



ComEd CLEAResult Community CFL Distribution Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Plan Year 9 (PY9)

Presented to
Commonwealth Edison Company

FINAL

April 26, 2018

Prepared by:

Sagar Deo
Navigant Consulting, Inc.

Charles Ampong
Navigant Consulting, Inc.

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

Chelsea Lamar, Managing Consultant
312.583.2673
Chelsea.Lamar@navigant.com

Disclaimer: This report was prepared by Navigant Consulting, Inc. ("Navigant") for ComEd based upon information provided by ComEd and from other sources. Use of this report by any other party for whatever purpose should not, and does not, absolve such party from using due diligence in verifying the report's contents. Neither Navigant nor any of its subsidiaries or affiliates assumes any liability or duty of care to such parties, and hereby disclaims any such liability.

TABLE OF CONTENTS

1. Introduction	1
2. Program Description	1
3. Program Savings.....	2
4. Program Savings by Measure.....	2
5. Impact Analysis Findings and Recommendations	4
5.1 Impact Parameter Estimates.....	4
5.2 Other Impact Findings and Recommendations.....	5
6. Appendix 1. Impact Analysis Methodology	5
6.1 LEDs and CFLs.....	6
7. Appendix 2. Impact Analysis Detail.....	6
8. Appendix 3. TRC Detail.....	9

LIST OF TABLES AND FIGURES

Figure 2-1. Measure Distribution by Type.....	2
Table 2-1. PY9 Volumetric Findings Detail	1
Table 3-1. PY9 Total Annual Incremental Savings	2
Table 4-1. PY9 Energy Savings by Measure	3
Table 4-2. PY9 Demand Savings by Measure.....	3
Table 4-3. PY9 Peak Demand Savings by Measure	4
Table 5-1. Verified Gross Savings Parameters.....	5
Table 7-1. 14 W Flood CFLs - Custom and Deemed Values Comparison	6
Table 7-2. 9W Globe CFLs - Custom and Deemed Values Comparison	7
Table 7-3. Volumetric Findings by Wattage	7
Table 7-4. PY9 Energy Savings by Food Bank.....	8
Table 7-5. PY9 Peak Demand Savings by Food Bank	9

1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's PY9 CLEAResult Community CFL Distribution (CFL Distribution) Program. It presents a summary of the electric energy and demand impacts for the total program and a detailed breakdown by measure. Section 6 presents the impact analysis methodology. PY9 covers June 1, 2016 through December 31, 2017.

2. PROGRAM DESCRIPTION

The CFL Distribution Program is a third-party community-based program that started in PY9 and provides Energy Star-certified CFL distribution to selected food banks. The food banks then use their network of local food pantries within ComEd's service territory to distribute a free 4-bulb pack to utility customers. The CFL products are distributed at no cost to the food banks 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. In September 2017, the program transitioned from CFLs to distributing only LEDs.

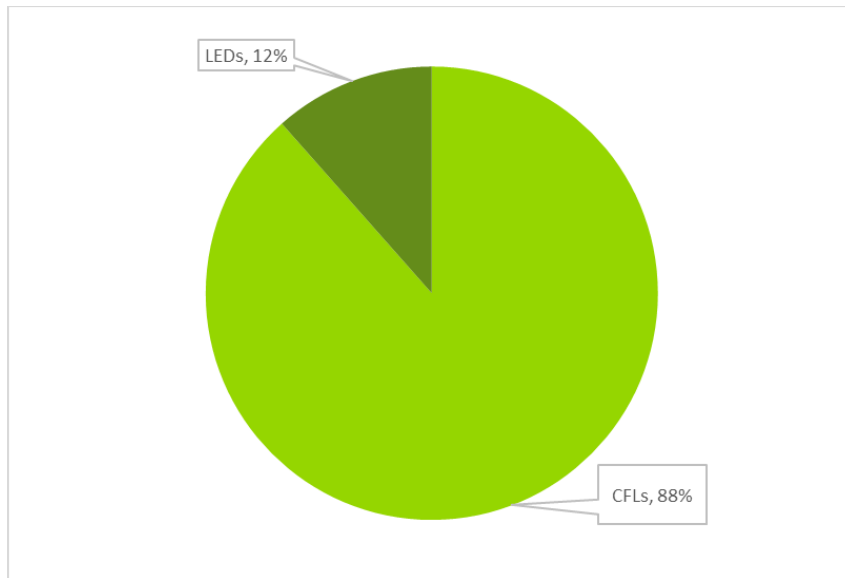
The PY9 program distributed a total of 1,329,057 bulbs, including 1,172,454 Standard CFLs, 3,147 Specialty CFLs and 153,456 LEDs. The following table and graph show the volumetric breakdown by each bulb type. A detailed breakdown of each bulb by Wattage is shown in Table 7-3. The CFL products distributed were 88 percent of total measure count, and 12 percent from LEDs, as shown in Figure 2-1.

