



ComEd Multi-Family Market Rate Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Program Year 2018 (CY2018)
(01/01/2018-12/31/2018)

Presented to
ComEd

FINAL

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1. INTRODUCTION

This report presents the results of the impact evaluation of ComEd’s CY2018 Multi-Family Market Rate 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 Multi-Family Market Rate Program is jointly implemented by ComEd and Nicor Gas Company, and ComEd and Peoples Gas (PGL) and North Shore Gas (NSG) companies. Franklin Energy is the implementation contractor for the joint program. The Multi-Family Market Rate Program is essentially a combination of offers from the PY9 Multi-Family Assessment Program and the Multi-Family Common Area (CA) Pilot Program. The Multi-Family Market Rate Program serves as a “one stop shop” to multi-family building owners and managers to generate electricity and natural gas savings throughout the property. Since this is a joint program all the therm savings are claimed by the gas utilities and are reported in the PGL/NSG and Nicor Gas evaluation reports.

The electric and natural gas saving services include:

- Electric and gas energy assessments and provision of educational information.
- Direct installation of electric and gas saving measures in tenant and common area spaces.
- Partner Trade Ally (PTA) installation of electric and gas saving measures at no cost to customer, following agreed upon program pricing.
- In addition, the Multi-Family Market Rate Program may provide information to building owners and managers as part of the assessment that explains how they can self-register for Business Energy Analyzer (BEA).

In CY2018 the program provided assessment services and installed various energy-saving measures, which include LEDs in tenant units, water-saving devices, programmable thermostats, pipe insulation, and LEDs in common area LED fixtures.

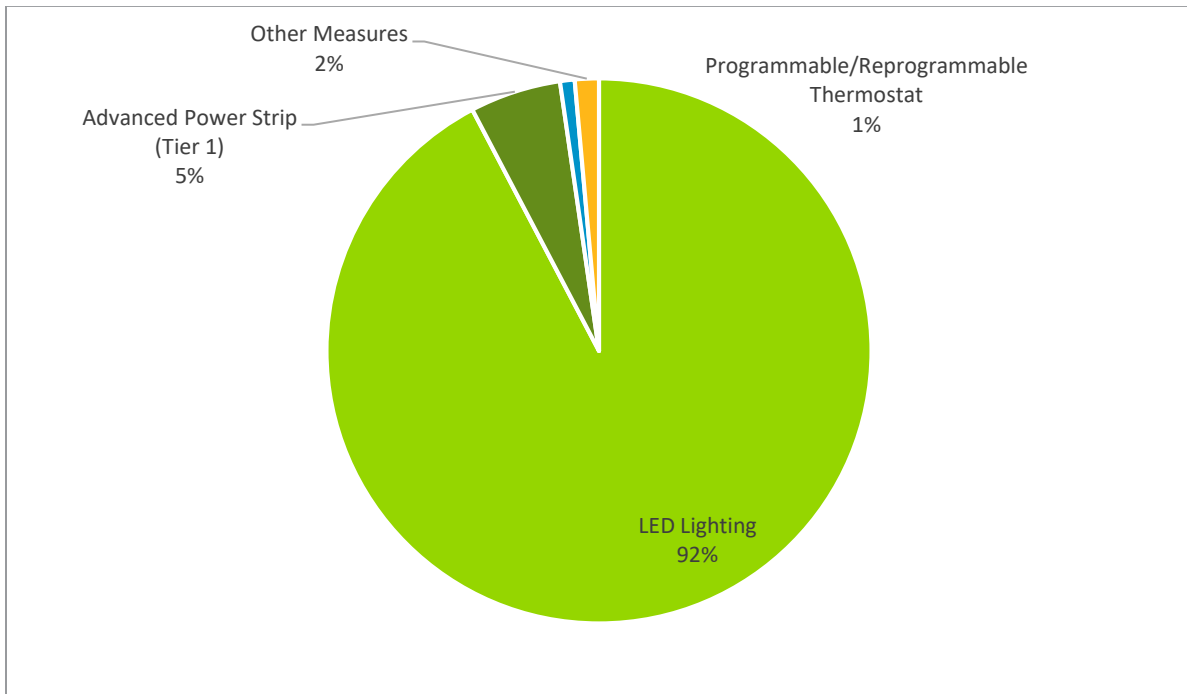
The program had 788 participants in CY2018 and distributed 179,803 measures as shown in the following table and graph. LED bulbs comprised 92 percent of all the measures installed, followed by advanced power strips (Tier 1), which were five percent of the total measures. Programmable and reprogrammable thermostats represented one percent of the measures installed, and the remaining two percent came from faucet aerators, domestic hot water pipe insulation, low flow showerheads, occupancy sensors and vending misers.

