ComEd Public Sector LED Streetlighting Program Impact Evaluation Report

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

Presented to
Commonwealth Edison Company

FINAL

August 28, 2018

Prepared by:

Chris Yoder
Navigant Consulting, Inc.

www.navigant.com

ComEd Public Sector PY9 Bridge Period LED Street Lighting Impact Evaluation Report

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	Jeff Erickson, Director	Rob Neumann, Associate Director
312.583.5714	608.497.2322	312.583.2176
Randy.Gunn@Navigant.com	Jeff.Erickson@Navigant.Com	Rob.Neumann@Navigant.com

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1. INTRODUCTION

This report presents the results of the impact evaluation of public sector portion of the ComEd's LED Streetlighting (Streetlighting) Program for the PY9 Bridge Period, June 2, 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 Streetlighting Program encourages early retirement of ComEd-owned High-Pressure Sodium and Mercury Vapor fixtures serving municipalities with Light-Emitting Diode (LED) fixtures. Participation for PY8 and PY9 is limited to those municipalities whose street light account is less than 100kW. The 100kW limitations exist because IPA is the source of the funding for the program. Approximately 73,000 HID lighting fixtures are ComEd-owned and rented by non-competitively declared municipalities[1]. ComEd's criteria for selecting a LED replacement fixture considers the fixture height (normally 25-30 feet) and the road way configuration at the fixture location (number of lanes and intersection versus mid-block).

ComEd's criteria for selecting municipalities included:

- Municipality was in the advanced metering infrastructure portion of ComEd's territory.
- Municipality had more than 50 fixtures.[2]

The Streetlighting Program launched in June 2014. The program was marketed to municipalities primarily through outreach by ComEd External Affairs personnel. PY7 was a pilot year before the program scaled up in PY8. The PY7 pilot included two municipalities, each with total demand under 100 kW and replaced 735 lights. The program expanded to 41 municipalities in PY8. In PY8, the program replaced 10,077 lights, exceeding its goal of replacing 10,000 lights in PY8. During the bridge period of PY9, ComEd assumed the public-sector programs including municipally owned street lighting and 26 municipalities utilized the program to install 14,303 new LED streetlights. When combining the 14,303 measures from ComEd's public sector program and the 6,536 from ComEd's utility-owned fixture program, the program incentivized 20,839 fixtures.

3. PROGRAM SAVINGS

The PY9 participants and measures are shown in the following tables and graphs.

Table 3-1 summarizes the LED Streetlight Program public sector (PS) participation achieved in PY9 bridge period.

---

[1] ComEd defines non-competitive municipalities as accounts with under 100kW of total demand.
[2] Email from ComEd Program Manager, January 4, 2017.

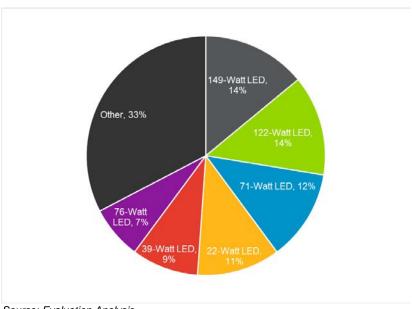**Table 3-1. PY9 Bridge Period Volumetric Findings Detail**

Participation	PY9 Bridge Total
Participants*	26
Projects†	84
Measures Installed	14,303
Units/Project	Varies
149-Watt LEDs	2,002
122-Watt LEDs	1,931
71-Watt LEDs	1,752
22-Watt LEDs	1,605
39-Watt LEDs	1,290
76-Watt LEDs	1,027
Other LEDs	4,655

* Participants are defined as unique Customer Names
† Unique projects are defined as unique Project IDs
Source: ComEd tracking data and Navigant team analysis.

Figure 3-1 displays the Streetlighting Program's distribution of installed measures by type achieved in PY9 bridge period for the public sector.

Figure 3-1. Distribution of Measures Installed by Type

Source: Evaluation Analysis

Table 3-2 summarizes the incremental energy and demand savings the Streetlighting Program achieved in PY9 bridge period for the public sector.

Table 3-2. Streetlighting PY9 Bridge Total Annual Incremental Savings

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	LED Installations	12,954,935	100%	12,954,935	1.00	12,954,935	NA	NA	12
	Total	12,954,935		12,954,935		12,954,935			

* A deemed value. Source: ComEd_NTG_History_and_PY9_Recommendations_2016-02-26_Final.xlsx, which is to be found on the IL SAGweb site here: http://ilsag.info/net-to-gross-framework.html.
† EUL is a combination of technical measure life and persistence.
Source: ComEd tracking data and Navigant team analysis.