Table 2-1. PY9 Volumetric Findings Detail

Participation	Total PY9 Count
Number of Food Banks	3
Number of Food Pantries	840
Number of LEDs distributed	153,456
Number of Standard CFLs distributed	1,172,454
Number of Specialty CFLs distributed	3,147
Total Number of Measures Distributed	1,329,057

Source: ComEd tracking data and Navigant team analysis.

Figure 2-1. Measure Distribution by Type



Source: Evaluation Analysis

3. PROGRAM SAVINGS

Table 3-1 summarizes the total incremental energy, demand and peak demand savings in PY9 of the CFL Distribution Program.

Table 3-1. PY9 Total Annual Incremental Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Peak Demand Savings (kW)
Ex Ante Gross Savings	21,404,196	NR*	NR*
Program Gross Realization Rate	100%	NA	NA
Verified Gross Savings	21,383,364	26,451	2,142
Program Net-to-Gross Ratio (NTGR)	1.00	1.00	1.00
Verified Net Savings	21,383,364	26,451	2,142

* Not Reported

Source: ComEd tracking data and Navigant team analysis.

4. PROGRAM SAVINGS BY MEASURE

Table 4-1, Table 4-2, and Table 4-3 below show the total PY9 energy, demand and peak demand savings for the different types of bulbs distributed as a part of the program. Savings from CFLs and LEDs accounted for 87 and 13 percent of the total program energy savings respectively.

Table 4-1. PY9 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	13WCFL	18,558,915	100%	18,558,915	1.00	18,558,915	NA	NA	4
Lighting	9WCFL	39,029	100%	39,029	1.00	39,029	NA	NA	4
Lighting	18WCFL	11,254	100%	11,254	1.00	11,254	NA	NA	4
Lighting	23WCFL	7,917	100%	7,917	1.00	7,917	NA	NA	4
Lighting	14 WCFL Flood	7,048	87%	6,811	1.00	6,811	NA	NA	7
Lighting	9WCFL Candelabra	831	100%	831	1.00	831	NA	NA	7
Lighting	9WCFL Globe	56,063	63%	35,468	1.00	35,468	NA	NA	7
Lighting	9WLED	2,723,140	100%	2,723,140	1.00	2,723,140	26	NA	10
Total		21,404,196	100%	21,383,364	1.00	21,383,364			

* 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>.

† EUL is a combination of technical measure life and persistence.

Source: ComEd tracking data and Navigant team analysis.

Table 4-2. PY9 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	13WCFL	NR†	NA	22,945	1.00	22,945
Lighting	9WCFL	NR	NA	48	1.00	48
Lighting	18WCFL	NR	NA	14	1.00	14
Lighting	23WCFL	NR	NA	10	1.00	10
Lighting	14 WCFL Flood	NR	NA	8	1.00	8
Lighting	9WCFL Candelabra	NR	NA	1	1.00	1
Lighting	9WCFL Globe	NR	NA	58	1.00	58
Lighting	9WLED	NR	NA	3,367	1.00	3,367
Total		NR	NA	26,451	1.00	26,451

* 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>.

