

ComEd Instant Discounts Impact Evaluation Report

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

Presented to
ComEd

DRAFT

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1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd's CY2018 Instant Discounts 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 Instant Discounts Program provides incentives to increase the market share of energy efficient products commonly sold to business customers. The Instant Discounts Program was launched as a pilot in Program Year 3 (PY3) and became a full-scale program in PY4.¹ The program is designed to provide an expedited, simple solution to business customers interested in purchasing efficient lighting or high efficiency battery chargers by providing instant discounts at the point of sale.

The Instant Discounts Program provides incentives on a mix of standard and specialty LEDs (lamps and fixtures), LED exit signs, linear fluorescent (LF) lamps, tubular LEDs (TLEDs), and battery chargers. The CY2018 rebate values vary by technology. The program incented 2,586,708 measures in CY2018, comprised of 33% LED lamps, 53% TLEDs, 6% LED fixtures, 7% LFs and 1% LED exit signs as shown below in Table 2-1 and Figure 2-1.

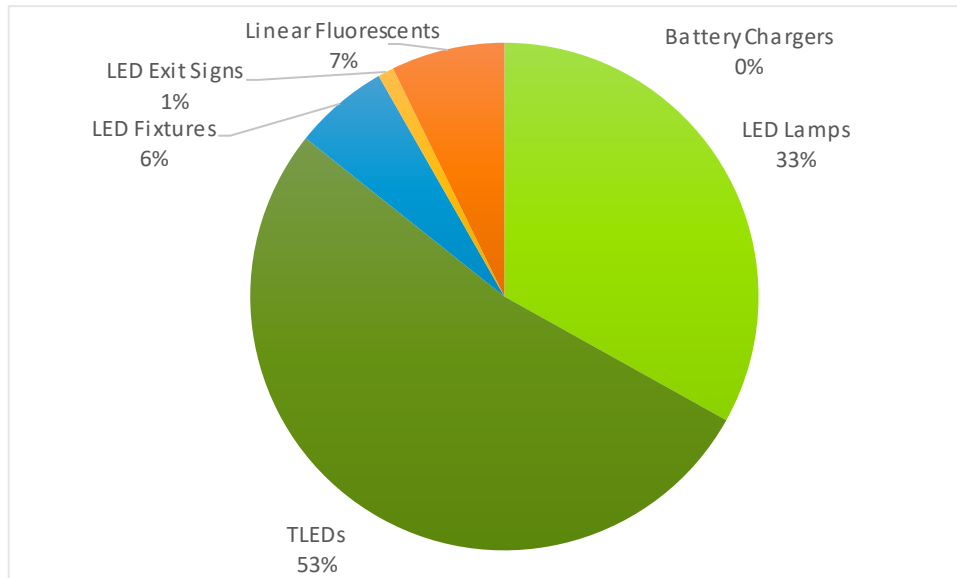
Table 2-1. CY2018 Volumetric Findings Detail

Participation	Total	LED Lamps	TLEDs	LED Fixtures	LED Exit Signs	Linear Fluorescents	Battery Chargers
CY2018 Incentivized Units	2,586,708	856,282	1,360,970	156,469	26,165	186,701	121
CY2018 1st Year Installed Units	2,496,288	813,205	1,326,073	148,810	26,165	181,914	121
PY8 Carryover – CY2018 Installs	21,881	14,517	-	2,828	-	4,536	-
PY9 Carryover – CY2018 Installs	31,954	10,108	13,430	5,080	-	3,337	-
Total Installed Units in CY2018	2,550,123	837,831	1,339,502	156,718	26,165	189,786	121

Source: ComEd tracking data and Navigant team analysis.

¹ The Instant Discounts Program was initially branded as the Midstream Incentive Program and was rebranded as the Business Instant Lighting Discounts program in PY5. In PY9, it was rebranded again as Instant Discounts due to the inclusion of non-lighting products.

Figure 2-1. Percentage of Measures Installed by Type



Source: Navigant analysis

3. PROGRAM SAVINGS DETAIL

Table 3-1 summarizes the incremental energy and demand savings the Instant Discounts Program achieved in CY2018. The values in Table 3-1 include carryover savings from PY8 and PY9. Net verified savings for CY2018 is 253,222,349 kWh. There are no gas savings associated with 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	296,418,741	80,224	NR
Program Gross Realization Rate	1.09	0.98	NA
Verified Gross Savings	321,683,597	78,331	63,350
Program Net-to-Gross Ratio (NTG)	0.79	0.79	0.79
Verified Net Savings	253,222,349	61,575	49,833
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	296,418,741	80,224	NR
Program Gross Realization Rate	1.09	0.98	NA
Verified Gross Savings	321,683,597	78,331	63,350
Program Net-to-Gross Ratio (NTG)	0.79	0.79	0.79
Verified Net Savings	253,222,349	61,575	49,833

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

NA = Not applicable

NR = Not reported

Note: 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 Instant Discounts Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 are shown in Table 4-1 and Figure 4-1 below. The total CPAS across all measures is 253,222,349 kWh. There are no gas savings associated with this program. LED (omni-directional) lamps have a reduction in net savings following the implementation of the Energy Standards and Independence Act (EISA) standards change in 2020. Savings from the CY2019 program may see increased reductions in 2024 if the EISA standards are applied to specialty and reflector lamps. However, since there currently is uncertainty regarding the implementation of the EISA standards to these bulb types, a reduction in future savings has not been applied within the tables below in accordance with Version 6 of the Illinois Technical Reference Manual (TRM).

