



ComEd Food Bank LED Distribution Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Program Year 2018 (CY2018)
(1/1/2018-12/31/2018)

Presented to
ComEd

FINAL

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TABLE OF CONTENTS

1. Introduction 1

2. Program Description 1

3. Program Savings Detail 2

4. Cumulative Persisting Annual Savings 2

5. Program Savings by Measure 4

6. Impact Analysis Findings and Recommendations 5

 6.1 Impact Parameter Estimates 5

 6.2 CY2019 Carryover Savings Estimates 6

 6.3 Other Impact Findings and Recommendations 7

7. Appendix 1. Impact Analysis Methodology 7

8. Appendix 2. Total Resource Cost Detail 8

LIST OF TABLES AND FIGURES

Figure 2-1. Number of Measures Installed by Type 1

Figure 4-1. Cumulative Persisting Annual Savings 4

Table 2-1. CY2018 Volumetric Findings Detail 1

Table 3-1. CY2018 Total Annual Incremental Electric Savings 2

Table 4-1. Cumulative Persisting Annual Savings (CPAS) – Electric 3

Table 5-1. CY2018 Energy Savings by Measure – Electric 4

Table 5-2. CY2018 Demand Savings by Measure 5

Table 5-3. CY2018 Summer Peak Demand Savings by Measure 5

Table 6-1. LED Savings Parameters 6

Table 6-2. APS Savings Parameters 6

Table 6-3. CY2019 Verified Savings Carryover Estimate 7

Table 8-1. Total Resource Cost Savings Summary 9

1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's CY2018 Food Bank LED Distribution Program. 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. CY2018 covers January 1, 2018 through December 31, 2018.

2. PROGRAM DESCRIPTION

The Food Bank LED Distribution Program provides packages of ENERGY STAR certified LEDs and Advanced Power Strips (APS) to select Feeding America food banks. The food banks use their network of local food pantries within ComEd's service territory to distribute the bulbs to utility customers. The LEDs and APSs are distributed at no cost to the food banks, food pantries and their customers. CLEAResult Consulting Inc. ("CLEAResult") implements the program and coordinates program activities, including engaging with the food banks and their participating food pantries. From PY9 to CY2018, the eligible measure changed from ENERGY STAR certified CFLs to ENERGY STAR certified 9W A-Line LED screw based omnidirectional bulbs and 7-plug APS.

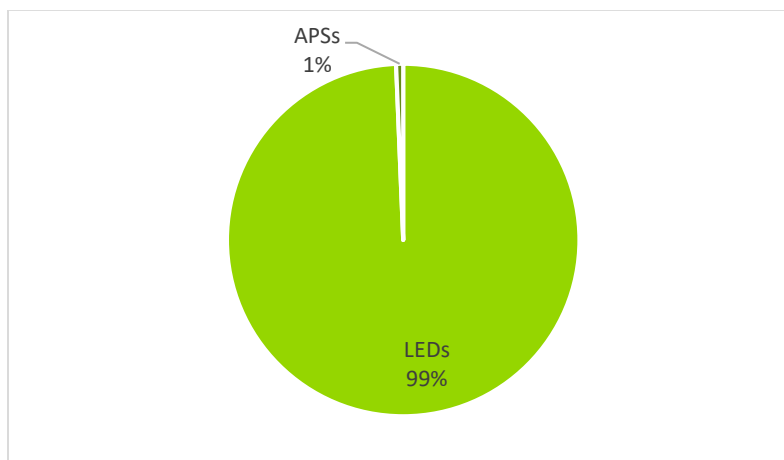
In CY2018 the program distributed a total of 1,700,256 LED bulbs and 11,064 power strips. The following table and graph show the volumetric breakdown by measure type.

Table 2-1. CY2018 Volumetric Findings Detail

Participation	Total CY2018 Count
Number of Participating Food Pantries	1,534
Number of LEDs Distributed	1,700,256
Number of APSs Distributed	11,064
Total Number of Measures Distributed	1,711,320

Source: ComEd tracking data and Navigant team analysis.

Figure 2-1. Number of Measures Installed by Type



Source: ComEd tracking data and Navigant team analysis.

3. PROGRAM SAVINGS DETAIL

Table 3-1 summarizes the incremental energy and demand savings the Food Bank LED Distribution Program achieved in CY2018. There are no gas savings for this program.

