



# ComEd Public Sector Free Lights Program Impact Evaluation Report

Energy Efficiency / Demand Response Plan:  
Plan Year 9 (PY9) Bridge Period  
(June 2, 2017 – December 31, 2017)

Presented to  
Commonwealth Edison Company

**DRAFT**

*July 19, 2018*

***Prepared by:***

Peter Vigilante  
Navigant Consulting, Inc.

Charles Ampong  
Navigant Consulting, Inc.

[www.navigant.com](http://www.navigant.com)

**Submitted to:**

ComEd  
Three Lincoln Centre  
Oakbrook Terrace, IL 60181

**Submitted by:**

Navigant Consulting, Inc.  
150 N. Riverside, Suite 2100  
Chicago, IL 60606

**Contact:**

Randy Gunn, Managing Director  
312.583.5714  
Randy.Gunn@Navigant.com

Jeff Erickson, Director  
608.497.2322  
Jeff.Erickson@Navigant.Com

Rob Neumann, Associate Director  
312.583.2176  
Rob.Neumann@Navigant.com

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## 1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd’s Free Lights Program for the PY9 bridge period, June 1, 2017 through December 31, 2017. It presents a summary of the energy and demand impacts for the total program and broken out by relevant measure and program structure details. The appendix presents the impact analysis methodology.

## 2. PROGRAM DESCRIPTION

The ComEd Free Lights Program supplies free lighting retrofits to nonresidential public-sector building customers, qualified by either the DesignLights Consortium or ENERGY STAR. If an applicant is accepted to the Free Lights program, lighting products are ordered by the customers through a web-based application form on the Grainger website. The ordered lights are then delivered to the respective nonresidential public-sector building. Grainger only supplies the lighting fixtures and controls for the program. The Free Lights program was implemented by ICF during the PY9 bridge period.

## 3. IMPACT ANALYSIS DETAIL

The primary objective of the evaluation of the Public Sector Free Lights Program is to verify the claimed delivery of energy savings. The evaluation is for the PY9 bridge period of June 1, 2017 to December 31, 2017.

## 4. PROGRAM SAVINGS

The PY9 participant details are shown in Table 4-1. All 47 PY9 Free Lights projects were installed during the bridge period. The Free Lights tracking system did not include all bridge period program measures. The project level measure data was only available in each specific project calculation sheet. Navigant only received 21 of the 47 specific project calculation sheets with measure level detail as part of the sampling approach to evaluate the Free Lights program. A total PY9 measures count could not be determined with no measure level detail in the program tracking data, and without conducting a census review of all 47 project calculation sheets. Total measure count is not available for these reasons.

**Table 4-1. PY9 Free Lights Volumetric Findings Detail**

Participation	PY9 Value
Installed Projects	47
Participants	18*
Total Measures	NA†

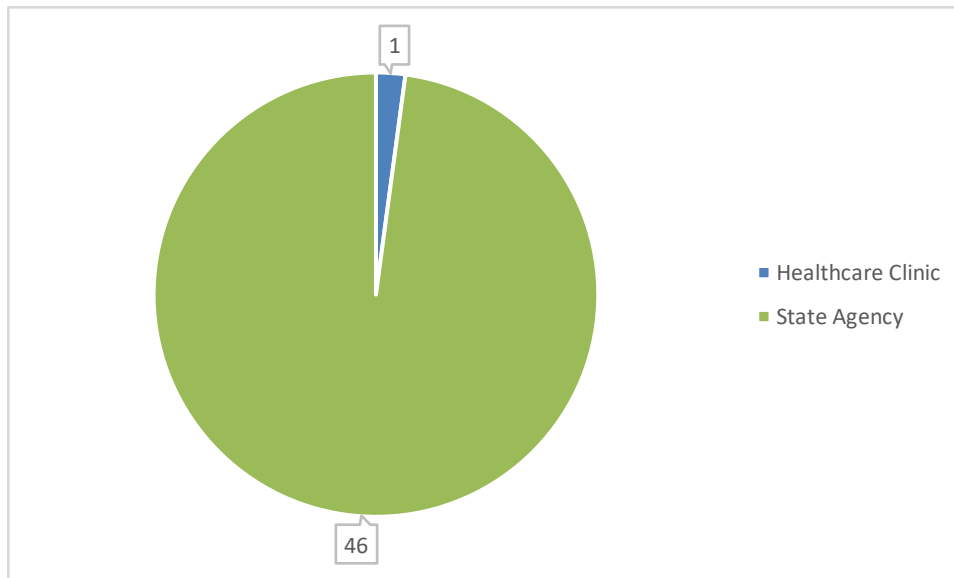
\*Determined by number of unique Contact Names