4. PROGRAM SAVINGS BY MEASURE

Table 4-1. Streetlighting 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)
Lighting	LED Installations	12,954,935	100%	12,954,935	1.00	12,954,935
	Total	12,954,935		12,954,935		12,954,935

* A deemed value. Source: 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.
Source: ComEd tracking data and Navigant team analysis

Table 4-2. Streetlighting 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	LED Installations	3,011	100%	3,011	1.00	3,011
	Total	3,011		3,011		3,011

*A deemed value. Source: 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.
Source: ComEd tracking data and Navigant team analysis

Table 4-3. Streetlighting 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 Net Peak Demand Reduction (kW)
Lighting	LED Installations	NA	NA	2,047	1.00	2,047
	Total	NA		2,047		2,047

* A deemed value. Source: 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.
Source: ComEd tracking data and Navigant team analysis.

5. PROGRAM IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

5.1 Impact Parameter Estimates

Energy and demand savings are estimated using the following formulas:

$$\Delta kWh = ((Watts_{base} - Watts_{EE}/1000) * Hours$$

$$Total\ kWh_{savings} = Q * \Delta kWh$$

$$\Delta kW = ((Watts_{base} - Watts_{EE}/1000)$$

$$Total\ kW_{savings} = Q * \Delta kW$$

$$\Delta kW_{peak} = \Delta kW * CF$$

$$Total\ kW_{peak\ savings} = Q * \Delta kW$$

Where:
$Watts_{base}$ = Baseline lighting fixture wattage
$Watts_{EE}$ = Energy efficient lighting fixture wattage
Hours = Annual hours of use
Q = Quantity of measures
CF = Coincidence factor

Navigant calculated HOUs to be 4,303 based on the average annual total hours of darkness for 2016 using the Astronomical Applications Department, U.S. Naval Observatory[3]. Darkness refers to sunrise and sunset, which is conventionally referred to the times when the upper edge of the disk of the Sun is on the horizon. Atmospheric conditions are assumed to be average, and the location is in a level region on the Earth's surface. Navigant and ComEd have agreed to using these HOUs since there is no LED street lighting or street lighting measure in the Illinois TRM.

The lifetime energy and demand savings are estimating by multiplying the verified savings by the effective useful life for each measure. Navigant calculated the effective useful life of each measure based on the specific measure TM-21 lumen maintenance measure hours divided by the 4,303 HOUs since there is no LED street lighting or street lighting measure in the Illinois TRM.

The EM&V team conducted research to validate the parameters that were not specified in the TRM. The results are shown in Table 5-1.

Table 5-1 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.

---

[3] U.S. Naval Observatory, Astronomical Applications Department web site: http://aa.usno.navy.mil/data/docs/Dur_OneYear.php. Accessed 3/31/2016.

Table 5-1. Verified Gross Savings Parameters

Gross Savings Input Parameters	Value	Deemed* or Evaluated
Quantity	Varies	Evaluated
Annual Hours of Use	4,303	Evaluated
Coincidence Factor	0.68	Evaluated
Measure Type and Eligibility	Varies	Evaluated
Gross Savings per Unit, Sampled Non-Deemed Measures	Varies	Evaluated
Verified Realization Rate on Ex-Ante Gross Savings (Lighting)	1.00	Evaluated

* State of Illinois Technical Reference Manual version 5.0 from http://www.ilsag.info/technical-reference-manual.html.
Source: ComEd tracking data and Navigant team analysis

5.2 Other Impact Findings and Recommendations

Program Participation

> **Finding 1**. The program replaced municipality-owned street lighting in 26 municipalities and installed 14,303 LED street lights. When combined with the 6,536 ComEd-owned street lights replaced in PY9, the Streetlighting program incentivized a total of 20,839 fixtures.

Verified Gross Impacts and Realization Rate

> **Finding 2**. The LED Street Lighting Program achieved verified gross savings of 12,954,935 kWh with a corresponding verified gross realization rate of 100 percent for energy savings.
> **Finding 3**. In PY9, ComEd's achieved a total verified net savings of 17,452,138 kWh (12,954,935 kWh from municipality-owned fixtures and 4,497,199 kWh from ComEd-owned fixtures.)
> **Finding 4**. Overall, the verified winter net peak demand reduction was 2,047 kW and the verified total net demand reduction was 3,011 kW (total verified winter net peak demand reduction was 2,758 kW and total verified total net demand reduction was 4,056 kW.)

Tracking Data

> **Finding 5**. The tracking data could be cleaned up to prevent confusion to improve the verification process as there are currently no consistency in file names.
> **Recommendation 1**. Navigant recommends that ComEd continues to standardize and improve its template for data tracking to help eliminate data entry errors.
> - Add a column indicating in which program year the fixture replacement occurred in the project level reports.
> - Remove color-coding or provide insight into color-coding methodology to help remove ambiguity in the verification process.
> - Ensure file naming is consistent so that R code can properly pull measure line information.

6. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

6.1 Verified Gross Program Savings Analysis Approach

Navigant's impact analysis methodology to calculate verified gross program savings included a consistency check on the Streetlighting program tracking data to validate the PY9 data. The tracking data

included the fixtures that were removed and the newly installed LED fixtures. Navigant examined values for per unit energy savings at the measure level in the following manner:

• Reviewed project documentation for quantities and replacement wattage values.
• Verified hours of use.
• Combined data for all participants into one dataset.

6.2 Verified Net Program Savings Analysis Approach

Navigant's impact analysis methodology to calculate verified net program savings included using a deemed value of 1.0 because detailed net-to-gross research has not been completed on municipality-owned fixtures and the NTG value for ComEd-owned fixtures is 1.0 since the fixtures require the assistance of the program to be retrofitted.

7. APPENDIX 2. IMPACT ANALYSIS DETAIL

In addition to the above analysis, Navigant has included figures detailing a breakdown of energy efficient fixture counts and energy savings, demand savings, and fixture count by municipality.

Figure 7-1 shows the count of energy efficient fixtures that were replaced through the program. Four fixtures including the 149-watt, 122-watt, 71-watt, and 22-watt LED fixtures represented over half of all the fixtures that were replaced.
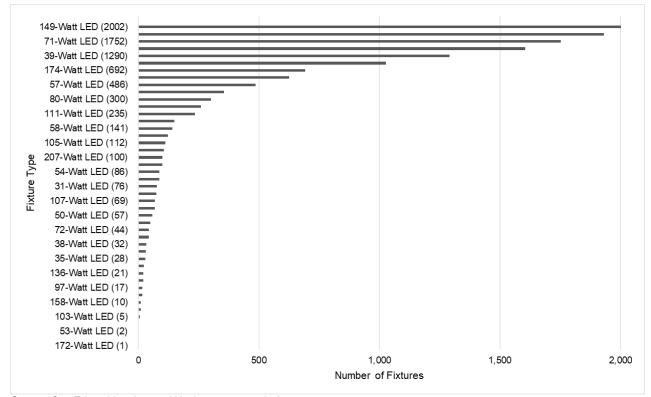
Figure 7-1. Energy Efficient Fixture Count

Source: ComEd tracking data and Navigant team analysis

Figure 7-2 shows energy savings by municipality. Three municipalities achieved approximately 80 percent of the program savings.

Figure 7-2. Energy Savings by Municipality-Owned Fixtures

Source: ComEd tracking data and Navigant team analysis

Figure 7-3 shows energy savings by program year. The program has grown from 460,000 kWh in PY7 to 17,452,138 kWh savings in PY9 as large increase in program savings.
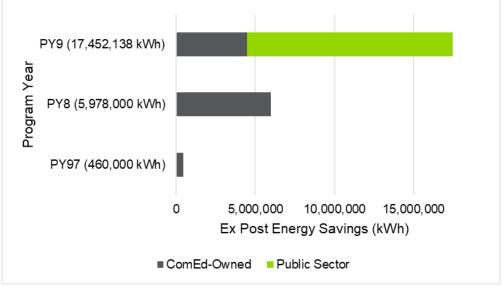
Figure 7-3. Energy Savings by Program Year

Source: ComEd tracking data and Navigant team analysis

Figure 7-4 shows the number of fixtures retrofitted by program year. The program has grown from retrofitting 735 fixtures in PY7 to 20,839 fixtures in PY9. This massive increase has been in line with ComEd's goals and the program is aiming to incentivize an additional 20,000 retrofitted fixtures in 2019.
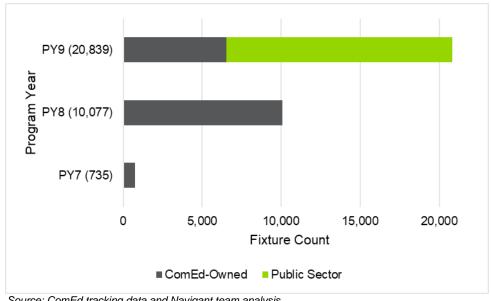
Figure 7-4. Fixture Count by Program Year

Source: ComEd tracking data and Navigant team analysis

8. APPENDIX 3. TRC DETAIL

Table 8-1, below, the Total Resource Cost (TRC) variable table, only includes cost-effectiveness analysis inputs available at the time of finalizing this 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. Details on EULs in this table are subject to change and are not final.

Table 8-1. TRC Savings Summary

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Ex Ante Gross Savings (kWh)	Ex Ante Gross Peak Demand Reduction (kW)*	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)
Lighting	LED Installations	Each	14,303	12	12,954,935	NA	12,954,935	2,047
	Total		14,303		12,954,935		12,954,935	2,047

The 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.