Table 2-1. CY2018 Volumetric Findings Detail

	Direct Install	Prescriptive	Total
Participants*	600	188	788
Total Measures	160,412	19,391	179,803
Installed Projects	15,105	194	15,299

*Participants comprise of distinct ComEd account numbers.
 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 4-1 summarizes the incremental energy and demand savings the Multi-Family Market Rate Program achieved in CY2018.

Table 4-1. CY2018 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Demand Savings (kW)	Summer Peak Demand Savings (kW)
Electricity			
Ex Ante Gross Savings	12,186,368	NR†	1,264
Program Gross Realization Rate	1.02	NA	1.01
Verified Gross Savings	12,396,380	7,918	1,276
Program Net-to-Gross Ratio (NTG)	Varies	Varies	Varies
Verified Net Savings	11,768,297	7,552	1,213
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	12,186,368	NR†	1,264
Program Gross Realization Rate	1.02	NA	1.01
Verified Gross Savings	12,396,380	7,918	1,276
Program Net-to-Gross Ratio (NTG)	Varies	Varies	Varies
Verified Net Savings	11,768,297	7,552	1,213

NA = Not applicable

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

Note: The coincident Summer Peak period is defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August. The demand savings are defined as difference in kW in the baseline and post installation period for measures installed in year 2018.

† Not reported

Source: ComEd tracking data and Navigant team analysis.

4. CUMULATIVE PERSISTING ANNUAL SAVINGS

The measure-specific and total verified gross savings for the Multi-Family Market Rate Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2018 are shown in the following tables and figure. The CY2018 total CPAS across all measures is 11,768,297 kWh. ComEd did not claim any converted gas savings for the Multi-Family Market Rate Program in CY2018.

Navigant applied the Illinois Technical Reference Manual (IL TRM) deemed EISA baseline adjustment for LED lamps starting in 2021. The EISA baseline shift only applies to LED omnidirectional bulbs. We estimated 2,553,123 total first year net kWh savings were realized from the LED lamps affected by the EISA baseline adjustment. Compared to 697,368 kWh after the EISA baseline adjustment, there is a 73 percent drop in total kWh net savings for baseline shift in 2021.

The evaluation estimated that 80 percent of linear fixtures (quantity) in CY2018 were from T12 baseline, which represents 83 percent of savings from linear fixtures for which T12s were the baseline. We estimated 2,539,345 total first year net kWh savings were realized from linear fixtures for which T12s were baseline. Compared to 2,074,238 kWh when standard T8s were assumed as the baseline, there is

an 18 percent drop in total kWh net savings for baseline shift in 2019 (after 1 year T12 baseline as deemed in the current TRM followed by a change in baseline to T8). Overall, there is 4 percent drop of the net savings from 2018 to 2019 CPAS due to the baseline shift.