†Due to sampling evaluation methodology, all measures were not recorded

Source: ComEd tracking data and Navigant team analysis. As noted, Navigant only received 21 of the 47 project specific calculation sheets with measure level detail.

Figure 4-1 shows that 46 projects were installed in State Agency buildings and one project was installed in a healthcare clinic, which totaled 47 projects in PY9.

**Figure 4-1. Distribution of Free Lights Projects by Customer Type**



Source: Evaluation Analysis

Table 4-2 summarizes the incremental energy and demand savings the Free Lights Program achieved in the PY9 Bridge Period. The verified net energy savings were 4,965,527 kWh and net peak demand reduction of 818 kW, based on a deemed net-to-gross ratio (NTGR) of 0.96.<sup>1</sup>

**Table 4-2. Free Lights PY9 Bridge Total Annual Incremental Savings**

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Peak Demand Savings (kW)
Ex Ante Gross Savings	4,650,295	NR†	NR†
Program Gross Realization Rate	111%	NA	NA
Verified Gross Savings	5,172,424	1,702	852
Program Net-to-Gross Ratio (NTGR)*	0.96	0.96	0.96
Verified Net Savings	4,965,527	1,634	818

Source: ComEd tracking data and Navigant team analysis.

\*Navigant Memo to ComEd "Bridge Period Sector Programs' Net-to-Gross Recommendations" March 30, 2018

† Not reported - Ex ante demand savings and peak demand savings were not reported in the tracking database.

## 5. PROGRAM SAVINGS BY MEASURE

Tables 5-1 through 5-3 below present the ComEd Free Lights PY9 energy savings, demand savings, and peak demand savings by measure. Lighting fixtures and controls is the only measure line in the energy and demand savings tables because various lighting fixture types and lighting sensor controls were the only measures offered in the ComEd Free Lights Program. More specific measure-level savings was not calculated since program tracking data did not provide measure level savings and only a sample of the project files with measure level information were provided for evaluation.

<sup>1</sup> Deemed NTG value was based on a memo submitted to the SAG and ComEd by Navigant on March 30, 2018 titled "Bridge Period Public Sector Programs' Net-to-Gross Recommendation".

**Table 5-1. Free Lights PY9 Bridge Energy Savings by Measure**

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTGR*	Verified Net Savings (kWh)	Technical Measure Life	Persistence	Effective Useful Life (EUL)†
Lighting	Fixtures and Controls	4,650,295	111%	5,172,424	0.96	4,965,527	NA	NA	15

Source: ComEd tracking data and Navigant team analysis

\*Navigant Memo to ComEd “Bridge Period Sector Programs’ Net-to-Gross Recommendations” March 30, 2018

† EUL is a combination of technical measure life and persistence. EUL is assumed to be for LEDs since majority of program savings were attributed to LED fixtures.