† Not Reported

Source: ComEd tracking data and Navigant team analysis.

Table 4-3. PY9 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	13W CFL	NR†	NA	1,858	1.00	1,858
Lighting	9W CFL	NR	NA	4	1.00	4
Lighting	18W CFL	NR	NA	1	1.00	1
Lighting	23W CFL	NR	NA	1	1.00	1
Lighting	14 W CFL Flood	NR	NA	1	1.00	1
Lighting	9W CFL Candelabra	NR	NA	0	1.00	0
Lighting	9W CFL Globe	NR	NA	4	1.00	4
Lighting	9W LED	NR	NA	273	1.00	273
Total		NR	NA	2,142	1.00	2,142

* 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>.

† Not Reported

Source: ComEd tracking data and Navigant team analysis.

5. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

5.1 Impact Parameter Estimates

Navigant’s analysis of the ComEd PY9 CFL Distribution Program resulted in a verified energy and peak demand savings of 21,383,364 kWh and 2,142 kW, respectively. The verified gross realization rate for energy savings is 99.9 percent.

Navigant verified the quantities and model numbers of all the bulbs distributed as part of the program in PY9 using the monthly invoices provided by CLEAResult. Table 5-1 summarizes the parameters and references the evaluation used in the verified gross and net savings calculations. Navigant calculated savings for each bulb using the algorithms defined by the Illinois TRM version 5.0, which can be found in Appendix 1. Impact Analysis Methodology. Appendix 2. Impact Analysis Detail, shows the input parameters used by CLEAResult and Navigant to calculate verified energy and peak demand savings for different types of bulbs distributed in PY9.

Table 5-1. Verified Gross Savings Parameters

Measure	Custom* Input Parameters	Deemed† Input Parameters	Deemed† Input Data Source
LEDs	WattsEE, quantity	WattsBase, Hours, WHFe, WHFd, CF, ISR	IL TRM v5.0 Section 5.5.8
CFLs	WattsEE, quantity	WattsBase, Hours, WHFe, WHFd, CF, ISR	IL TRM v5.0 Section 5.5.1

* Based on the monthly invoices provided by CLEAResult.

†State of Illinois Technical Reference Manual version 5.0 from <http://www.ilsag.info/technical-reference-manual.html>.

Source: IL TRM and Navigant Analysis.

5.2 Other Impact Findings and Recommendations

PY9 impact findings and recommendations for the bulbs distributed in the program are listed below.

Finding 1. The implementer assumed a baseline wattage and average hours of use per year (HOU) of 65W and 891 hours for the 14 W CFL flood lights. Navigant did not find the source of the 891 hours. The IL TRM does not deem HOU values for CFL Flood lights. Due to their similarity with interior reflectors, Navigant used an HOU of 861 hours for the verified savings. This decreased the savings for the measure. No recommendation or action is required since CFLs are phased out of the program.

Finding 2. For the 9W Globe CFL, the implementer used assumptions for a 23W CFL bulb of 72W baseline wattage and 23W efficient wattage. The correct wattages for a 9W Globe CFL are 40W and 9W baseline and efficient wattages respectively. The adjustment decreased the savings for the measure. No recommendation or action is required since CFLs are phased out of the program.

Finding 3. CLEAResult provided Navigant with the total number of 4-packs distributed at each food pantry, but the type of bulbs included in each 4-packs was not provided.

Recommendation 1. Navigant recommends tracking the bulb type distributed at each food pantry to enable completion of a bottom-up evaluation analysis of the quantity of lamps distributed.

Finding 4. The total number of bulbs distributed at the Greater Chicago, Northern Illinois and Riverbend food banks in PY9 were 623,231, 648,514 and 57,312 respectively and the corresponding net energy savings were 10,056,708 kWh, 10,415,887 kWh and 910,769 kWh respectively. More details about the energy and peak demand savings of each food bank can be found in Table 7-4 and Table 7-5.