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

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		
Power Electronics	Battery Chargers	15.0	1,115,677	0.80	13,388,124	892,542	892,542	892,542	892,542	892,542	892,542	892,542	892,542	892,542		
Lighting	LED Exit Signs	16.0	4,802,685	0.80	61,474,364	3,842,148	3,842,148	3,842,148	3,842,148	3,842,148	3,842,148	3,842,148	3,842,148	3,842,148		
Lighting	LED Fixtures	12.3	24,523,042	0.78	233,575,560	19,127,973	19,127,973	19,127,973	19,090,101	19,028,567	19,027,979	19,014,242	18,859,452	18,678,757		
Lighting	LED HID	14.5	8,796,662	0.78	99,103,835	6,861,396	6,861,396	6,861,396	6,861,396	6,861,396	6,861,396	6,860,610	6,851,399	6,828,617		
Lighting	LED Lamps	7.6	148,894,706	0.78	834,899,143	116,137,871	116,137,871	116,137,871	113,965,990	106,954,244	97,735,499	92,166,479	32,231,903	11,160,173		
Lighting	TLEDs	13.0	116,766,453	0.80	1,112,604,941	93,413,162	93,413,162	93,413,162	93,413,162	93,413,162	93,408,550	87,160,826	74,579,855	73,277,322		
Lighting	Linear Fluorescents	11.4	3,195,844	0.75	26,870,818	2,396,883	2,396,883	2,396,883	2,392,206	2,385,057	2,352,988	2,270,609	1,922,054	1,803,066		
Lighting	Carryover	8.7	13,588,528	0.78	60,662,021	10,550,375	10,550,375	10,550,375	4,380,407	4,380,407	4,380,407	4,380,407	4,380,407	1,888,640		
CY2018 Program Total Electric CPAS			321,683,597		2,442,578,806	253,222,349	253,222,349	253,222,349	244,837,951	237,757,523	228,501,509	216,587,862	143,559,758	118,371,266		
CY2018 Program Expiring Electric Savings‡								8,384,398	15,464,826	24,720,840	36,634,487	109,662,591	134,851,084			

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Power Electronics	Battery Chargers	892,542	892,542	892,542	892,542	892,542	892,542						
Lighting	LED Exit Signs	3,842,148	3,842,148	3,842,148	3,842,148	3,842,148	3,842,148	3,842,148					
Lighting	LED Fixtures	18,643,582	15,450,538	7,262,747	7,231,673	7,111,073	6,792,931						
Lighting	LED HID	6,805,110	6,804,151	6,740,685	6,525,486	6,165,377	4,354,023						
Lighting	LED Lamps	8,766,177	8,084,212	7,287,845	3,312,720	2,746,199	2,074,089						
Lighting	TLEDs	66,438,041	59,256,291	51,339,088	50,497,208	45,900,930	43,681,018						
Lighting	Linear Fluorescents	1,705,901	1,656,418	1,381,412	959,700	537,375	313,383						
Lighting	Carryover	1,888,640	1,867,402	724,262	724,262	7,827	7,827						
CY2018 Program Total Electric CPAS		108,982,140	97,853,701	79,470,729	73,985,740	67,203,471	61,957,960	3,842,148					
CY2018 Program Expiring Electric Savings‡		144,240,209	155,368,648	173,751,620	179,236,610	186,018,879	191,264,390	249,380,202	253,222,349	253,222,349	253,222,349	253,222,349	253,222,349

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 IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

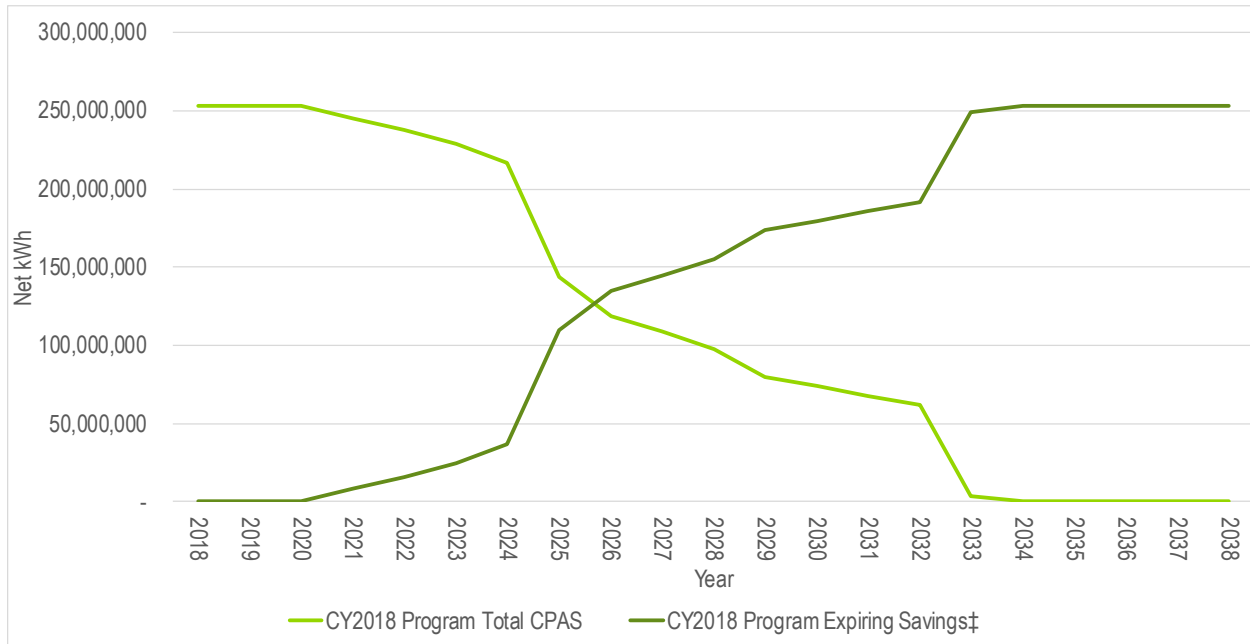
† Lifetime savings are the sum of CPAS savings through the EUL.