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	
Hot Water	Bathroom Aerator	9.00	12,288	1.00	110,588	12,288	12,288	12,288	12,288	12,288	12,288	12,288	12,288	12,288	
Hot Water	DHW Pipe Insulation	15.00	21,581	0.95	307,529	20,502	20,502	20,502	20,502	20,502	20,502	20,502	20,502	20,502	
Hot Water	Kitchen Aerator	9.00	46,065	1.00	414,589	46,065	46,065	46,065	46,065	46,065	46,065	46,065	46,065	46,065	
Lighting	LED (CA Exterior Omni 11W, Incandescent)	10.20	29,561	0.95	150,568	28,083	28,083	28,083	9,211	9,211	9,211	9,211	9,211	9,211	
Lighting	LED (CA Exterior Omni 15W, Incandescent)	10.20	8,826	0.95	50,690	8,385	8,385	8,385	3,547	3,547	3,547	3,547	3,547	3,547	
Lighting	LED (CA Exterior Omni 6W, Incandescent)	10.20	16,943	0.95	74,481	16,096	16,096	16,096	3,638	3,638	3,638	3,638	3,638	3,638	
Lighting	LED (CA Exterior Omni 9W, Incandescent)	10.20	82,160	0.95	386,451	78,052	78,052	78,052	21,152	21,152	21,152	21,152	21,152	21,152	
Lighting	LED (CA Exterior Specialty, Omni Replacing CFL)	10.20	157,361	0.95	1,524,831	149,493	149,493	149,493	149,493	149,493	149,493	149,493	149,493	149,493	
Lighting	LED (CA Garage Omni 15W, Incandescent)	14.13	2,703	0.95	19,796	2,568	2,568	2,568	1,086	1,086	1,086	1,086	1,086	1,086	
Lighting	LED (CA Garage Omni 9W, Incandescent)	14.13	2,649	0.95	15,142	2,517	2,517	2,517	682	682	682	682	682	682	
Lighting	LED (CA Garage Omni Replacing CFL)	14.13	2,412	0.95	32,379	2,291	2,291	2,291	2,291	2,291	2,291	2,291	2,291	2,291	
Lighting	LED (CA Interior Omni 11W, Incandescent)	8.40	62,434	0.95	282,989	59,312	59,312	59,312	19,454	19,454	19,454	19,454	19,454	7,782	
Lighting	LED (CA Interior Omni 15W, Incandescent)	8.40	45,511	0.95	228,463	43,235	43,235	43,235	18,288	18,288	18,288	18,288	18,288	7,315	
Lighting	LED (CA Interior Omni 6W, Incandescent)	8.40	68,230	0.95	273,562	64,819	64,819	64,819	14,649	14,649	14,649	14,649	14,649	5,860	
Lighting	LED (CA Interior Omni 9W, Incandescent)	8.40	707,802	0.95	3,001,242	672,412	672,412	672,412	182,224	182,224	182,224	182,224	182,224	72,889	
Lighting	LED (CA Interior Specialty, Omni Replacing CFL)	8.40	1,038,275	0.95	8,285,438	986,362	986,362	986,362	986,362	986,362	986,362	986,362	986,362	394,545	
Lighting	LED (CA Interior TLED, T12)	8.15	2,672,995	0.95	17,370,144	2,539,345	2,074,238	2,074,238	2,074,238	2,074,238	2,074,238	2,074,238	2,074,238	311,136	
Lighting	LED (CA Interior TLED, T8)	8.15	545,852	0.95	4,226,260	518,560	518,560	518,560	518,560	518,560	518,560	518,560	518,560	77,784	
Lighting	LED (Exit Sign)	16.00	689,584	0.95	10,481,670	655,104	655,104	655,104	655,104	655,104	655,104	655,104	655,104	655,104	
Lighting	LED (Exterior DD Omni>26W)	10.20	1,278,528	0.95	12,388,933	1,214,601	1,214,601	1,214,601	1,214,601	1,214,601	1,214,601	1,214,601	1,214,601	1,214,601	
Lighting	LED (Garage 24/7 Omni>26W)	5.70	243,303	0.95	1,317,488	231,138	231,138	231,138	231,138	231,138	161,797				
Lighting	LED (Garage DD Omni>26W)	14.70	32,452	0.95	453,190	30,829	30,829	30,829	30,829	30,829	30,829	30,829	30,829	30,829	
Lighting	LED (IU Omni 11W, Incandescent)	10.00	9,124	0.95	45,903	8,667	8,667	8,667	2,843	2,843	2,843	2,843	2,843	2,843	
Lighting	LED (IU Omni 15W, Incandescent)	10.00	523	0.95	2,963	497	497	497	210	210	210	210	210	210	
Lighting	LED (IU Omni 6W, Incandescent)	10.00	109,343	0.95	475,961	103,876	103,876	103,876	23,476	23,476	23,476	23,476	23,476	23,476	
Lighting	LED (IU Omni 9W, Incandescent)	10.00	1,541,688	0.95	7,172,166	1,464,604	1,464,604	1,464,604	396,908	396,908	396,908	396,908	396,908	396,908	
Lighting	LED (IU Specialty)	10.30	1,938,493	0.95	18,968,153	1,841,568	1,841,568	1,841,568	1,841,568	1,841,568	1,841,568	1,841,568	1,841,568	1,841,568	
Lighting	Occupancy Sensor	8.00	21,870	0.95	166,215	20,777	20,777	20,777	20,777	20,777	20,777	20,777	20,777	20,777	
HVAC	Programmable Thermostat	5.00	81,996	0.90	368,980	73,796	73,796	73,796	73,796	73,796					
HVAC	Reprogrammable Thermostat	2.00	3,093	0.90	5,567	2,783	2,783								
Hot Water	Showerhead	10.00	230,897	0.92	2,124,253	212,425	212,425	212,425	212,425	212,425	212,425	212,425	212,425	212,425	
Consumer Electronics	Advanced Power Strip (Tier 1)	7.00	690,225	0.95	4,589,994	655,713	655,713	655,713	655,713	655,713	655,713	655,713	655,713		
Consumer Electronics	Vending Miser	5.00	1,613	0.95	7,661	1,532	1,532	1,532	1,532	1,532					
CY2018 Program Total Electric CPAS			12,396,380		95,324,236	11,768,297	11,303,190	11,300,406	9,444,652	9,444,652	9,299,982	9,138,185	8,482,472	5,525,231	
CY2018 Program Expiring Electric Savings‡							465,107	467,891	2,323,645	2,323,645	2,468,315	2,630,112	3,285,825	6,243,066	

