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Memorandum

To: Vince Gutierrez, ComEd
CC: Jennifer Morris, ICC Staff
Jeff Erickson, Randy Gunn, Nishant Mehta and Rob Neumann, Navigant
From: Amy Buege and Ethan Barquest, Itron Evaluation Team
Date: August 20, 2018
Re: ComEd Residential Lighting Discounts Program Recommended NTGR Updates

1. INTRODUCTION

This memorandum presents the evaluation research[1] net-to-gross ratio (NTGR) estimates for omni-directional, directional and specialty LEDs sold through ComEd's Residential Lighting Discounts Program during PY9.

2. RESULTS SUMMARY

The table below presents the PY9 Evaluation Research NTGR estimates for program omni-directional, directional and specialty LEDs. These results were estimated using the same participant self-report method used in previous evaluation years. This method is consistent with the methodology used to estimate the NTGR for lamps sold through Ameren Illinois's residential lighting program. The NTGR results in Table 2-1 are inclusive of participant and non-participant spillover.

Table 2-1: PY9 Evaluation Research NTGR Results

LED Type	Segment	Free-Ridership	Participant[2] Spillover	Nonparticipant Spillover	NTGR
Omni-Directional	Non-Demo Periods	0.41	0.02	0.06	0.67
	Demo Periods	0.32	0.02	0.06	0.76
	Recommended PY9 Estimate (5/95 Demo/Non-Demo split)	0.41	0.02	0.06	0.67
Directional	Non-Demo Periods	0.47	0.02	0.06	0.61
	Demo Periods	0.49	0.02	0.06	0.59
	Recommended PY9 Estimate (5/95 Demo/Non-Demo split)	0.47	0.02	0.06	0.61
Specialty	Non-Demo Periods	0.55	0.02	0.06	0.53
	Demo Periods	0.43	0.02	0.06	0.65
	Recommended PY9 Estimate (5/95 Demo/Non-Demo split)	0.55	0.02	0.06	0.53

Source: PY9 In-store Intercept Surveys

[1] It should be noted that the NTGR estimates presented here are the evaluation verified estimates (based on the PY9 in-store intercept surveys) and weighted by the number of program sold in PY9.
[2] Note that the evaluation team developed a single estimate for participant spillover and a single estimate for non-participant spillover across all LED types.

As shown in Table 2-1, the NTGR estimates for omni-directional and specialty LEDs purchased during demonstration events were higher than the NTGR estimates for bulbs purchased during non-demonstration event periods. Though the NTGR for directional LEDs at demonstration events was lower than during non-demonstration even periods, the difference was very small (0.02 difference in NTGR). Due to the increased program sales which occurred during demo events, and the fact that the in-store data collection methodology resulted in an over-sampling of demonstration period data,[3] the final results were estimated separately for demonstration and non-demonstration event periods and then weighted by the estimated percentage of bulbs sold during demonstration events. The recommended NTGR results below assumed a 5%/95% demonstration event/non-demonstration event period split which represents an upper bound on the likely percentage of program bulbs sold annually during demonstration events. Sensitivity analyses performed on the demonstration/non-demonstration event split (ranging from a 1%/99% demo/non-demo split to a 10%/90% demo/non-demo split) found little difference in the resulting NTGR estimates.

3. PY9 NTGR METHODOLOGY

The evaluation research NTGR estimates included in this memo are based on a total of 817 in-store intercept surveys conducted during the PY9 evaluation. Table 3-1 below shows (by retailer type and overall) the number of retail store locations where intercept surveys were conducted in PY9, the number of days of interviewing that took place, the distribution of completed intercept surveys, and the PY9 program LED bulb sales used for NTGR analysis retailer weighting. As this table shows, a total of 75-person days were spent in retail stores conducting intercept surveys and a total of 25[4] program retail stores were visited across the four program retailers included in the sample. This table also shows that the greatest proportion of PY9 intercept surveys were conducted with lighting purchasers (program and non-program) in DIY stores (73%). DIY stores account for 44% of PY9 program LED bulb sales. The average number of intercept surveys completed per day varied by retailer type, ranging from a high of 14.1 in DIY stores, to a low of 4.5 in warehouse stores. The NTGR results presented in this memo are weighted by PY9 retailer type program bulb sales in order to make the results representative of the distribution of PY9 Residential Lighting Discounts program bulb sales.