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

§ EUL is the weighted average EUL for all lighting measures with carryover. The carryover CPAS extends through the longest individual measure type EUL.

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 seven measure types, as shown in the following tables. LED lamps and TLEDs contributed the most energy savings; 46% and 36%, respectively. The 130% energy realization rate for TLEDs is driven by adjusted hours of operation and an increased in-service rate (ISR) of 98%. The 293% realization rate is driven by adjustments based on IL TRM v6 deemed values. Additional details on these differences and adjustments can be found in Section 8 (Appendix 2).

Table 5-1. CY2018 Energy Savings by Measure

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
Power Electronics	Battery Chargers	380,246	2.93	1,115,677	0.80	892,542	15.0
Lighting	LED Exit Signs	4,791,829	1.00	4,802,685	0.80	3,842,148	16.0
Lighting	LED Fixtures	25,235,831	0.97	24,523,042	0.78	19,127,973	12.3
Lighting	LED HID	8,480,720	1.04	8,796,662	0.78	6,861,396	14.5
Lighting	LED Lamps	150,796,602	0.99	148,894,706	0.78	116,137,871	7.6
Lighting	TLEDs	90,149,139	1.30	116,766,453	0.80	93,413,162	13.0
Lighting	Linear Fluorescents	2,995,846	1.07	3,195,844	0.75	2,396,883	11.4
Lighting	Carryover	13,588,528	N/A	13,588,528	0.78	10,550,375	8.7
Total		296,418,741	1.09	321,683,597	0.79	253,222,349	

* 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)
Power Electronics	Battery Chargers	83	1.35	112	0.80	90
Lighting	LED Exit Signs	538	0.93	499	0.80	399
Lighting	LED Fixtures	7,086	0.96	6,805	0.78	5,308
Lighting	LED HID	2,211	1.01	2,238	0.78	1,745
Lighting	LED Lamps	40,564	0.97	39,194	0.78	30,572
Lighting	TLEDs	25,315	0.99	25,104	0.80	20,083
Lighting	Linear Fluorescents	861	0.95	815	0.75	611
Lighting	Carryover	3,565	1.00	3,565	0.78	2,768
Total		80,224	0.98	78,331	0.79	61,575

* 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)
Power Electronics	Battery Chargers	NR	NA	9	0.80	7
Lighting	LED Exit Signs	NR	NA	682	0.80	545
Lighting	LED Fixtures	NR	NA	5,205	0.78	4,060
Lighting	LED HID	NR	NA	1,795	0.78	1,400
Lighting	LED Lamps	NR	NA	30,007	0.78	23,406
Lighting	TLEDs	NR	NA	21,876	0.80	17,501
Lighting	Linear Fluorescents	NR	NA	670	0.75	502
Lighting	Carryover	NR	NA	3,106	0.78	2,411
Total		NR	NA	63,350	0.79	49,833

* 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>.

NA = Not applicable

NR = Not reported

Source: ComEd tracking data and Navigant team analysis.

6. IMPACT ANALYSIS FINDINGS AND RECOMMENDATIONS

6.1 Impact Parameter Estimates

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

Verified Gross Annual ΔkWh = ResSplit * Res ΔkWh + NonResSplit * NonRes ΔkWh

Where:

Res ΔkWh = Bulbs * DeltaWatts/1000 * ISR_r * (1-Leakage) * HOU_r * $WHFe_r$

NonRes ΔkWh = Bulbs * DeltaWatts/1000 * ISR_{nr} * (1-Leakage) * HOU_{nr} * $WHFe_{nr}$

Verified Gross Annual ΔkW = Delta Watts/1000 * ISR * (1-Leakage)

Verified Gross Annual Summer Peak ΔkW = Gross Annual ΔkW * Summer Peak CF * $WHFd$

Verified Gross Annual Winter Peak ΔkW = Gross Annual ΔkW * Winter Peak CF

Where:

- **Res/NonRes split** = Percentage of program bulbs installed in residential and non-residential locations. Deemed within Illinois TRM v6.
- **Bulbs** = Quantity of bulbs sold through the CY2018 program, based on program tracking data.
- **Delta Watts** = Difference in wattage between the baseline bulb (WattsBase) and the efficient program bulb (WattsEE):
 - WattsBase = Baseline bulb wattage, mapping deemed in Illinois TRM v6.
 - WattsEE = Wattage of efficient program bulb, based on program tracking data.
- **$ISR_{r(nr)}$** = First year installation rate (residential or non-residential), deemed in Illinois TRM v6.
- **Leakage** = Percentage of program bulbs installed outside of ComEd service territory, deemed in Illinois TRM v6.
- **$HOU_{r(nr)}$** = Annual hours of use (residential or non-residential), deemed in Illinois TRM v6.
- **$WHFe_{r(nr)}$** = Waste heat factor – Energy (residential or non-residential), deemed in Illinois TRM v6.
- **$WHFd_{r(nr)}$** = Waste heat factor – Demand (residential or non-residential), deemed in Illinois TRM v6.
- **Summer Peak CF** = Peak load coincidence factor, the percentage of program bulbs turned on during summer peak hours (weekdays from 1 to 5 P.M.).
- **Winter Peak CF** = Peak load coincidence factor, the percentage of program bulbs turned on during the PJM Winter Peak hours.²

The lifetime energy and demand savings are estimated by multiplying the verified savings by the effective useful life for each measure with a unique EUL value.

The EM&V team conducted research to validate the parameters that were not specified in the TRM. The results are shown in the following table.

² The Winter Peak Period is defined by PJM as the period from 6-8 am and 5-7 pm, Central Time Zone, between January 1 and February 28.

Table 6-1. Savings Parameters

Verified Savings Parameters	Data Source	Deemed* or Evaluated?
Program Bulbs	CY2018 Program Tracking Data	Evaluated
Delta Watts	Illinois TRM v6	Deemed
Installation Rate	Illinois TRM v6	Deemed
Leakage	PY9 End User Surveys	Evaluated
Res / Non-Res Split	Illinois TRM v6	Deemed
Hours of Use (HOU)	Illinois TRM v6	Deemed
Summer Peak Coincidence Factor (CF)	Illinois TRM v6	Deemed
Energy Interactive Effects	Illinois TRM v6	Deemed
Demand Interactive Effects	Illinois TRM v6	Deemed
NTG†	IL Stakeholder Advisory Group website	Deemed

* State of Illinois Technical Reference Manual version 6.0 from <http://www.ilsag.info/technical-reference-manual.html>. † 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>.

6.2 Other Impact Findings and Recommendations

The evaluation team has developed several recommendations based on findings from the CY2018 evaluation, as follows:

Finding 1. Overall, the tracking data was mostly accurate in terms of bulb information and application of the IL TRM v6.0. The bulb information provided (wattages, center beam candlepower (CBCP), beam angle, lamp diameter, and LED directional shape) was complete and accurate for most of the measures. There were some instances where the lamps had different specifications for the same make and model number.

Recommendation 1: ComEd should make sure that the parameters (wattage, CBCP, beam angle, lamp diameter and lumens) are consistent for each unique lamp. The base wattage for each lamp or fixture is based on these values, so providing consistent inputs will improve the savings estimates.

Finding 2: Overall, the tracking data contained the relative information needed for verification and participant information was well populated. However, there are several improvements that can be made to data and the eTRACK system.

Finding 2-1: The evaluation team found that roughly 32% of transactions had either a missing or zero value for the “Unit_Lamp_Life”.

Recommendation 2: The evaluation team recommends including lamp lives for all transactions included in the tracking data so EULs reported in the eTRACK system can be verified.

Finding 2-2: During the data review, the evaluation team noted that all “Two Pin Based LED” and “Four Pin Based LED” were stick LEDs and were classified as Omni-Directional Lamps.

Recommendation 3: The evaluation team recommends including the lamp type for all pin based lamps.

Finding 2-3: The evaluation team found 660 transactions of PAR30 LED lamps that did not specify if the lamp was a PAR30L or PAR30S lamp. As a result, the verification team assumed that these lamps were PAR30S lamps for purposes of lumen mapping.

Recommendation 4: The team recommends including the specific PAR30 type designation whenever possible to more accurately estimate program savings.

Finding 2-4: Currently, the eTRACK system does not record the residential parameters used to calculate the savings associated with the residential share of program lamps.

Recommendation 5: The evaluation team recommends including these values in the tracking system to help identify the cause of any discrepancies between the ex ante and verified values.

Finding 3: The ex ante ISR applied to TLEDs was derived from the LED screw-based bulb and fixture value of 95.7%.

Recommendation 6: The evaluation team recommends that the TLED ISR value for LFs (98%) be used rather than 95.7%.

Finding 4: The evaluation team reviewed the equation used to calculate the ex ante savings estimates. The evaluation team found that the residential share of ex ante savings was calculated using commercial interactive effects and ISRs.

Recommendation 7: The team recommends that residential parameters found in the TRM be applied to the residential share of savings.

Recommendation 8: The evaluation team recommends including the program leakage rate from the previous evaluation cycle research. The leakage rate can be found in the “ComEd PY9 Instant Discounts Evaluation Research Report” from the previous year.

Finding 5: The evaluation team found that the building type field was always populated as unknown and the unknown building type and associated parameters were applied for all transactions.

Recommendation 9: ComEd could improve their ex ante savings estimates by establishing preliminary business types for end users where possible and applying the associated parameters from the TRM. (See Table 7-1 for business types the evaluation assigned to participants.)

Finding 6: The ex ante tracking data currently does not provide an estimate for peak demand savings.