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Hot Water	Bathroom Aerator												
Hot Water	DHW Pipe Insulation	20,502	20,502	20,502	20,502	20,502	20,502						
Hot Water	Kitchen Aerator												
Lighting	LED (CA Exterior Omni 11W, Incandescent)	9,211	1,842										
Lighting	LED (CA Exterior Omni 15W, Incandescent)	3,547	709										
Lighting	LED (CA Exterior Omni 6W, Incandescent)	3,638	728										
Lighting	LED (CA Exterior Omni 9W, Incandescent)	21,152	4,230										
Lighting	LED (CA Exterior Specialty, Omni Replacing CFL)	149,493	29,899										
Lighting	LED (CA Garage Omni 15W, Incandescent)	1,086	1,086	1,086	1,086	1,086	141						
Lighting	LED (CA Garage Omni 9W, Incandescent)	682	682	682	682	682	89						
Lighting	LED (CA Garage Omni Replacing CFL)	2,291	2,291	2,291	2,291	2,291	298						
Lighting	LED (CA Interior Omni 11W, Incandescent)												
Lighting	LED (CA Interior Omni 15W, Incandescent)												
Lighting	LED (CA Interior Omni 6W, Incandescent)												
Lighting	LED (CA Interior Omni 9W, Incandescent)												
Lighting	LED (CA Interior Specialty, Omni Replacing CFL)												
Lighting	LED (CA Interior TLED, T12)												
Lighting	LED (CA Interior TLED, T8)												
Lighting	LED (Exit Sign)	655,104	655,104	655,104	655,104	655,104	655,104	655,104					
Lighting	LED (Exterior DD Omni>26W)	1,214,601	242,920										
Lighting	LED (Garage 24/7 Omni>26W)												
Lighting	LED (Garage DD Omni>26W)	30,829	30,829	30,829	30,829	30,829	21,580						
Lighting	LED (IU Omni 11W, Incandescent)	2,843											
Lighting	LED (IU Omni 15W, Incandescent)	210											
Lighting	LED (IU Omni 6W, Incandescent)	23,476											
Lighting	LED (IU Omni 9W, Incandescent)	396,908											
Lighting	LED (IU Specialty)	1,841,568	552,470										
Lighting	Occupancy Sensor												
HVAC	Programmable Thermostat												
HVAC	Reprogrammable Thermostat												
Hot Water	Showerhead	212,425											
Consumer Electronics	Advanced Power Strip (Tier 1)												
Consumer Electronics	Vending Miser												
CY2018 Program Total Electric CPAS		4,589,568	1,543,294	710,495	710,495	710,495	697,715	655,104	-	-	-	-	-
CY2018 Program Expiring Electric Savings†		7,178,729	10,225,003	11,057,802	11,057,802	11,057,802	11,070,583	11,113,193	11,768,297	11,768,297	11,768,297	11,768,297	11,768,297

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

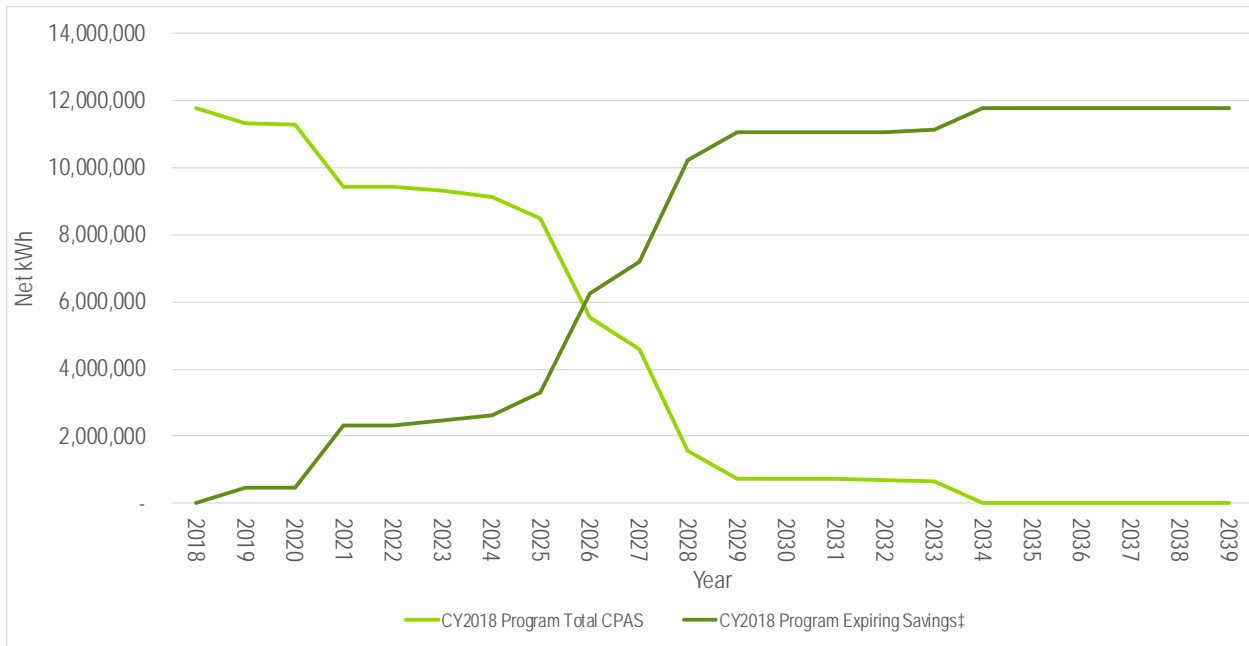
* A deemed value. Source: ComEd_NTG_History_and_PY10_Recommendations_2017-03-01.xlsx, which is to be found on the IL SAG web site here: <http://ilsag.info/net-to-gross-framework.html>.