**Table 5-2. Free Lights PY9 Bridge Demand Savings by Measure**

End Use Type	Research Category	Ex Ante Gross Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (kW)	NTGR*	Verified Net Demand Reduction (kW)
Lighting	Fixtures and Controls	NR†	NA	1,702	0.96	1,634

Source: ComEd tracking data and Navigant team analysis

\*Navigant Memo to ComEd “Bridge Period Sector Programs’ Net-to-Gross Recommendations” March 30, 2018

Source: ComEd tracking data and Navigant team analysis

†Not reported

**Table 5-3. Free Lights PY9 Bridge Peak Demand Savings by Measure**

End Use Type	Research Category	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Peak Demand Reduction (kW)	NTGR*	Verified Peak Net Demand Reduction (kW)
Lighting	Fixtures and Controls	NR†	NA	852	0.96	818

Source: ComEd tracking data and Navigant team analysis

\*Navigant Memo to ComEd “Bridge Period Sector Programs’ Net-to-Gross Recommendations” March 30, 2018

†Not reported

## 6. PROGRAM IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

### 6.1.1 Impact Parameter Estimates

Table 6-1 summarizes the parameters and references used in verified gross and net savings calculation. Navigant calculated savings for each measure following algorithms defined by the Illinois TRM version 5.0.

**Table 6-1. Verified Gross Savings Parameters**

Gross Savings Input Parameters	Value	Deemed or Evaluated?
Quantity	Varies	Evaluated
NTGR	0.96	Deemed*
LED Installations	Varies	Deemed†
Lighting Sensors	Varies	Deemed

\* ComEd\_NTG\_History\_and\_PY9\_Recommendations\_2016-02-26\_Final.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>

† State of Illinois Technical Reference Manual version 2.0 from <http://www.ilsag.info/technical-reference-manual.html>.

## 6.1.2 Other Impact Findings and Recommendations

### Impact Analysis

**Finding 1.** The PY9 Free Lights Program achieved 5,172,424 kWh verified gross energy savings with a verified gross demand reduction of 1,702 kW and verified gross peak demand reduction of 852 kW. The program’s verified gross realization rate for energy savings was 111 percent. There are no verified program gross realization rates for demand savings and peak demand savings because the program did not provide ex ante demand and peak demand values.

**Finding 2.** The high gross realization rate of 111 percent energy savings was due to several factors. There are inconsistencies within the provided project calculation sheets and documentation. For all 21 sampled projects, a calculation workbook with measure level detail was provided, as well as other project documentation such as invoices and product lists. There were multiple instances within the project calculation workbooks where the pre-installation or post-installation fixture quantity, type, or wattage would be incorrect according to supporting project documentation. Navigant updated the verified savings for all sampled projects to match the correct pre-installation and post-installation scenarios.

An example of the issue occurred in is Project 38482. The calculation used for the ex ante savings value stated that (535) 172 Watt Troffers were replaced by (535) 38 Watt Troffers. However, both the project’s revised energy savings workbook and the product list state 1,318 of these troffers were replaced. Navigant updated the 535 pre-installation and post-installation quantity values to match the revised workbook and project product list.

**Recommendation 1.** Navigant recommends that the implementer accurately calculate project level lighting savings by making sure all pre-installation and post-installation fixture types, quantities, and wattages are correct and agree with project documentation.

**Finding 3.** The high program realization rate was due to instances of multiple calculation workbooks including a single project and the incorrect workbook was used to calculate ex ante savings. The multiple energy savings workbooks for a single project reflected revisions to the energy savings calculation. Some ex ante energy savings values in the Free Lights program tracking data reflected an original or earlier energy savings calculation workbook and not the most recently revised workbook.

Project 38482, referenced in Finding 2, was also an example of multiple energy savings workbooks documenting savings and the tracking data did not use revised project workbook savings for ex ante energy savings used for the program tracking data.

**Recommendation 2.** Navigant recommends that if energy savings calculations are revised over multiple iterations, that the most recent and accurate savings value is provided in the tracking data.

**Finding 4.** Another reason for the discrepancy in energy savings was that the lighting fixtures in multiple projects were deemed incorrectly exterior or interior in the energy savings calculation. For example, Project 37415 deemed multiple measures lines as exterior lighting fixtures. However, the revised workbook and ComEd’s list of exterior lighting fixture types<sup>2</sup> confirmed that all the lighting fixtures were interior fixtures.