Recommendation 10: The evaluation team recommends that the peak demand be calculated per the TRM v6 and included in the ex ante results.

Finding 7: The evaluation team found that the ex ante methodology for battery chargers is inconsistent with the IL TRM v6.

Recommendation 11: The evaluation team recommends that the utilities use the deemed values for battery chargers for energy savings and peak demand savings, as per IL TRM v6.

Finding 8: Several of the PAR and MR wattage baselines included in the tracking data did not align with the verified baseline wattage values. The majority of these transactions were a result of rounding up the value derived from the ENERGY STAR Center Beam Candle Power tool found in the IL TRM v6.

Recommendation 12: The evaluation team recommends rounding down values derived from ENERGY STAR Center Beam Candle Power tool to the appropriate permitted wattage for each specific PAR or MR lamp type, as specified in the IL TRM v6.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

7.1 Tracking System Review

The tracking system review for the CY2018 Instant Discounts Program was an iterative process. ComEd provided a comprehensive dataset that included the current program year data. The evaluation team ran checks and found that the current program year records were complementary and non-overlapping with bulb sales attributed to previous program years. The evaluation team also checked the records to verify that the bulbs were bought and installed in ComEd territory in 2018.

7.1.1 Customer Information

The completeness of the purchaser and end user contact information is important in establishing the samples for the evaluation research purchaser surveys and attempting to determine the end user business types of installations of instant discounts products. Overall, the purchaser information is well populated. Every transaction contains a purchaser name and its associated address. However, there were approximately 11% of records where the email addresses for purchasers were missing. Additionally, there are many instances of purchases made by the same company, but under varying combinations of slightly different names, phone numbers, or emails. The actual unique purchasers and associated contact info is only able to be determined after a manual review and update of distinct combinations prior to sampling.

7.1.2 Building Type Lookups

The tracking data did not provide unique building types for any records, instead used an unknown building type. The evaluation team attempted to assign business types to large transactions, as specified in the IL TRM. The evaluation team used the business name to assign a more accurate business type to each end user, for the top 50% of non-contractor sales volume, as specified in the IL TRM v6.0. Additionally, where the evaluation team identified the purchaser as a contractor, the business type was also assigned as "Unknown" because contractors may install lamps at a variety of business types. After this process, the evaluation team was able to establish business type for 8% of Instant Discounts transactions (34% of total sales volume). Table 7-1 shows the distribution of the assigned business types used in the analysis. The evaluators recommend that ComEd and the implementation team continue to work collaboratively with evaluation efforts to improve business type assignments.

Table 7-1. Distribution of End User Business Types

End-User Business Type	Transactions	Percent	Total Units Sold	Percent
Assisted Living	194	0.41%	20,172	1%
College	194	0.41%	35,319	1%
Elementary School	10	0.02%	2,451	0.1%
Exterior	1	0.00%	1,000	0.0%
Grocery	20	0.04%	49,150	2%
Healthcare Clinic	681	1.44%	86,388	3%
High School	61	0.13%	25,739	1%
Hospital - CAV econ	402	0.85%	20,681	1%
Hospital - VAV econ	446	0.94%	117,536	5%
Hotel/Motel - Common	179	0.38%	20,023	1%
Hotel/Motel - Guest	254	0.54%	44,228	2%
MF - High Rise - Common	162	0.34%	24,609	1%
MF - Mid Rise	32	0.07%	10,792	0.4%
Manufacturing Facility	196	0.41%	69,036	3%
Movie Theater	29	0.06%	5,312	0.2%
Office - High Rise - CAV econ	30	0.06%	3,968	0.2%
Office - High Rise - VAV econ	180	0.38%	33,350	1%
Office - Low Rise	158	0.33%	89,158	3%
Office - Mid Rise	120	0.25%	29,309	1%
Religious Building	15	0.03%	4,707	0.2%
Retail - Department Store	126	0.27%	78,014	3%
Retail - Strip Mall	51	0.11%	14,342	1%
Unknown	23,244	49.06%	926,551	36%
Warehouse	319	0.67%	95,523	4%
Contractor (Unknown)	20,278	42.80%	779,350	30%

Source: ComEd tracking data and Navigant team analysis.

7.1.3 Make and Model Lookups

The evaluation team also reviewed lamp information by manufacturer and model number. The wattage and lumens were verified for the top two-thirds (66.7%) of lighting sales volume. For directional LEDs, the CBCP, beam spread, and lamp diameter were also verified. This resulted in a handful of minor changes to these fields to increase the accuracy of impact calculations. The evaluation team also looked up reflector types (e.g., PAR38, BR20, etc.) for each of the directional LEDs. These are necessary to use the lumen mappings in the IL TRM v6.0 to determine delta watts of these bulbs. In this review, the evaluation team confirmed whether the bare lamp measure wattages for TLED manufacturers was correct. The evaluation team used the manufacturer-reported measure wattages in these cases to arrive at delta watts.

8. APPENDIX 2. IMPACT ANALYSIS DETAIL

8.1 HID Lamps

The II TRM v6 utilizes the lumen output match to determine a baseline wattage for LED fixtures, but older metal halide and sodium vapor lamps have a much higher lumen rating than the LED equivalent, therefore the TRM-prescribed baseline wattage would be much higher than what was actually assigned. The evaluation team consulted previous evaluation of lighting in California and consulted lighting manufacturers to determine an appropriate factor to use to determine the baseline wattage. Per discussions with ComEd and the implementation team, all HID lamps received a baseline wattage that was 2.5 times higher than the measure wattage. As a result, HID lamps have larger savings estimates than what was reported in the tracking data and were the primary cause of the 1.04 realization rate for these lamps.