Table 3-1. PY9 Intercept Survey Summary by Retailer Type

Retailer Type	Stores	Person-Days	PY9 Intercepts		Average Intercepts/ Day	PY9 LED Bulb Sales	
			#	%		#	%
Big Box	6	18	158	19%	8.8	2,420,878	15%
DIY	14	42	592	73%	14.1	7,298,796	44%
Warehouse	5	15	67	8%	4.5	5,177,639	31%
Other	0	0	0	0%	n/a	1,706,352	10%
Total	25	75	817	100%	10.9	16,603,665	100%

Source: PY9 In-store Intercept Surveys

Table 3-2 below shows the distribution of PY9 intercept survey respondents by retailer and bulb type purchased. As this table shows, 51% of intercept survey respondents purchased one or more program bulb (the majority of the bulbs purchased were omni-directional LEDs) and 53% of respondents purchased one or more non-program bulb (the majority of these being incandescent bulbs).

[3] Each three-day data collection period at a program retailer commenced with a half day demonstration event so that the program implementation staff were on hand to introduce the intercept surveyor to retail staff and secure approval for the in-store data collection activities. Demonstration events occurred on 13 of the 75 days when intercepts were being conducted (17% of the data collection period), which is a significantly higher percentage of time than throughout the remainder of the program year.
[4] Two stores (one Big Box and one DIY) were visited in both the fall and spring intercept survey efforts, they are counted twice in the total store count (i.e., there were 23 distinct store locations visited).

Table 3-2. Distribution of PY9 Intercept Survey Respondents by Bulb Type Purchased

Retailer Type	Program Bulbs				Non-Program Bulbs						All
	Omni	Dir	Spec	All	Omni	Dir	Spec	CFL	Inc /Hal	All	
Big Box	63	2	5	69	23	4	13	0	61	99	**158**
DIY	198	82	28	292	97	30	43	22	154	327	**592**
Warehouse	42	6	10	56	7	2	3	0	0	11	**67**
Total	303	90	43	417	127	36	59	22	215	437	**817**
% Surveyed	37%	11%	5%	51%	16%	4%	7%	3%	26%	53%	**100%**
% Pgm Lamps	70%	71%	42%								

Source: Evaluation Team Analysis of PY9 Shelf Survey Data

Table 3-2 above shows that in PY9, around 70% of intercept respondents purchasing omni-directional and directional LEDs were buying program lamps. This was not the case for specialty lamps where only 42% of the lamps purchased were program lamps. This was primarily driven by specialty LED purchases at big box and DIY stores, where only 28% and 39% of purchases were program lamps.

Table 3-3 shows that the overall number of LEDs incentivized in PY9 at the four program retailers where intercepts were performed was virtually unchanged between PY8 and PY9 (209 LED models in PY8 vs. 207 models in PY9). However, as the table shows, the number of program models at big box stores decreased by roughly half the program models at DIY and warehouse stores increased by 30% or more.

Table 3-3. Number of Unique Model Numbers of Incentivized LEDs Sold by Intercept Retailers

Retailer Type	PY9[5]				PY8				
	Omni	Dir	Spec	All	Omni	Dir	Spec	All	YOY Increase
Big Box	25	9	5	39	21	28	32	81	48%
DIY	47	48	56	151	44	57	16	117	129%
Warehouse	5	4	8	17	4	4	3	11	155%
Total	77	61	69	207	69	89	51	209	99%

Source: Evaluation Team Analysis of PY9 Shelf Survey Data

Table 3-4 below presents the number of intercepts conducted and the volume of program versus non-program bulbs purchased during ComEd sponsored in-store demonstration events (demo events) versus during non-demonstration event periods. In-store interviewers accompanied program implementation staff into program retail stores during demonstration events to familiarize themselves with the program offerings. As this table shows, demonstration events were being conducted during roughly 17% of the time in-store intercepts were being conducted and 24% of completed surveys occurred during a demonstration event. Program bulbs were purchased at a higher rate during demonstration events (76% of bulbs sold during demo events were program bulbs vs 67% being program bulbs during non-demo events). Typically, 20 to 40 ComEd-sponsored demonstration events occur each month across all program retailers and thus intercepts occurring during demonstration events are likely over-represented in our sample.[6] To account for this over-representation, the NTGR estimates were calculated separately for