Finding 5. CLEAResult did not report the ex ante demand and peak demand savings for the program.

Recommendation 2. Navigant recommends the ex ante demand and peak demand savings for each measure be tracked and reported.

6. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant calculated verified gross and net savings using the following algorithms as defined by the IL TRM v5.0 in PY9.

6.1 LEDs and CFLs

Navigant used measure level inputs deemed by the IL TRM v5.0. Table 5-1 shows the source of all the inputs used. There was no change between the ex ante and the verified energy and demand savings of any bulb except the 14W Flood and 9W Globe CFLs. The reasons for the discrepancies are highlighted in Findings 1 and 2 in Section 5.2 above. The verified energy and peak demand savings are highlighted in Table 4-1 and Table 4-3 respectively.

Energy and demand savings are estimated using the following formulas as specified in the IL TRM:

Equation 1. LED and CFL Savings Equation and Inputs, IL TRM v5.0 Section 5.5.8 and 5.5.1 respectively

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

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

Where:

- WattsBase* = Baseline wattage, based on lumens of the LED and CFL bulbs and program year installed
- WattsEE* = Actual wattage of LED and CFL included in the kits
- ISR* = In Service Rate, the percentage of units sent 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.
- quantity* = total number of bulbs distributed in PY9
- CF* = Coincidence Factor for electric load reduction

7. APPENDIX 2. IMPACT ANALYSIS DETAIL

Table 7-1 and Table 7-2 below show the comparison of input assumptions used by Navigant and CLEAResult in ex ante and ex post calculations. The inputs comparison is only done for measures with a discrepancy between ex ante and ex post savings.

Table 7-1. 14 W Flood CFLs - Custom and Deemed Values Comparison

Savings Parameter	Ex Ante Value	Verified Value	Deemed/Evaluated	Source	Discrepancy?
Wattsbase	65	65	Evaluated	Invoices	-
WattsEE	14	14	Evaluated	Invoices	-
ISR	0.59	0.59	Deemed	IL TRM v5.0	-
Hours	891	861	Deemed	IL TRM v5.0	Yes. Used deemed value 861
WHFe	1.06	1.06	Deemed	IL TRM v5.0	-
WHFd	NR*	1.11	Deemed	IL TRM v5.0	-
CF	NR	0.081	Deemed	IL TRM v5.0	-
Quantity	248	248	Evaluated	Invoices	-

* Not Reported

Source: ComEd tracking data and Navigant team analysis.

Table 7-2. 9W Globe CFLs - Custom and Deemed Values Comparison

Savings Parameter	Ex Ante Value	Verified Value	Deemed/Evaluated	Source	Discrepancy?
Wattsbase	72	40	Evaluated	Invoices	Yes
WattsEE	23	9	Evaluated	Invoices	Yes
ISR	59.0%	0.59	Deemed	IL TRM v5.0	-
Hours	639	639	Deemed	IL TRM v5.0	-
WHFe	1.06	1.06	Deemed	IL TRM v5.0	-
WHFd	NR*	1.11	Deemed	IL TRM v5.0	-
CF	NR	0.075	Deemed	IL TRM v5.0	-
Quantity	2,863	2,863	Evaluated	Invoices	-

* Not Reported

Source: ComEd tracking data and Navigant team analysis.

The following table shows the quantities of bulbs distributed as a part of the program broken down by their wattages.

Table 7-3. Volumetric Findings by Wattage

Participation	Total PY9 Count
13W CFL	1,167,858
9W CFL	3,684
18W CFL	607
23W CFL	305
14W CFL Flood	248
9W CFL Candelabra	36
9W CFL Globe	2,863
9W LED	153,456
Total Number of Measures Distributed	1,329,057

Source: ComEd tracking data and Navigant team analysis.

Table 7-4 and Table 7-5 below show the quantities, energy and peak demands savings for each food bank at a measure level.