† 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.

Source: Navigant analysis

Figure 3-1. 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 energy and demand savings for each measure installed as a part of the program are shown in Table 5-1 through Table 5-3.

LED lamps contributed the most towards the overall verified gross energy and peak demand savings, representing 91% of the verified gross energy savings and 89% of the verified gross peak demand savings. The Advanced Power Strip (Tier 1) measure was the second highest impact measure contributing 6% of the verified gross energy savings and 6% of the verified gross peak demand savings. The rest of the savings came from faucet aerators, low flow showerheads, DHW pipe insulation, programmable/reprogrammable thermostat, vending miser and occupancy sensor measures.

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
Consumer Electronics	Advanced Power Strip (Tier 1)	690,452	1.00	690,225	0.95	655,713	7.00
Hot Water	Bathroom Aerator	12,288	1.00	12,288	1.00	12,288	9.00
Hot Water	DHW Pipe Insulation	22,957	0.94	21,581	0.95	20,502	15.00
Hot Water	Kitchen Aerator	46,344	0.99	46,065	1.00	46,065	9.00
Lighting	LED Lighting	11,055,463	1.02	11,286,753	0.95	10,722,415	9.57
Lighting	Occupancy Sensor	20,410	1.07	21,870	0.95	20,777	8.00
HVAC	Programmable/Reprogrammable Thermostat	105,944	0.80	85,088	0.90	76,579	4.89
Hot Water	Showerhead	230,897	1.00	230,897	0.92	212,425	10.00
Consumer Electronics	Vending Miser	1,613	1.00	1,613	0.95	1,532	5.00
Total		12,186,368		12,396,380		11,768,297	

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)
Consumer Electronics	Advanced Power Strip (Tier 1)	NR	NA	96.82	0.95	91.98
Hot Water	Bathroom Aerator	NR	NA	558.53	1.00	558.53
Hot Water	DHW Pipe Insulation	NR	NA	2.46	0.95	2.34
Hot Water	Kitchen Aerator	NR	NA	599.36	1.00	599.36
Lighting	LED Lighting	NR	NA	5,719.26	0.95	5,433.30
Lighting	Occupancy Sensor	NR	NA	10.91	0.95	10.36
HVAC	Programmable/Reprogrammable Thermostat	NR	NA	0.00	0.90	0.00
Hot Water	Showerhead	NR	NA	931.04	0.92	856.55
Consumer Electronics	Vending Miser	NR	NA	0.00	0.95	0.00
Total				7,918.37		7,552.42

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)
Consumer Electronics	Advanced Power Strip (Tier 1)	77.48	1.00	77.46	0.95	73.58
Hot Water	Bathroom Aerator	12.29	1.00	12.29	1.00	12.29
Hot Water	DHW Pipe Insulation	2.62	0.94	2.46	0.95	2.34
Hot Water	Kitchen Aerator	13.17	1.00	13.16	1.00	13.16
Lighting	LED Lighting	1,128.37	1.01	1,135.41	0.95	1,078.64
Lighting	Occupancy Sensor	4.61	2.13	9.81	0.95	9.32
HVAC	Programmable/Reprogrammable Thermostat	0.00	NA	0.00	0.90	0.00
Hot Water	Showerhead	25.88	1.00	25.88	0.92	23.81
Consumer Electronics	Vending Miser	0.00	NA	0.00	0.95	0.00
Total		1,264.43		1,276.47		1,213.14

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

Navigant used the savings algorithms and inputs deemed by the IL TRM v6.0 and IL TRM v6.0 Errata, where applicable to calculate the energy and demand savings for each measure installed as a part of the program in CY2018. Table 6-1 lists all the inputs used to calculate the savings along with its source. A more detailed breakdown of the unit energy and demand savings for each measure can be found in Appendix 2. The lifetime energy savings are estimating by multiplying the verified savings by the effective useful life for each measure.