[5] PY9 model numbers were taken from the bulb list provided to the evaluation team from ComEd on October 16, 2017.
[6] The evaluation team estimates that between 1% and 5% of all annual program sales occur during a demonstration event period. This assumption is based on roughly 40 demonstration events occurring monthly, roughly 800 participating retail store fronts and a four-fold increase in the rate of sale during a demonstration events.

demo vs. non-demo event periods and the final NTGR results were weighted based upon an estimate of the percent of annual sales that occurred during demo event periods.

Table 3-4. PY9 Demo Event versus Non-Demo Event Intercept Survey Summary

Demo Event?	Person-Days[7]		Intercepts		Bulb Sales			
	#	%	#	%	Pgm LEDs	%	NonPgm LEDs	%
Demo Event	13	17%	192	24%	746	76%	235	24%
Non-Demo Event	62	83%	625	76%	1,770	67%	853	33%
Total	75	100%	817	100%	2,516	70%	1,088	30%

Source: Evaluation Team Analysis of PY9 Shelf Survey Data

4. PY9 NTGR Estimation Methodology

In PY9, NTGR estimates for LEDs were calculated using the customer self-report method based on data collected during the PY9 in-store intercept surveys. The NTGR definition used in the state of Illinois includes both Free-ridership and Participant and Non-Participant spillover and is calculated as follows:

NTGR = 1 – Free-ridership + Spillover (participant and non-participant)

The calculation of Free-ridership and Participant and Non-Participant Spillover are provided in the sections below.

5. PY9 Evaluation Verified Free-ridership Results

Free-ridership was estimated by calculating two separate free-ridership scores. These scores were the following:

1) *Program Influence Score* (PI Score) - The degree of influence the program[8] had on the customers' decision to install LEDs, on a scale of 0 to 10.
2) *No-Program Score* (NP Score) – The customer's self-reported purchasing plans if the ComEd incentive had not been offered and the bulbs had been more expensive.

Once these scores were calculated for all program bulb purchasers, free-ridership was calculated as:

Free-Ridership = 1 – (PI Score + NP Score) / 20

Table 5-1 through Table 5-3, below, present the ***unweighted*** free-ridership estimates for omni-directional, directional, and specialty LEDs, as well as the free-ridership results segmented by Demo Event (whether the intercept survey occurred during an in-store demonstration event), Retailer Type (big box, DIY, or warehouse), and Demo Event and Retailer Type. As shown in the tables below, the number of intercept surveys completed with customers purchasing directional and specialty bulbs in big box and warehouse retailers was very low (ten or less). For this reason, the final weighted free-ridership estimates were not weighted by retailer type for these bulb types.

[7] Demonstration events lasted approximately 4 hours and so were considered 0.5 of a day.
[8] Program influence could be attributable to the program incentive, in-store information materials, placement of incentivized bulbs, or information from retail store personnel who call out the ComEd program.

Table 5-1. Unweighted PY9 Omni-Directional LED Free-Ridership Segmentation Analysis

Omni-Directional LED Free-Ridership		N	Free-Ridership	Lower 90%CL	Upper 90%CL
All Omni-Directional LEDs		302	0.38	0.35	0.41
Demo Event	Yes	95	0.32	0.27	0.36
	No	207	0.41	0.37	0.45
Retailer Type	Big Box	62	0.35	0.28	0.41
	DIY	198	0.42	0.38	0.46
	Warehouse	42	0.24	0.17	0.31
Demo Event and Retailer Type	Big Box – No Demo	50	0.39	0.31	0.47
	Big Box – Demo	12	0.23	0.15	0.31
	DIY – No Demo	132	0.45	0.40	0.50
	DIY - Demo	66	0.35	0.29	0.41
	Warehouse – No Demo	25	0.22	0.14	0.31
	Warehouse - Demo	17	0.26	0.14	0.38