8.2 PAR and MR Lamps

Several of the PAR and MR baselines included in the tracking data did not align with the verified baseline values. The majority of these transactions were a result of rounding up the value derived from the ENERGY STAR Center Beam Candle Power tool found in the TRM. This rounding caused the baseline wattage assigned value to be placed in a higher baseline wattage bin than the evaluator assigned value. For example, a PAR38 that received a "Wattsbase" of 99.65 was rounded up to 100. Whereas, the TRM specifies that "the result of the equation ... should be rounded DOWN to the nearest wattage established by ENERGY STAR", which results in a verified baseline wattage of 90. Additionally, 11 transactions appear to be mapped using the "R, BR, and ER with medium screw bases diameter <=2.25'" category. Seven transactions used permitted wattages that were not appropriate for that bulb's specific PAR type. To correct these discrepancies, the evaluation team recommends rounding down values derived from ENERGY STAR Center Beam Candle Power tool to the appropriate permitted wattage for each specific PAR/MR lamp type.

8.3 EUL

While the EULs for every transaction were provided, a large portion of the reported measure lives in the "Unit_Lamp_Life" variable was either missing or reported as zero. Roughly 32% of transactions, across a variety of lamp types, had either a missing or zero value for "Unit_Lamp_Life". It is important to include the measure lives for all transactions, so the evaluation team can verify EULs reported in the tracking data, which are used for cumulative persistence annual savings estimates. This is particularly important for measures that do not receive a deemed measure life. For example, LED lamps and fixtures (A-lamps, reflectors, globes, candelabras, and others) have measure lives and EULs reported as the rated measure life divided by the deemed hours of use. In addition, the lamp life is important in calculating a weighted average measure life for the residential/non-residential split.

8.4 Program Volumetric Detail

As shown in Table 8-1, the total number of units sold during the CY2018 Instant Discounts Program was 2,586,708 which is a 26 % increase from the total units sold in PY9³. This was largely due to the 61% increase in TLED sales between PY9 and CY2018. LEDs⁴ comprised nearly 93% of CY2018 Instant Discount sales. Compared to PY9, the total sales of LEDs increased by 37% and total sales of LF lamps decreased by 38%.

Table 8-1. CY2018 Volumetric Findings Detail

Program Year	Standard CFLs	Specialty CFLs	LEDs	Linear FLs	HIDs	LF Ballasts	Battery Chargers	Total
CY2018	NA	NA	2,399,886	186,701	NA	NA	121	2,586,708
PY9	NA	NA	1,749,883	303,331	NA	NA	169	2,053,383
PY8	NA	NA	1,131,992	503,948	NA	NA	76	1,636,016
PY7	279,320	261,262	1,109,148	791,443	2,025	67,331	160	2,510,689
PY6	343,577	362,332	804,299	840,903	2,607	67,391	NA	2,421,109
PY5	249,799	347,639	211,955	503,627	2,799	NA	NA	1,315,819
PY4	194,180	381,072	NA	NA	NA	NA	NA	575,252
PY3	4,173	929	NA	NA	NA	NA	NA	5,102

Note: PY9 was 19 months long. All other years were 12 months.

NA = Not applicable

Source: ComEd tracking data and Navigant team analysis.

8.5 Gross Program Impact Parameter Estimates

The EM&V team conducted research to validate and supplement parameters that were not fully specified in the tracking system. Evaluation research verified specialty bulb type classifications (globe, candelabra, PAR30, etc.) and ensured that TRM parameters that vary by bulb type were applied correctly. The evaluation team also applied the residential and non-residential splits for each product type (detailed in section 8.5.4). Finally, where possible, the evaluation team assigned building type based on business name and address and applied the building type specific parameters from the TRM. The resulting verified savings parameters used in CY2018 that are independent of installation location (residential versus non-residential) are included in Table 8-2 and those parameters that may vary are included in Table 8-3. These tables include both ex ante and verified savings parameter estimates. The differences are explained in the section after the tables.

³ PY9 was 19 months long.

⁴ Including LED lamps, TLEDs, fixtures and exit signs.

Table 8-2. Verified Gross Savings Parameters

Gross Savings Input Parameters	Product Type	CY2018 Ex Ante Value	CY2018 Verified Savings Value	Deemed* or Evaluated?
Program Unit Sales	LED Lamps	856,282	856,282	Evaluated
	TLEDs	1,360,970	1,360,970	Evaluated
	LED Fixtures	156,469	156,469	Evaluated
	LED Exit Signs	26,165	26,165	Evaluated
	Linear Fluorescents	186,701	186,701	Evaluated
	Battery Chargers	121	121	Evaluated
	Total		2,586,708	2,586,708
Delta Watts	LED Lamps	50.4	50.3	Deemed
	TLEDs	18.9	18.9	Deemed
	LED Fixtures	46.1	45.7	Deemed
	LED Exit Signs	19.7	19.7	Deemed
	Linear Fluorescents	4.5	4.5	Deemed
	Battery Chargers	-	-	Deemed
Res/NonRes Split	LED Lamps, LED Fixtures	0%/100%	4%/96%	Deemed
	Linear Fluorescents, TLEDs	0%/100%	1%/99%	Deemed
	LED Exit Signs, Battery Chargers, LED HID	0%/100%	0%/100%	Deemed
Leakage	All	NR	0.53%	Evaluated