The results are shown in the following table.

Table 6-1. Savings Parameters

Measure	Custom Input Parameters	Deemed Input Parameters	Deemed* Input Data Source
Bathroom Aerator	None	%DHW, GPM_base, GPM_low, L_base, L_low, Household, FPH, DF, EPG_electric, ISR, Hours, CF, NTG [†]	IL TRM v6.0 – Section 5.4.4
DHW Pipe Insulation	R_new, L, C	R_exist, ΔT, η_DHW, NTG [†]	IL TRM v6.0 – Section 5.4.1
Kitchen Aerator	None	%DHW, GPM_base, GPM_low, L_base, L_low, Household, FPH, DF, EPG_electric, ISR, Usage, Hours, CF, NTG [†]	IL TRM v6.0 – Section 5.4.4 and Section 4.3.2
LED Lighting	Watts_EE, Watts_Base	Watts_Base, Hours, WHF_e, ISR, WHF_d, CF, NTG [†]	IL TRM v6.0 – Section 4.5.4, Section 5.5.6, Section 5.5.8 and Errata
Occupancy Sensor	None	kW_controlled, Hours, ESF, WHF_e, WHF_d, CF_baseline, CF_os, NTG [†]	IL TRM v6.0 – Section 4.5.10
Programmable/Reprogrammable Thermostat	None	%Electric Heat, Elec_Heating_Consumption, Heating_Reduction, HF, ISR, F_e, NTG [†]	IL TRM v6.0 – Section 5.3.11
Showerhead	None	%DHW, GPM_base, GPM_low, L_base, L_low, Household, SPH, SPCD, EPG_electric, ISR, Hours, CF, NTG [†]	IL TRM v6.0 – Section 5.4.5
Advanced Power Strip (Tier 1)	None	kWh, ISR, Hours, CF, NTG [†]	IL TRM v6.0 – Section 5.2.1
Vending Miser	None	Watts_Base, ESF, Hours, NTG [†]	IL TRM v6.0 – Section 4.6.2

* 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, and they are detailed in the section below.

Finding 1. The ex ante gross energy and peak demand savings in the tracking data provided by ComEd are actually the net ex ante savings. Navigant converted these net ex ante savings using the measure specific net-to-gross (NTG) from the ex ante calculator to determine the correct ex ante gross savings for calculating the realization rates.

Recommendation 1. Navigant recommends that the tracking data should be fixed to include the ex ante gross energy and demand savings.

Finding 2. For the Electric Pipe Insulation – DHW (CA) and Occupancy Sensor (Interior 24/7, $\geq 100W$) measures, the ex ante energy and demand savings provided in the tracking data do not match the values provided in the ex ante calculator.

Recommendation 2. Navigant requests the source for the energy and demand savings value in the tracking data be provided.

Finding 3. For the Electric Aerator – Kitchen (CA) measure, the ex ante savings are calculated using the algorithm and inputs deemed for the Showerhead measure.

Recommendation 3. Navigant recommends using the savings algorithm and inputs deemed for the Low Flow Faucet Aerator measure in section 4.3.2 of the IL TRM.

Finding 4. For the Occupancy Sensor (Interior CA, $\geq 100W$) measure, the ex ante peak demand savings are not being calculated using the algorithm deemed by the IL TRM and an Energy Savings Factor (ESF) is used to calculate both the ex ante energy and peak demand savings for this measure.

Recommendation 4. Navigant recommends updating the ex ante peak demand savings algorithm to follow the methodology deemed by the section 4.5.10 of the IL TRM v6.0

Finding 5.

LED Lighting (CA Omnidirectional and CA Specialty Lamps) – The ex ante savings are calculated using an ISR of 0.969, while the average first year In-Service Rate as per the measure section 4.5.4 of the IL TRM v6.0 Errata is 0.957.

LED Lighting (Exterior Omni $>26W$, Exterior) – The ex ante savings for this measure as per the tracking data do not match the corresponding savings in the ex ante calculator.

LED Lighting (IU Interior, 6W LED Globe) – The ex ante savings for this measure have been updated by ComEd. These updated values differ slightly from the calculated values.

Recommendation 5.

LED Lighting (CA Omnidirectional and CA Specialty Lamps) – Revise the In-Service Rate used to calculate the savings for this measure from 0.969 to 0.957 per the measure section 4.5.4 of the IL TRM v6.0 Errata.

LED Lighting (Exterior Omni $>26W$, Exterior) – Navigant requests the algorithm and the inputs used to calculate the ex ante savings value provided in the tracking data for this measure.

LED Lighting (IU Interior, 6W LED Globe) – Avoid the use of hard coded values in the ex ante calculator and Navigant would also like to request the algorithm and the inputs used to arrive at the hard coded value for this measure.