Table 3-1. CY2018 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Summer Peak Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	35,041,376	NR	3,149
Program Gross Realization Rate	1.00	NA	0.98
Verified Gross Savings	35,041,513	42,461	3,095
Program Net-to-Gross Ratio (NTG)	1.00	1.00	1.00
PY9 Verified Net Carryover Savings	4,711,589	5,828	472
Total Verified Net Savings including Carryover	39,753,102	48,289	3,567
Converted from Gas*			
Ex Ante Gross Savings	NA	NA	NA
Program Gross Realization Rate	NA	NA	NA
Verified Gross Savings	NA	NA	NA
Program Net-to-Gross Ratio (NTG)	NA	NA	NA
Verified Net Savings	NA	NA	NA
Total Electric Plus Gas			
Ex Ante Gross Savings	35,041,376	NR	3,149
Program Gross Realization Rate	1.00	NA	0.98
Verified Gross Savings	35,041,513	42,461	3,095
Program Net-to-Gross Ratio (NTG)	1.00	1.00	1.00
PY9 Verified Net Carryover Savings	4,711,589	5,828	472
Total Verified Net Savings including Carryover	39,753,102	48,289	3,567

* Gas savings converted to kWh by multiplying therms * 29.31 (which is based on 100,000 Btu/therm and 3,412 Btu/kWh).

NR = Not reported

NA = Not applicable

Note: Demand savings are defined as the difference in kW between the baseline and energy efficiency period for the measures installed in CY2018. The coincident Summer Peak period is defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August.

Source: ComEd tracking data and Navigant team analysis.

4. CUMULATIVE PERSISTING ANNUAL SAVINGS

The measure-specific and total ex ante gross savings for the Food Bank LED Distribution Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 are shown in the following tables and figure. The total CPAS across all measures is 39,753,102 kWh.

The evaluation team applied the EISA baseline for LED lamps starting in 2021. The EISA baseline shift only applies to LED omnidirectional bulbs. Beginning in 2021, the LED baseline shifts from 43 watts to 20 watts for LED lamps being distributed as a part of the program.

Table 4-1. Cumulative Persisting Annual Savings (CPAS) – Electric

End Use Type	Research Category	EUL	CY2018 Verified Gross Savings	NTG*	Lifetime Net Savings†	Verified Net kWh Savings									
						2018	2019	2020	2021	2022	2023	2024	2025	2026	
Lighting	9W LED bulb	10	34,255,195	1.00	180,343,527	34,255,195	34,255,195	34,255,195	11,082,563	11,082,563	11,082,563	11,082,563	11,082,563	11,082,563	
Consumer Electronics	Advanced Power Strip - Tier 1	7	786,318	1.00	5,504,226	786,318	786,318	786,318	786,318	786,318	786,318	786,318	786,318		
Carryover	PY9 Carryover	4§	4,711,589	1.00	15,095,374	4,711,589	4,711,589	4,711,589	138,599	138,599	138,599	138,000	135,603	135,603	
CY2018 Program Total Electric CPAS			39,753,102		200,943,126	39,753,102	39,753,102	39,753,102	12,007,480	12,007,480	12,007,480	12,006,881	11,218,166	11,218,166	
CY2018 Program Expiring Electric Savings‡									27,745,621	27,745,621	27,745,621	27,746,221	28,534,935	28,534,935	

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
Lighting	9W LED bulb	11,082,563												
Consumer Electronics	Advanced Power Strip - Tier 1													
Carryover	PY9 Carryover	135,603												
CY2018 Program Total Electric CPAS		11,218,166	-	-	-	-	-	-	-	-	-	-	-	-
CY2018 Program Expiring Electric Savings‡		28,534,935	39,753,102	39,753,102	39,753,102	39,753,102	39,753,102	39,753,102	39,753,102	39,753,102	39,753,102	39,753,102	39,753,102	39,753,102

Note: The green highlighted cell shows program total first year electric savings.

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the Illinois Stakeholder Advisory Group (IL SAG) web site here:

<http://ilsag.info/net-to-gross-framework.html>.