NR = Not reported

* 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 8-3. Verified Gross Savings Parameters – Residential vs. Non-Residential

Gross Impact Parameters	Product Type	CY2018 ComEd Reported (Ex Ante)	CY2018 Verified (Ex Post)		Deemed* or Evaluated?
			Res	Non-Res	
Installation Rate	LED Lamps	95.7%	89.9%	95.7%	Deemed
	TLEDs	95.7%	93.5%	98.0%	Deemed
	LED Fixtures	95.7%	93.5%	95.7%	Deemed
	LED Exit Signs	100.0%	100.0%	100.0%	Deemed
	Linear Fluorescents	98.0%	93.5%	98.0%	Deemed
	Battery Chargers	100.0%	100.0%	100.0%	Deemed
Hours of Use	LED Lamps	3,612	847	3,555	Both†
	TLEDs	3,379	891	4,096	Both†
	LED Fixtures	3,379	891	3,393	Both†
	LED Exit Signs	8,766	8,766	8,766	Both†
	Linear Fluorescents	3,379	891	3,563	Both†
	Battery Chargers	8,280	8,280	8,280	Both†
Summer Peak CF	LED Lamps	NR	0.08	0.58	Both†
	TLEDs	NR	0.09	0.63	Both†
	LED Fixtures	NR	0.09	0.58	Both†
	LED Exit Signs	NR	1.00	1.00	Both†
	Linear Fluorescents	NR	0.09	0.60	Both†
	Battery Chargers	NR	0.00	0.58	Both†
Winter Peak CF	LED Lamps	NR	0.12	0.55	Evaluated
	TLEDs	NR	0.12	0.57	Evaluated
	LED Fixtures	NR	0.12	0.55	Evaluated
	LED Exit Signs	NR	1.00	1.00	Evaluated
	Linear Fluorescents	NR	0.12	0.55	Evaluated
	Battery Chargers	NR	-	-	Evaluated
Interactive Effects	LED Lamps	1.09	1.06	1.11	Both†
	TLEDs	1.09	1.06	1.13	Both†
	LED Fixtures	1.09	1.06	1.09	Both†
	LED Exit Signs	1.09	1.04	1.10	Both†
	Linear Fluorescents	1.09	1.06	1.11	Both†
	Battery Chargers	NA	NA	NA	Both†

NR = Not reported

NA = Not applicable

‡ State of Illinois Technical Reference Manual version 6.0 from * A value of "Both" indicates that business type specific parameters from the TRM were used, but that evaluation activities were necessary to identify business types.

8.5.1 Unit Sales

There were no misclassifications of lamp categories in the tracking system; therefore, there were no differences in unit sales in any lamp category between ex ante and ex post.

8.5.2 Delta Watts

The differences in delta watts between ex ante and ex post were marginal for each of the measure groups. ComEd accurately defined ex ante assignments of baseline and measure, with only small discrepancies for a handful of line items. Average delta watts for each lighting measure differed by no more than 0.4W between ex ante and ex post. These remaining small differences were due to the updates of lamp specifications based on the evaluation team's bulb information lookups and a small number of misclassified lamp types.

8.5.3 Installation Rates

The installation rates defined by ComEd match the IL TRM v6.0 for non-residential installations with the exception of TLEDs. The ex ante ISR applied to TLEDs was derived from the LED screw-based bulb and fixture value of 95.7% whereas the evaluation team recommends using the ISR for LFs (98.0%). Along with that, ComEd does not define a residential and non-residential split in their ex ante estimates as defined by the IL TRM. Instead, ex ante estimates use only the non-residential installation rates from the IL TRM v6.0. Due to the applied residential and non-residential split, a small portion of the LED bulbs, LED fixtures, and LFs were subject to a slightly lower residential installation rate for the verification analysis.

8.5.4 Residential/Non-residential Installation Location Split

There were no residential installations for Instant Discounts products assumed by ComEd in their tracking system (100% non-residential). Evaluators used the IL TRM v6.0 for the ex post verified savings residential and non-residential split values. For LED bulbs and fixtures, the split was 4% residential and 96% non-residential. For LED exit signs, the split was 100% non-residential. For LFs, the split was 1% residential and 99% non-residential. For LED HID, the split was 100% non-residential based on discussion and agreement between ComEd and the evaluators.

8.5.5 Leakage

Based on the end user telephone interviews conducted for the PY9 evaluation, leakage of program bulbs outside of ComEd territory appears to be a very small issue for the Instant Discounts Program. Of the 529 respondents, only 28 indicated that some bulbs of the program bulbs they purchased were installed outside of the ComEd service territory. The estimated percentage of bulbs reported to have been installed outside of ComEd territory was approximately 0.53% of the total bulbs purchased by survey respondents. Additional details on leakage from CY2018 and the end user survey will be presented in an evaluation research report. The evaluation team recommends that ComEd apply the leakage rate from the previous evaluation period's Evaluation Research Report to more accurately estimate savings.