Table 7-4. PY9 Energy Savings by Food Bank

Food Bank	Research Category	Quantity	Ex-Ante kWh	RR kWh	Verified kWh	NTG	Net Verified kWh
Greater Chicago	13W CFL	521,408	8,285,910	100%	8,285,910	1.00	8,285,910
	9W CFL	3,684	39,029	100%	39,029	1.00	39,029
	18W CFL	607	11,254	100%	11,254	1.00	11,254
	23W CFL	305	7,917	100%	7,917	1.00	7,917
	14 W CFL Flood	248	7,048	97%	6,811	1.00	6,811
	9W CFL Candelabra	36	831	100%	831	1.00	831
	9W CFL Globe	2,863	56,063	63%	35,468	1.00	35,468
	9W LED	94,080	1,669,488	100%	1,669,488	1.00	1,669,488
	Subtotal	623,231	10,077,540	100%	10,056,708	1.00	10,056,708
Northern Illinois	13W CFL	589,138	9,362,236	100%	9,362,236	1.00	9,362,236
	9W LED	59,376	1,053,652	100%	1,053,652	1.00	1,053,652
	Subtotal	648,514	10,415,887*	100%	10,415,887	1.00	10,415,887
Riverbend	13W CFL	57,312	910,769	100%	910,769	1.00	910,769
	Subtotal	57,312	910,769	100%	910,769	1.00	910,769
	Total	1,329,057	21,404,196	100%	21,383,364	1.00	21,383,364

* Numbers do not sum exactly due to rounding

Source: ComEd tracking data and Navigant team analysis.

Table 7-5. PY9 Peak Demand Savings by Food Bank

Food Bank	Research Category	Quantity	Ex-Ante kW	RR kW	Verified kW	NTG	Net Verified kW
Greater Chicago	13W CFL	521,408	NA	NA	830	1.00	830
	9W CFL	3,684	NA	NA	4	1.00	4
	18W CFL	607	NA	NA	1	1.00	1
	23W CFL	305	NA	NA	1	1.00	1
	14 W CFL Flood	248	NA	NA	1	1.00	1
	9W CFL Candelabra	36	NA	NA	0	1.00	0
	9W CFL Globe	2,863	NA	NA	4	1.00	4
	9W LED	94,080	NA	NA	167	1.00	167
Subtotal		623,231	NA	NA	1,008	1.00	1,008
Northern Illinois	13W CFL	589,138	NA	NA	938	1.00	938
	9W LED	59,376	NA	NA	106	1.00	106
	Subtotal	648,514	NA	NA	1,043*	1.00	1,043
Riverbend	13W CFL	57,312	NA	NA	91	1.00	91
Subtotal		57,312	NA	NA	91	1.00	91
Total		1,329,057	NA	NA	2,142	1.00	2,142

* Numbers do not sum exactly due to rounding
Source: ComEd tracking data and Navigant team analysis.

8. APPENDIX 3. TRC DETAIL

Table 8-1, the Total Resource Cost (TRC) variable table, only includes cost-effectiveness analysis inputs available at the time of finalizing the PY9 CFL Distribution 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. EUL information in this table is subject to change and is not final.

Table 8-1. Total Resource Cost 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	13WCFL	Lamp	1,167,858	4	18,558,915	NR	18,558,915	1,858
Lighting	9WCFL	Lamp	3,684	4	39,029	NR	39,029	4
Lighting	18WCFL	Lamp	607	4	11,254	NR	11,254	1
Lighting	23WCFL	Lamp	305	4	7,917	NR	7,917	1
Lighting	14 WCFL Flood	Lamp	248	7	7,048	NR	6,811	1
Lighting	9WCFL Candelabra	Lamp	36	7	831	NR	831	0
Lighting	9WCFL Globe	Lamp	2,863	7	56,063	NR	35,468	4
Lighting	9W LED	Lamp	153,456	10	2,723,140	NR	2,723,140	273

†EUL is a combination of technical measure life and persistence.
Source: ComEd tracking data and Navigant team analysis.