**Recommendation 3.** Navigant recommends classifying projects using the most appropriate building type or measure location, as defined in the IL TRM, or justify other assumptions of building types if not in the TRM.

**Finding 5.** The implementer did not track ex ante gross demand and ex ante gross peak demand reduction values. ComEd confirmed<sup>3</sup> that demand savings were not captured in their tracking system and, thus, were not provided as part of the Free Lights program tracking data. Navigant calculated ex ante demand and ex ante peak demand values from the provided ex ante energy savings (kWh) values for all projects using commercial lighting end use assumptions from IL TRM v5.0, and assuming unknown building type coincidence factors and interactive factors.

**Recommendation 4.** Navigant recommends that ComEd track ex ante energy, demand, and peak demand savings for all programs at both the program and project level.

**Finding 6.** The program tracking data did not provide project level building type information. The program tracking data stated 46 of the 47 projects were State Agency facilities, and one project was a healthcare clinic. The IL TRM v5.0 does not deem State Agency facilities as a building type, and the program tracking data and project documentations do not provide supplemental information on the projects building types. Based on this, Navigant assumed that all the projects in the program (besides the one healthcare clinic) were “unknown” building type in the IL TRM. ComEd also confirmed<sup>4</sup> that there was no other way of tracking whether light fixtures were interior or exterior besides limited information provided in the project specific calculation sheets.

**Recommendation 5.** The tracking system should track the types of public sector buildings and indicate the location of the bulb installations. Correcting these two issues would enable the evaluation to adequately determine the verified demand and peak demand savings.

**Finding 7.** Several the sampled projects install lighting sensor controls as well as lighting fixtures and these projects lacked sufficient detail to calculate lighting sensor control saving. The project level documentation did not indicate which lights the sensors controlled.<sup>5</sup> The type of sensors and lights which the sensors are controlling are necessary data points used to calculate energy savings attributed to lighting sensors.

**Recommendation 6.** Navigant recommends that the tracking data provide proper information for projects with lighting sensor controls so that savings can be calculated correctly. Also, project documentation needs to be specific to measures and installations for evaluation to complete its work. The lighting control type as well as the retrofit lighting fixture(s) quantity, description, wattage, and location should be available to calculate lighting control savings. This information would also be used to calculate the measure level effective useful life as well as at the program level total resource cost (TRC).

<sup>2</sup> Email correspondence with ComEd [3/15/2018]

<sup>3</sup> Ibid

<sup>4</sup> Ibid

<sup>5</sup> ComEd stated “Frontier was only minimally modified to accommodate the public sector program and especially the Free Lights one, and thus not all information was readily available from DCEO.



### Program Participation

**Finding 8.** The PY9 Free Lights Program included 47 projects submitted by 18 unique participants. Some participants submitted rebates within the Free Lights program for multiple projects at distinct locations. The total number of measures installed could not be calculated since Navigant only evaluated a sample of the projects which made up the program.

The only dates associated with the projects provided in the tracking data were the payment approval dates. Using these dates, 36 of the projects were approved during the Bridge Period (6/2/2017 – 12/31/2017) and 11 of the projects were approved in 2018.

**Recommendation 7.** Navigant recommends that the implementer provide any information regarding total measures installed at a program level. Navigant also recommends that the implementer provide clear installation dates for all projects within the program tracking data.

## 7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

### 7.1.1 Verified Gross Program Savings Analysis Approach

Navigant determined verified gross energy savings at a program level by sampling 21 of the 47 PY9 projects, calculating savings for the sampled projects, and rolling up the savings of the sample to the program level. Navigant used a stratified sampling strategy to account for the different sized projects in the program. The project level energy savings were calculated using algorithms and assumptions in the IL TRM v5.0 Volume 3. Finally, a roll up analysis was conducted to use the sampled projects' verified energy savings to calculate a program level realization rate. This realization rate was then multiplied by the ex ante reported energy savings to calculate a program level verified energy savings value.