8.5.6 Hours of Use and Interactive Effects

In ComEd's tracking system, there were no residential installations assumed and all end user business types were classified as "Unknown." As mentioned above, the evaluation team used the business name to assign a more accurate business type for the top 50% of non-contractor sales volume. This resulted in varying values for hours of use and interactive effects. For energy and demand interactive effects, there were only small differences between ex ante and non-residential ex post values. Residential interactive effects values, which are lower, were applied to a small portion of sales in accordance with the residential and non-residential split. The primary drivers of the realization rates for TLEDs and LFs were the differences in hours of use. For TLEDs, this resulted in an average non-residential HOU that was 21% higher than ex ante values. For LFs, the ex post non-residential HOU was 5% higher than ex ante. In

addition, while residential installations make up a small portion of sales, the residential HOU values for the lighting measures were much lower than their non-residential counterparts.

8.6 CY2019 Carryover Savings Estimate

Calculation of the CY2019 carryover estimate relies upon the IL TRM v7.0 and the PY8 and PY9 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 late installed bulbs are calculated based on the following parameters:

- Delta Watts – Verified savings estimate from the year of installation (source: IL TRM v7.0).
- Res/Non-Res Split - Verified savings estimate from the year of purchase (source: IL TRM v5.0 and IL TRM v6.0).
- HOU and Peak CF – Verified savings estimate from the year of installation (source: IL TRM v7.0).
- Energy and Demand IE – Verified savings estimate from the year of installation (source: IL TRM v5.0.)
- Installation Rate - Verified savings estimate from the year of purchase (source: IL TRM v5.0 and IL TRM v6.0). For false transactions from PY9, the CY2019 installation rate is half of the difference between the adjusted first year and lifetime installation rates as detailed in the memo titled “PY9 ComEd Business Instant Lighting Discounts Program – Power Energy Solutions Data Investigation and Transaction Verification,” dated 1/17/2018.
- NTG – Evaluation research from the year of purchase (source: PY9 and CY2018 Reports).

Table 8-4 shows that in CY2019, 78,390 bulbs, purchased during either PY9 or CY2018 (including false transactions), 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 10,843,574 kWh, 2,182 summer peak kW, and 2,068 winter peak kW, which will be counted in CY2019 as Instant Discounts Program carryover savings.

Table 8-4. CY2018 Verified Savings Carryover Estimate

CY2019 Verified Savings Carryover Estimate	PY9 Bulbs	CY2018 Bulbs	False Transactions CY2019 Carryover	CY2019 Carryover
Carryover Bulbs Installed During CY2018	10,316	45,381	23,233	78,930
Average Delta Watts	53.8	32.6	71.0	46.7
Average Daily Hours of Use	9.40	9.59	9.61	9.57
Summer Peak Load Coincidence Factor	0.55	0.57	0.56	0.56
Winter Peak Load Coincidence Factor	0.52	0.54	0.53	0.54
Gross kWh Impact Per Unit	186.0	113.7	249.4	163.1
Gross kW Impact Per Unit	0.05	0.03	0.07	0.05
Installation Rate	100%	100%	100%	100%
Energy Interactive Effects	1.04	1.09	1.09	1.08
Demand Interactive Effects	1.37	1.36	1.36	1.36
Carryover Gross Energy Savings (kWh)	1,993,450	5,622,067	6,313,908	13,929,424
Carryover Gross Demand Savings (kW)	530	1,479	1,650	3,659
Carryover Gross Summer Peak Demand Savings (kW)	399	1,143	1,260	2,803
Carryover Gross Winter Peak Demand Savings (kW)	378	1,084	1,194	2,656
Net-to-Gross Ratio	0.77	0.78	0.78	0.78
Carryover Net Energy Savings (kWh)	1,534,593	4,384,133	4,924,848	10,843,574
Carryover Net Demand Savings (kW)	408	1,153	1,287	2,848
Carryover Net Summer Peak Demand Savings (kW)	307	892	983	2,182
Carryover Net Winter Peak Demand Savings (kW)	291	845	931	2,068
EUL (Res/Non-res)	15/9	15/10	15/8	15/9

Source: ComEd tracking data and Navigant team analysis.

9. APPENDIX 3. TOTAL RESOURCE COST DETAIL

Table 9-1, 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 9-1. 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)	Heating Penalty (Therms)
Lighting	Battery Chargers	Units	121	15.0	380,246	83	1,115,677	112	-
Lighting	LED Exit Signs	Lamp	26,165	16.0	4,791,829	538	4,802,685	499	(62,864)
Lighting	LED Fixtures	Lamp	156,469	12.3	25,235,831	7,086	24,523,042	6,805	(310,909)
Lighting	LED HID	Lamp	27,196	14.5	8,480,720	2,211	8,796,662	2,238	(112,328)
Lighting	LED Lamps	Lamp	829,086	7.6	150,796,602	40,564	148,894,706	39,194	(1,902,124)
Lighting	TLEDs	Lamp	1,360,970	13.0	90,149,139	25,315	116,766,453	25,104	(1,430,925)
Lighting	Linear Fluorescents	Lamp	186,701	11.4	2,995,846	861	3,195,844	815	(40,082)
Lighting	Carryover	Lamp	77,067	8.7	13,588,528	3,565	13,588,528	3,565	(67,746)

Source: ComEd tracking data and Navigant team analysis.