Finding 6. For CA Interior TLED measures, the ex ante savings are calculated using a blended baseline of 80% T12s and 20% T8s.

Recommendation 6. Navigant recommends tracking the actual baseline lamp type for each TLED installation and using the corresponding Watts base to calculate the energy and demand savings instead.

Finding 7. For 2L 2ft TLED (Interior, CA, Delamp 2L Utube T12/T8) measure, the Watts base used to calculate the ex ante savings is incorrect. The blended Watts base of 58.056 W is calculated using an assumption of 20% T12 and 80% T8 lamps in the baseline. This is incorrect as the TRM deems a baseline of 80% T12 and 20% T8 instead.

Recommendation 7. Navigant recommends updating the ex ante calculations to follow the methodology highlighted in Finding 6 above.

Finding 8. Programmable/Reprogrammable Thermostat (IU) – The realization rate for this measure when rounded up to two decimal places is 1.00, however there is a small

discrepancy between the verified and the ex ante energy savings value. This is because the ex ante savings for this measure have been updated by ComEd in the ex ante calculator. The ex ante calculations claimed savings from more than one thermostat for the same household. The verified savings were capped at one thermostat per household as per the measure section 5.3.11 of the IL TRM v6.0

Recommendation 8.

Avoid the use of hard coded values in the ex ante calculator and Navigant would also like to request the algorithm and the inputs used to arrive at the hard coded value for this measure. Claim savings for only one thermostat per household.

Finding 9. Programmable/Reprogrammable Thermostat (CA) – The ex ante energy savings for this measure are calculated using a Household Factor (HF) of 100% valid for single-family household types, while the verified savings are calculated using a HF of 65% valid for multi-family household types.

Recommendation 9. Navigant recommends updating the Household Factor for this measure to 65% as per the section 5.3.11 of the IL TRM v6.0.

7. APPENDIX 1. IMPACT ANALYSIS METHODOLOGY

Navigant determined verified gross savings for each program measure by:

1. Reviewing the savings algorithm inputs in the measure workbook for agreement with the TRM v6.0 and the IL TRM v6.0 Errata, where applicable.
2. Validating the savings algorithm was applied correctly.
3. Cross-checking per-unit savings values in the tracking data with the verified values in the measure workbook or in Navigant’s calculations if the workbook did not agree with the TRM.
4. Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

Navigant calculated verified net energy and demand (coincident peak and overall) savings by multiplying the verified gross savings estimates by a net-to-gross (NTG). In CY2018, the NTG estimates used to calculate the net verified savings were based on past evaluation research and defined by a consensus process through SAG, as documented in a spreadsheet.¹

8. APPENDIX 2. IMPACT ANALYSIS DETAIL

Navigant used the following documents to verify the per-unit savings for each program measure:

- Final CY2018 tracking data: “MF_2018_EOY_Data_Rev1_01242019.xlsx”
- Illinois Technical Reference Manual (TRM v6.0) for deemed input parameters or secondary evaluation research to verify any custom inputs used in the ex ante calculations.
- Implementer Savings Calculations: “RESIDENTIAL PG NSG MMDB PY7.xlsx”

Table 8-1. Verified Measure Per Unit Impact Detail – Electricity

End Use Type	Research Category	Unit	Ex Ante Gross kWh/Unit Savings	Ex Ante Gross Peak kW/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings RR	Verified Gross Peak kW/Unit	Peak kW Savings RR	Source
HVAC	Prog. T-Stat - Gas - Furnace (CA)	Each	57.33	0.00	37.26	65%	0.00	NA	5.3.11

¹ 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>.