A similar approach was conducted to verify gross demand reduction and gross peak demand reduction values. However, the ex ante reduction values were not provided for the program's demand and peak demand values, so Navigant had to initially calculate ex ante gross demand (kW) and ex ante gross peak demand (kW) using the total gross energy (kWh) provided in the tracking data. Navigant used the IL TRM v5.0 Lighting End Use section and assumed a building type of unknown to calculate population level verified gross demand and peak demand savings. verified savings.

### 7.1.2 Sampling Design for Savings Verification

The sample draw for the PY9 Free Lights Program gross impact evaluation was designed to provide a 90/10 level confidence and relative precision for gross impact realization rate results for the overall program. Strata were defined by the project size based on ex ante gross energy savings boundaries that placed about one-half of program-level savings in each stratum (large and small).

Table 7-1 below provides the sample selection by end use category and stratification. Overall, the sample represented 73 percent (3,408,881 kWh) of the population ex ante savings of 4,650,295 kWh. A total of 21 Free Lights projects were selected for sampling.

**Table 7-1. Profile of PY9 Gross Impact Sample by Strata**

Program	Population Summary			Sample		
	Sampling Strata	Number of Project (N)	Ex Ante Gross Savings (kWh)	n	Ex Ante Gross Savings (kWh)	Sampled % of Population (% kWh)
Free Lights Projects	1	6	2,204,056	6	2,204,056	100%
	2	41	2,446,239	15	1,204,825	49%
TOTAL		47	4,650,295	21	3,408,881	73%

Table 7-2 below provides the gross energy realization rates and relative precision at 90% confidence level for the Free Lights program. Due to sampling a large portion of the program savings (73%), the relative precision ended up being lower than the 10% desired level at 90 percent confidence.

**Table 7-1. Gross Energy Realization Rates and Relative Precision at 90% Confidence Level**

Program	Strata	Relative Precision +or-%	Mean Energy (kWh) RR	Standard Error
Free Lights	1	0.0%	112%	0.00
	2	8.9%	111%	0.06
Total kWh RR (90/10)		5.2%	111%	0.03

**7.1.3 Verified Net Program Savings Analysis Approach**

Navigant calculated verified net program energy savings by multiplying the verified gross savings (kWh), verified demand reduction (kW), and verified peak demand reduction (kW) by a deemed net-to-gross ratio (NTGR) of 0.96. This value was based on a memo submitted to ComEd by Navigant on March 30, 2018 titled "Bridge Period Public Sector Programs' Net-to-Gross Recommendation".

### 8. APPENDIX 3. TRC DETAIL

Due to limitations in program tracking data and individual project files, a research category level based TRC table could not be calculated for the Free Lights program. The program included LED fixtures, exit signs, occupancy sensors, and potentially other research categories which fall into the larger lighting fixtures and controls group. Table 8-1 presents the TRC table with one research category, Fixtures and Controls.

Table 8-1 below shows the total resource cost savings summary for the Free Lights Program.

**Table 8-1. Total Resource Cost Savings Summary**

End Use Type	Research Category	Units	Quantity	Effective Useful Live	Ex Ante Gross Savings (kWh)	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)
Lighting	Fixtures and Controls	Each	NR*	15†	4,650,295	NR*	5,172,424	852

\* Not reported

† EUL is a combination of technical measure life and persistence. EUL is assumed to be for LEDs since majority of program savings were attributed to LED fixtures and limitations in tracking data.

The Total Resource Cost (TRC) variable table only includes cost-effectiveness analysis inputs available at the time of finalizing this PY9 impact evaluation report. Additional required cost data (e.g., measure costs, program level incentive and non-incentive costs) are not included in this table and will be provided to evaluation later. Further, detail in this table (e.g., EULs) other than final PY9 savings and program data are subject to change and are not final.