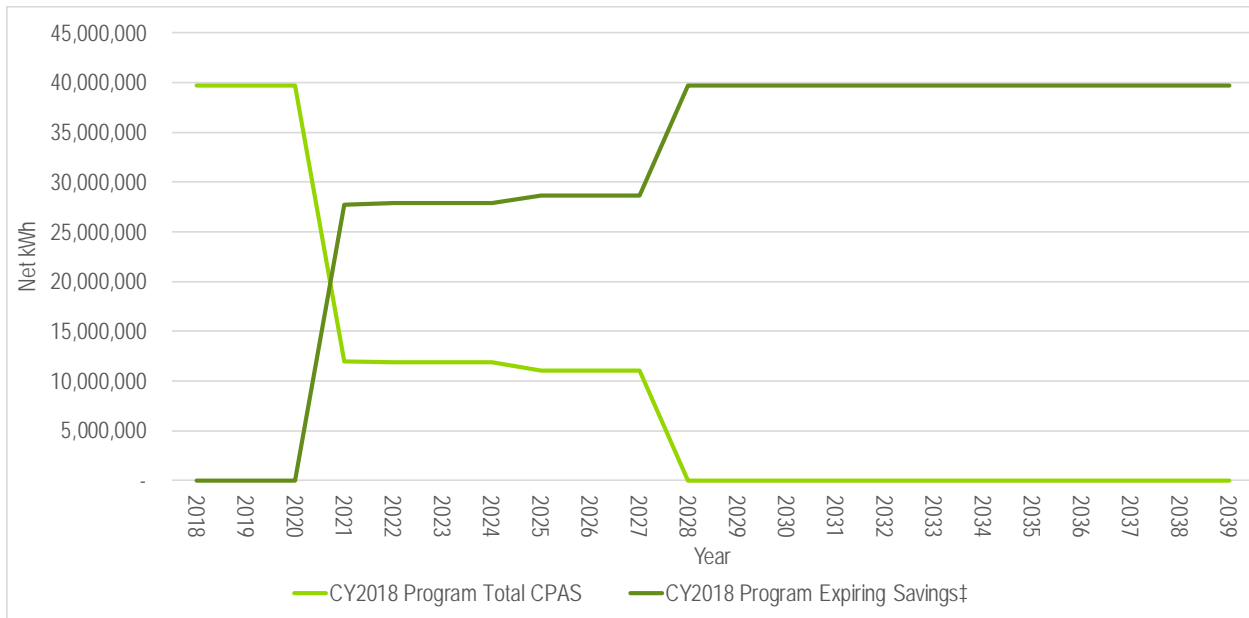
† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

§ This is the weighted average measure life (WAML) for all the lamps included in the carryover calculations from PY9. The PY9 carryover savings of all the lamps do not expire until 2027 since there are some omnidirectional LEDs which have an EUL of 10 years. Most of the lamps in the carryover are CFLs which have a much shorter EUL leading to an overall WAML of 4 years.

Source: Navigant analysis

Figure 4-1. Cumulative Persisting Annual Savings



‡ Expiring savings are equal to CPAS Yn-1 - CPAS Yn + Expiring Savings Yn-1.

Source: Navigant analysis

5. PROGRAM SAVINGS BY MEASURE

The program includes ENERGY STAR certified 9W A-Line LED screw based omnidirectional bulbs and 7-plug APS and the energy and demand savings for each measure is shown in Table 5-1 to Table 5-3. The LED bulbs contributed to 98% of the total energy savings while the APS contributed to the remaining 2% of the energy savings.

Table 5-1. CY2018 Energy Savings by Measure – Electric

End Use Type	Research Category	Ex Ante Gross Savings (kWh)	Verified Gross Realization Rate	Verified Gross Savings (kWh)	NTG*	Verified Net Savings (kWh)	Effective Useful Life
Lighting	9W LED bulb	34,255,058	1.00	34,255,195	1.00	34,255,195	10.0
Consumer Electronics	Advanced Power Strip - Tier 1	786,318	1.00	786,318	1.00	786,318	7.0
Carryover	PY9 Carryover	NR	NA	4,711,589	1.00	4,711,589	4.0
Total		35,041,376		39,753,102		39,753,102	

Note: NR = Not reported by ComEd

NA = Not applicable

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.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 5-2. CY2018 Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Demand Reduction (kW)	NTG*	Verified Net Demand Reduction (kW)
Lighting	9W LED bulb	NR	NA	42,351	1.00	42,351
Consumer Electronics	Advanced Power Strip - Tier 1	NR	NA	111	1.00	111
Carryover	PY9 Carryover	NR	NA	5,828	1.00	5,828
Total		NR		48,289		48,289

Note: NR = Not reported by ComEd

NA = Not applicable

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.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 5-3. CY2018 Summer 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)	NTG*	Verified Net Peak Demand Reduction (kW)
Lighting	9W LED bulb	3,060	0.98	3,007	1.00	3,007
Consumer Electronics	Advanced Power Strip - Tier 1	89	1.00	89	1.00	89
Carryover	PY9 Carryover	NR	NA	472	1.00	472
Total		3,149		3,567		3,567

Note: NR = Not reported by ComEd

NA = Not applicable

* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.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.

6. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

6.1 Impact Parameter Estimates

Table 6-1 and Table 6-2 show the inputs used to calculate the verified energy and demand savings for LED and APS measures respectively along with details about the source of each input.

