%	2.11%
Apr 2019	2.19%	0.77%	2.09%	0.82%	2.67%	1.51%	0.88%	1.93%
May 2019	2.09%	0.76%	2.13%	0.80%	1.68%	1.45%	1.38%	1.76%

Source: Navigant analysis.

Table C-4: Wave Monthly Regression Savings (MWh/yr)*

Month	2012 Market Rate	2015 Market Rate	2015 Low Income	2018 Low Income
Jun 2018	183.00	478.15	145.99	N/A
Jul 2018	164.72	564.02	211.04	-2.36
Aug 2018	173.10	569.26	214.94	1.67
Sep 2018	152.17	470.41	158.83	4.45
Oct 2018	215.28	483.09	158.26	0.95
Nov 2018	240.97	457.75	181.12	-1.16
Dec 2018	333.19	506.34	141.22	-17.36
Jan 2019	334.28	504.02	148.89	-22.03
Feb 2019	267.09	449.88	163.63	-26.56
Mar 2019	258.61	458.67	223.73	-21.72
Apr 2019	221.30	449.43	156.96	14.00
May 2019	242.07	529.38	102.16	22.61

*Savings are prior to any overlap adjustments or reassignments for low income identification.
Source: Navigant analysis.

Navigant estimated negative total savings for the 2018 LI HER wave, and the result was not statistically different from zero at the 95% confidence level. This wave had unique properties that factored into the lack of detectable savings.

The 2018 LI HER was the newest wave in the program, having been active for 11 months at the end of PY10. HER program savings typically take 12-18 months before they begin to fully realize savings. Customers in this wave also had the lowest average daily usage, as show in Table C-5, leaving less room for potential savings. This was the smallest wave with 3,318 participants (based on PY10 billing data), resulting in increased uncertainty due to the small sample size.

Table C-5: Wave Average Daily Use

Wave	Average Daily Use (kWh)
2012 Market Rate	33.5
2015 Market Rate	25.3
2015 Low Income	24.0
2018 Low Income	22.8

Source: Navigant analysis.

To the extent that the HER waves increase participation in other solutions, some savings from the evaluation's regression analysis could be double counted if appropriate adjustments are not made. Double counting can be avoided for downstream programs that track participation at the customer level by generating estimates of uplift—that is, the increase in participation in the given program among HER participants. This is also known as the overlap savings.

To generate estimates of uplift, Navigant followed the Phase III Evaluation Framework guidance on completing dual participation analyses. The Phase III Evaluation Framework conveys that exposure to the HER messaging often motivates participants to take advantage of other Duquesne Light program offerings that may be promoted through HER promotional materials. This exposure creates a situation where households in the treatment groups tend to participate in other programs at a higher rate than households in the control groups. The Phase III Evaluation Framework methodology calls for program-specific uplift calculations, and the SWE requests those values be reported.

Navigant estimated aggregate uplift across residential programs. From a theoretical standpoint, the program uplift, which is associated with suggestions provided in the HERs, may be allocated to either the Behavioral program (or LIEEP for the LI HER waves) or the other program involved in its realization since the savings would not have occurred in the absence of either program. However, the

industry standard approach is to subtract the amount of the overlap savings from the Behavioral program savings; Navigant followed this approach. This approach is also consistent with the detailed methodology described in Section 6.1.1.8.1 of the Phase III Evaluation Framework.

Navigant calculated downstream overlap savings using reported values from other Duquesne Light energy efficiency programs. If those savings exceeded 5% of gross verified HER savings, Navigant examined downstream overlap savings at the program and measure level. If a single program, initiative, or measure exceeded 20% of total downstream double counted savings and the realization rate for the applicable measure(s) was outside the range of 90% to 110%, Navigant used the verified savings values (rather than reported savings values) for the applicable measure(s) in the downstream overlap savings calculation. For PY10, verified savings values were applied for energy efficiency kits.

Navigant's overlap analysis also accounts for upstream programs, in particular the upstream lighting component of REEP. The calculation of overlap savings from upstream programs is complicated by the fact that participation is not tracked at the customer level and the approaches described previously for specific homes are infeasible. Per Section 6.1.1.8.2 of the Phase III Evaluation Framework, the team used the Framework's assumed upstream reduction factor dependent on the number of years of activity for the given wave. That reduction factor was subtracted from the estimate of energy savings for each wave after downstream overlap savings had been removed.

Table C-6 shows the upstream reduction factors. Table C-7 shows how adjustments are applied to the regression results to arrive at the final verified savings values. Table C-7 also incorporates the market segment reclassifications for certain participants, as described in Section 3.3, in addition to demand impacts.

Table C-6: Upstream Adjustment Factors

Years Since Cohort *Inception*	Default Upstream *Reduction Factor*	Waves
1	0.75%	2018 LI
2	1.50%	-
3	2.25%	-
4 and beyond	3.00%	2012 MR, 2015 LI, 2015 MR

Source: Phase III Evaluation Framework.

Table C-7: Savings Adjustments and Final Savings

Wave	Regression Savings (MWh/yr)	Downstream Dual Participation Savings (MWh/yr)	Upstream Dual Participation Savings (MWh/yr)	Market Segment Reclassifications (MWh/yr)	Net Savings (MWh/yr)	Demand Savings (MW/yr)
2012 Market Rate	2,785.76	-413.34	-71.17	-80.54	2,220.71	0.254
2015 Market Rate	5,920.42	-1232.28	-140.64	-190.99	4,356.50	0.497
2015 Low Income	2,006.77	-249.05	-52.73	271.54	1,976.52	0.226
2018 Low Income	-47.53	-37.27	0.64	0.00	-84.17	-0.010

Source: Navigant analysis.

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