Table 5-2. Unweighted PY9 Directional LED Free-Ridership Segmentation Analysis

Directional LED Free-Ridership		N	Free-Ridership	Lower 90%CL	Upper 90%CL
All Directional LEDs		90	0.48	0.42	0.53
Demo Event	Yes	24	0.49	0.38	0.59
	No	66	0.47	0.40	0.54
Retailer Type	Big Box*	2	0.59	0	1
	DIY	82	0.48	0.42	0.54
	Warehouse	6	0.28	0.15	0.41
Demo Event and Retailer Type	Big Box – No Demo*	2	0.59	0	1
	Big Box – Demo	0	n/a	n/a	n/a
	DIY – No Demo	58	0.48	0.41	0.56
	DIY - Demo	24	0.49	0.38	0.59
	Warehouse – No Demo	6	0.28	0.15	0.41
	Warehouse - Demo	0	n/a	n/a	n/a

* Confidence limits bounded by 0 and 1.

Table 5-3. Unweighted PY9 Specialty LED Free-Ridership Segmentation Analysis

Specialty LED Free-Ridership		N	Free-Ridership	Lower 90%CL	Upper 90%CL
All Specialty LEDs		43	0.52	0.43	0.62
Demo Event	Yes	13	0.43	0.24	0.61
	No	30	0.55	0.44	0.66
Retailer Type	Big Box	5	0.31	0.14	0.49
	DIY	28	0.53	0.43	0.63
	Warehouse	10	0.55	0.28	0.81
Demo Event and Retailer Type	Big Box – No Demo	4	0.29	0.07	0.50
	Big Box – Demo	1	0.50	n/a	n/a
	DIY – No Demo	18	0.59	0.48	0.70
	DIY - Demo	10	0.38	0.17	0.59
	Warehouse – No Demo	8	0.54	0.23	0.86
	Warehouse – Demo*	2	0.57	0	1

* Confidence limits bounded by 0 and 1.

5.1 Weights

Because the in-store intercept surveys conducted and used to calculate free-ridership for PY9 were based on a convenience sample, the evaluation team applied case weights to the segmented results to correct for the over-representation of demo event completes within the final sample and also retailer type for omni-directional LEDs where the sample was large enough to support such segmentation. The goal of applying these weights is to derive LED bulb type free-ridership estimates that are representative of the final distribution of PY9 bulb sales. Table 5-4 below shows the distribution of PY9 omni-directional, directional and specialty LEDs sales by retailer-type and intercept-store status (whether intercepts were conducted at one or more retail storefronts for a given retailer). As this table shows the four stores where intercepts were conducted were responsible for slightly more than half of program bulbs sold in PY9. While the optimal data collection effort would include all retailers participating in the PY9 program, this is not possible due to the daily program bulb sales rate in some retailers being too low to be able to cost-effectively include the retailer in the data collection effort and issues gaining permission to conduct in-store research at other retailers.

Table 5-4. PY9 LED Sales used for Analysis Weights

Intercept Retailer?	Retailer Type	Omni-Directional	%	Directional	%	Specialty	%
Yes	Big Box	1,722,876	14%	27,397	1%	45,450	3%
	DIY	4,170,549	35%	1,624,368	49%	552,603	40%
	Warehouse	732,002	6%	65,365	2%	63,679	5%
	Intercept Stores	**6,625,427**	**56%**	**1,717,130**	**52%**	**661,732**	**48%**
No	Big Box	555,951	5%	52,182	2%	17,022	1%
	Discount	82,243	1%	10,732	0%	7,501	1%
	DIY	638,667	5%	266,067	8%	46,542	3%
	Dollar Stores	135,461	1%	0	0%	0	0%
	Electronics	128,955	1%	41,197	1%	5,495	0%
	Grocery/ Drug	410,569	3%	566	0%	1,331	0%
	Online	58,464	0%	15,592	0%	3,286	0%
	Small Hardware	526,535	4%	209,349	6%	69,076	5%
	Warehouse	2,743,003	23%	996,793	30%	576,797	42%
	Non-Intercept Stores	**5,279,848**	**44%**	**1,592,478**	**48%**	**727,050**	**52%**

5.2 Weighted Free-ridership Results

While the distribution of program bulbs sales by demonstration event status is unknown, it is believed to be 5% or less. As in past years, weighted free-ridership estimates have been calculated assuming three different demo/non-demo splits (1/99, 5/95, 10/90) to test the sensitivity of the free-ridership estimate to this split. Table 5-5 through Table 5-7 below present the weighted free-ridership estimates for omni-directional, directional, and specialty LEDs by demo event period and 3 different demo-non-demo splits. The recommended weighted free-ridership estimates are shown in the tables in **bold**.