Table 6-1. LED Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed * or Evaluated?	Source
Quantity	1,700,256	# measures	Evaluated	ComEd Tracking Data
WattsEE	9	W	Deemed	Specifications
WattsBase	43	W	Deemed	IL TRM v6.0 – Section 5.5.8
Hours	847	Hours/year	Deemed	IL TRM v6.0 – Section 5.5.8
WHFe	1.06	-	Deemed	IL TRM v6.0 – Section 5.5.8
WHFd	1.11	-	Deemed	IL TRM v6.0 – Section 5.5.8
CF	0.071	-	Deemed	IL TRM v6.0 – Section 5.5.8
ISR	0.66	-	Deemed	IL TRM v6.0 – Section 5.5.8

* State of Illinois Technical Reference Manual version 6.0 from <http://www.ilsag.info/technical-reference-manual.html>.
 Source: ComEd tracking data and Navigant team analysis.

Table 6-2. APS Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed * or Evaluated?	Source
Quantity	11,064	# measures	Evaluated	ComEd Tracking Data
kWh (Annual kWh savings per unit)	103	kWh	Deemed	IL TRM v6.0 – Section 5.2.1
Hours	7129	Hours/year	Deemed	IL TRM v6.0 – Section 5.2.1
CF	0.8	-	Deemed	IL TRM v6.0 – Section 5.2.1
ISR	0.69	-	Deemed	IL TRM v6.0 – Section 5.2.1

* State of Illinois Technical Reference Manual version 6.0 from <http://www.ilsag.info/technical-reference-manual.html>.
 Source: ComEd tracking data and Navigant team analysis.

6.2 CY2019 Carryover Savings Estimates

Calculation of the Calendar Year 2019 (CY2019) carryover estimate relies upon the IL TRM v7.0 and the PY9 and CY2018 reports. At this time all of these data sources are available and thus it is possible to estimate the gross and net carryover energy savings that the evaluation team recommends for CY2019. The energy and demand savings from these PY9 and CY2018 deferred installs are calculated based on the following parameters:

- Delta Watts – calculated for the year of installation (source: IL TRM v7.0, CY2018 program data).
- HOU and Peak CF – IL TRM deemed value from the year of installation (source: IL TRM v7.0).
- Energy and Demand Interactive Effects – IL TRM deemed value from the year of installation (source: IL TRM v7.0.)
- Installation Rate – IL TRM deemed value from the year of purchase (source: IL TRM v7.0).
- NTG – Evaluation research from the year of purchase (source: PY9 and CY2018 Reports).

Table 6-3 shows that in CY2019, 384,232 bulbs, purchased during either PY9 or CY2018, are expected to be installed within ComEd service territory. The table provides both the gross and net energy and demand savings from these bulbs. The total net energy savings is estimated to be 15,399,320 kWh and 111 summer peak kW, which will be counted in CY2019 as LED Distribution Program carryover savings.

Table 6-3. CY2019 Verified Savings Carryover Estimate

CY2019 Verified Savings Carryover Estimate	PY9 Bulbs	CY2018 Bulbs	CY2019 Carryover
Carryover Bulbs Installed During CY2019	146,196	238,036	384,232
Average Delta Watts	30.4	34.0	32.6
Average Annual Hours of Use	1,159	1,159	1,159
Energy Interactive Effects	1.06	1.06	1.06
Demand Interactive Effects	1.11	1.11	1.11
Summer Peak Load Coincidence Factor	0.09	0.14	0.12
Carryover Gross Energy Savings (kWh)	5,456,471	9,942,849	15,399,320
Carryover Gross Demand Savings (kW)	4,931	8,983	13,915
Carryover Gross Summer Peak Demand Savings (kW)	399.39	1,212.77	111.07
Net-to-Gross Ratio	1.00	1.00	1.00
Carryover Net Energy Savings (kWh)	5,456,471	9,942,849	15,399,320
Carryover Net Demand Savings (kW)	4,931	8,983	13,915
Carryover Net Summer Peak Demand Savings (kW)	399.39	1,212.77	111.07
Effective Useful Life	4.8	10.0	8.1

Source: ComEd tracking data and Navigant team analysis.

6.3 Other Impact Findings and Recommendations

The evaluation team has developed the following recommendations based on findings from the CY2018 evaluation:

Finding 1. The ex ante calculations do not include the carryover savings from previous evaluation years.

Recommendation 1. Navigant recommends including the carryover savings from previous evaluation years in the ex ante energy and demand savings.