Table 5-5 provides the free-ridership results for omni-directional LEDs. As this table shows, omni-directional LED free-ridership level was not very sensitive to a +/-5% shift in the percentage of program sales occurring during a demo event and thus the evaluation team recommends using a 5/95 demo/non-demo split as in previous years to calculate the final omni-directional free-ridership estimate. This weighted free-ridership estimate is slightly lower than the PY8 estimate (0.41 in PY9 versus 0.49 in PY8). The evaluation team speculates that this may be due to the fact that the PY8 omni-directional LED free-ridership score included specialty bulbs, which have been estimated separately in PY9 (due to increased sales volumes). As shown in Table 5-7 below, free-ridership for specialty LEDs in PY9 was much higher than for omni-directional LEDs (the specialty LED free-ridership score in PY9 was calculated to be 0.55).

Table 5-5. Weighted Omni-Directional LED Free-Ridership Estimates

Event Period	Free-ridership Estimate
Non-Demo Event Period	0.41
Demo Event Period	0.32
Weighted 1/99 demo/non-demo	0.41
Weighted 5/95 demo/non-demo	**0.41**
Weighted 10/90 demo/non-demo	0.40

Table 5-6 shows the free-ridership results for program directional LEDs. As this table shows, directional LED free-ridership was also not sensitive to a +/-5% shift in the percentage of program sales occurring during a demonstration event and thus the evaluation team recommends using a 5/95 demo/non-demo split as in previous years to calculate the final directional free-ridership estimate. The weighted PY9 directional LED free-ridership estimate is slightly higher than the PY8 estimate (0.47 in PY9 and 0.42 in PY8). This is likely due to customers' greater familiarity with the technology and increasing market acceptance of LEDs.

Table 5-6. Weighted Directional LED Free-Ridership Estimates

Event Period	Free-ridership Estimate
Non-Demo Event Period	0.47
Demo Event Period	0.49
Weighted 1/99 demo/non-demo	0.47
Weighted 5/95 demo/non-demo	**0.47**
Weighted 10/90 demo/non-demo	0.47

Table 5-7 shows the free-ridership results for program specialty LEDs. Again, the results show that weighted Specialty LED free-ridership estimates are fairly insensitive to a +/- 5% shift in the percentage of annual bulbs sold during demonstration events. Free-ridership for specialty LEDs was not calculated separately in PY8 due to low program specialty LED sales.

Table 5-7. Weighted Specialty LED Free-Ridership Estimates

Event Period	Free-ridership Estimate
Non-Demo Event Period	0.55
Demo Event Period	0.43
Weighted 1/99 demo/non-demo	0.55
Weighted 5/95 demo/non-demo	**0.55**
Weighted 10/90 demo/non-demo	0.54

6. SPILLOVER

In PY9, participant and non-participant omni-directional, directional, and specialty LED spillover was also estimated based on data collected during the in-store intercept surveys. Unlike the free-ridership results presented above, the spillover results were not broken down by intercepts occurring during demo and non-demo events, due to small sample sizes. The participant and non-participant spillover results are presented below.

6.1 Participant Spillover

Participant spillover occurs when a customer who is purchasing a program LED is influenced by the program to also purchase a non-program non-discounted LED bulb. A single participant spillover estimate was developed for all LED types. Table 6-1 below present the results of the LED participant spillover analysis.

As shown in Table 6-1 below, a total of 27 respondents who purchased a program LED also purchased a non-discounted LEDs. Of these 27 respondents, 15 respondents reported that the program influenced their decision to purchase the non-program LEDs. Based on this data, LED participant spillover rate was

calculated as the ratio of the spillover LEDs bulb purchases to the program LED purchases. As the table below shows, this yielded a participant LED spillover rate of 2.2%.

Table 6-1 – PY9 Participant LED Spillover Results – Self-Report Method

Participant LED Spillover	n	Bulb/Purchase	Bulbs
Non-Pgm LED Purchases by Participants	27	4.88	132
Spillover Purchases	15	3.67	55
Program Purchases	417	6.03	2,516
Participant LED Spillover Rate			**2.2%**

6.2 Nonparticipant Spillover

Nonparticipant spillover occurs when a survey respondent who is not purchasing a program LED reports that the program in some way influenced them to purchase a non-program LED bulb. A single nonparticipant spillover estimate was developed for all LED types. Table 6-2 present the results for the nonparticipant spillover analysis. Survey respondents were included in this analysis if they did not purchase any program LEDs but purchased one or more non-program LED.

As shown in Table 6-2, 42 customers who were not purchasing program LEDs reported they were influenced by ComEd's Residential Lighting Program to purchase one or more non-program LEDs. Based on this data and the respondents stated purchase intentions when they entered the store, the nonparticipant spillover rate was extrapolated to the estimated population of ComEd non-participant customers to yield an estimated 661,586 non-program LEDs being purchased by program nonparticipants. Dividing these extrapolated spillover purchases by the annualized[9] quantity of program LEDs sold in PY9 resulted in an estimated nonparticipant spillover rate of 6.0%.

Table 6-2. PY9 Nonparticipant LED Spillover Results

Nonparticipant LED Spillover	n	Bulbs / Purchase	Total Bulbs
Nonparticipant LED Spillover Purchases	42	3.78	158.9
Population Extrapolated Spillover Purchases	174,868	3.78	661,586
Annualized Program LED Sales			11,069,110
Nonparticipant LED Spillover Rate			**6.0%**

7. FINAL NTGR

Table 7-1 through Table 7-3 below present the overall self-reported PY9 bulb-weighted NTGR estimates for omni-directional, directional, and specialty LEDs. Table 7-1 shows the NTGR for omni-directional LEDs purchased during demo events was 0.76 and the NTGR for Omni-directional LEDs purchased outside demo events was 0.67. The sensitivity analysis performed on the demo/non-demo rate showed little change on the NTGR estimate when the demo rate was increased to 10%. The evaluation recommended NTGR estimate for omni-directional LEDs based on the PY9 analysis is 0.67.

[9] PY9 program sales were extrapolated to a 12-month sales number.

Table 7-1. PY9 Omni-directional LED NTGR

Segmentation	Free-Ridership	Participant Spillover	Nonparticipant Spillover	NTGR
Non-Demo Event Periods	0.41	0.022	0.06	0.67
Demo Event Periods	0.32	0.022	0.06	0.76
Recommended PY9 Estimate (5/95 Demo/Non-Demo)	**0.41**	**0.022**	**0.06**	**0.67**

Table 7-2 shows the NTGR for directional LEDs purchased during a demo event was 0.59 and the NTGR for directional LEDs purchased outside of a demo event was 0.61. The sensitivity analysis performed on the demo/non-demo rate showed no change in the NTGR estimate when the demo rate was increased to 10%. As a result, the evaluation recommended NTGR estimate for directional LEDs based on the PY9 analysis is 0.61.

Table 7-2. PY9 Directional LED NTGR

Segmentation	Free-Ridership	Participant Spillover	Nonparticipant Spillover	NTGR
Non-Demo Event Periods	0.47	0.022	0.060	0.61
Demo Event Periods	0.49	0.022	0.060	0.59
Recommended PY9 Estimate (5/95 Demo/Non-Demo)	**0.47**	**0.022**	**0.060**	**0.61**

Table 7-3 shows the NTGR for specialty LED purchased during a demo event was 0.65 and the NTGR for specialty LEDs purchased outside of a demo event was 0.53. The sensitivity analysis performed on the demo/non-demo rate showed only a small fluctuation in the NTGR estimate when the demo rate was increased to 10%. The evaluation recommended NTGR estimate for specialty LEDs based on the PY9 analysis is 0.53.

Table 7-3. PY9 Specialty LED NTGR

Segmentation	Free-Ridership	Participant Spillover	Nonparticipant Spillover	NTGR
Non-Demo Event Periods	0.55	0.022	0.060	0.53
Demo Event Periods	0.43	0.022	0.060	0.65
Recommended PY9 Estimate (5/95 Demo/Non-Demo)	**0.55**	**0.022**	**0.060**	**0.53**