Finding 2. The realization rate for the peak demand savings without including the PY9 carryover is 98% due to rounding errors in the per unit ex ante demand savings for the LED bulbs.

Recommendation 2. Navigant recommends using five significant digits when calculating the kW per unit because using fewer number leads to inaccurate overall demand and energy savings when the quantity is large.

Finding 3. The units of the quantity provided in the final end of year tracking data was not number of LEDs and APSs distributed and no information about the unit was provided. The database quantities needed to be multiplied by 96 and 24 for LED and APS measures respectively to determine the actual measure quantities.

Recommendation 3. Navigant recommends providing the unit information in the tracking data or providing actual number of bulbs or APSs.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant used Equation 1 and Equation 2 along with measure level inputs deemed by the IL TRM v6.0 to calculate the energy and demand savings for LED and APS measures respectively.

Equation 1. LED Savings Equation and Inputs, IL TRM v6.0 Section 5.5.8

$$\text{Verified Gross Annual kWh Savings} = ((\text{WattsBase} - \text{WattsEE}) / 1000) * \text{ISR} * \text{Hours} * \text{WHFe} * \text{Quantity}$$

$$\text{Verified Gross Annual kW Savings} = ((\text{WattsBase} - \text{WattsEE}) / 1000) * \text{ISR} * \text{WHFd} * \text{CF} * \text{Quantity}$$

Where:

- WattsBase* = Actual wattage of LED purchased / installed. If unknown, use default provided
- WattsEE* = Actual wattage of LED purchased / installed. If unknown, use default provided
- ISR* = In service rate, the percentage of units rebated that are actually in service
- Hours* = Average hours of use per year
- WHFe* = Waste heat factor for energy to account for cooling energy savings from efficient lighting
- WHFd* = Waste heat factor for demand to account for cooling savings from efficient lighting
- CF* = Summer peak coincidence Factor for measure
- Quantity* = total number of bulbs distributed in CY2018

Equation 2. APS Savings Equation and Inputs, IL TRM v6.0 Section 5.2.1

$$\text{Verified Gross Annual kWh Savings} = \text{kWh} * \text{ISR}$$

$$\text{Verified Gross Annual kW Savings} = \text{kWh} * \text{ISR} * \text{CF} / \text{Hours}$$

Where:

- kWh* = Assumed annual kWh savings per unit
- ISR* = In service rate, the percentage of units rebated that are actually in service
- Hours* = Average hours of use per year
- CF* = Summer peak coincidence Factor for measure
- Quantity* = total number of APS units distributed in CY2018

8. APPENDIX 2. TOTAL RESOURCE COST DETAIL

Table 8-1, below, shows the Total Resource Cost (TRC) table. It includes only the cost-effectiveness analysis inputs available at the time of finalizing this 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.

Table 8-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	Effective Useful Life	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)	Gross Heating Penalty (Therms)	NTG Ratio	Verified Net Savings (kWh)	Verified Net Peak Demand Reduction (kW)	Net Heating Penalty (Therms)
Lighting	LED Lighting*	Lamp	1,700,256	10.0	34,255,195	3,007	(771,841)	1.00	34,255,195	3,007	(771,841)
Advanced Power Strip (APS)	(APS) Tier 1	Each	11,064	7.0	786,318	89	-	1.00	786,318	89	-
Carryover	PY9 Carryover (13W CFL)	Lamp	151,822	4.0	4,089,252	410	(92,139)	1.00	4,089,252	410	(92,139)
Carryover	PY9 Carryover (9W CFL)	Lamp	479	4.0	8,600	1	(194)	1.00	8,600	1	(194)
Carryover	PY9 Carryover (18W CFL)	Lamp	79	4.0	2,480	0	(56)	1.00	2,480	0	(56)
Carryover	PY9 Carryover (23W CFL)	Lamp	40	4.0	1,744	0	(39)	1.00	1,744	0	(39)
Carryover	PY9 Carryover (14 W Flood)	Lamp	32	6.8	1,501	0	(34)	1.00	1,501	0	(34)
Carryover	PY9 Carryover (9W Candelabra)*	Lamp	5	6.8	183	0	(4)	1.00	183	0	(4)
Carryover	PY9 Carryover (9W Globe)*	Lamp	372	6.8	7,815	1	(176)	1.00	7,815	1	(176)
Carryover	PY9 Carryover (9W LED)*	Lamp	19,949	10.0	600,014	60	(13,520)	1.00	600,014	60	(13,520)

*The energy and demand savings for these measures varies over time due to baseline shifts. See CPAS tables in Section 4.
 Source: ComEd tracking data and Navigant team analysis.