End Use Type	Research Category	Unit	Ex Ante Gross kWh/Unit Savings	Ex Ante Gross Peak kW/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings RR	Verified Gross Peak kW/Unit	Peak kW Savings RR	Source
HVAC	Reprog. T-Stat - Gas - Furnace (CA)	Each	57.33	0.00	37.26	65%	0.00	NA	5.3.11
Hot Water	Electric Aerator - Kitchen (CA)	Each	427.41	0.05	149.01	35%	0.04	80%	4.3.2
Hot Water	Electric Pipe Insulation - DHW (CA)	Per Linear Foot	24.19	0.00	22.72	94%	0.00	94%	5.4.1
Lighting	11W LED (CA Exterior, 18W CFL)	Each	33.26	0.00	32.85	99%	0.00	NA	4.5.4
Lighting	11W LED (CA Exterior, 75W Incandescent)	Each	199.54	0.00	197.07	99%	0.00	NA	4.5.4
Lighting	15W LED (CA Exterior, 100W Incandescent)	Each	270.81	0.00	267.45	99%	0.00	NA	4.5.4
Lighting	15W LED (CA Exterior, 23W CFL)	Each	38.01	0.00	37.54	99%	0.00	NA	4.5.4
Lighting	15W LED Flood (CA Exterior, 100W Incandescent)	Each	403.84	0.00	398.83	99%	0.00	NA	4.5.4
Lighting	15W LED Flood (CA Exterior, 23W CFL)	Each	38.01	0.00	37.54	99%	0.00	NA	4.5.4
Lighting	5W LED Candelabra (CA Exterior, 40W Incandescent)	Each	166.29	0.00	164.23	99%	0.00	NA	4.5.4
Lighting	5W LED Candelabra (CA Exterior, 9W CFL)	Each	19.00	0.00	18.77	99%	0.00	NA	4.5.4
Lighting	6W LED (CA Exterior, 40W Incandescent)	Each	109.27	0.00	107.92	99%	0.00	NA	4.5.4
Lighting	6W LED (CA Exterior, 9W CFL)	Each	14.25	0.00	14.08	99%	0.00	NA	4.5.4
Lighting	8W LED Flood (CA Exterior, 15W CFL)	Each	33.26	0.00	32.85	99%	0.00	NA	4.5.4
Lighting	8W LED Flood (CA Exterior, 65W Incandescent)	Each	270.81	0.00	267.45	99%	0.00	NA	4.5.4
Lighting	9W LED (CA Exterior, 13W CFL)	Each	19.00	0.00	18.77	99%	0.00	NA	4.5.4
Lighting	9W LED (CA Exterior, 60W Incandescent)	Each	161.53	0.00	159.53	99%	0.00	NA	4.5.4
Lighting	15W LED (CA Garage, 100W Incandescent)	Each	195.53	0.05	193.10	99%	0.05	99%	4.5.4
Lighting	15W LED (CA Garage, 23W CFL)	Each	27.44	0.01	27.10	99%	0.01	99%	4.5.4
Lighting	9W LED (CA Garage, 13W CFL)	Each	13.72	0.00	13.55	99%	0.00	99%	4.5.4
Lighting	9W LED (CA Garage, 60W Incandescent)	Each	116.63	0.03	115.18	99%	0.03	99%	4.5.4
Lighting	11W LED (CA Interior, 18W CFL)	Each	46.01	0.01	45.44	99%	0.01	99%	4.5.4
Lighting	11W LED (CA Interior, 75W Incandescent)	Each	276.05	0.03	272.64	99%	0.03	99%	4.5.4
Lighting	15W LED (CA Interior, 100W Incandescent)	Each	374.65	0.05	370.01	99%	0.05	99%	4.5.4

End Use Type	Research Category	Unit	Ex Ante Gross kWh/Unit Savings	Ex Ante Gross Peak kW/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings RR	Verified Gross Peak kW/Unit	Peak kW Savings RR	Source
Lighting	15W LED (CA Interior, 23W CFL)	Each	52.58	0.01	51.93	99%	0.01	99%	4.5.4
Lighting	5W LED Candelabra (CA Interior, 40W Incandescent)	Each	230.05	0.03	227.20	99%	0.03	99%	4.5.4
Lighting	5W LED Candelabra (CA Interior, 9W CFL)	Each	26.29	0.00	25.97	99%	0.00	99%	4.5.4
Lighting	6W LED (CA Interior, 40W Incandescent)	Each	151.17	0.02	149.30	99%	0.02	99%	4.5.4
Lighting	6W LED (CA Interior, 9W CFL)	Each	19.72	0.00	19.47	99%	0.00	99%	4.5.4
Lighting	6W LED Globe (CA Interior, 40/60W Incandescent)	Each	289.20	0.04	285.62	99%	0.04	99%	4.5.4
Lighting	6W LED (CA Interior, 9W CFL)	Each	19.72	0.00	19.47	99%	0.00	99%	4.5.4
Lighting	7W LED Tracklight (CA Interior, 11W CFL)	Each	26.29	0.00	25.97	99%	0.00	99%	4.5.4
Lighting	7W LED Tracklight (CA Interior, 50W Incandescent)	Each	282.63	0.04	279.13	99%	0.03	99%	4.5.4
Lighting	8W LED Flood (CA Interior, 15W CFL)	Each	46.01	0.01	45.44	99%	0.01	99%	4.5.4
Lighting	8W LED Flood (CA Interior, 65W Incandescent)	Each	374.65	0.05	370.01	99%	0.05	99%	4.5.4
Lighting	9W LED (CA Interior, 13W CFL)	Each	26.29	0.00	25.97	99%	0.00	99%	4.5.4
Lighting	9W LED (CA Interior, 60W Incandescent)	Each	223.47	0.03	220.71	99%	0.03	99%	4.5.4
Lighting	6/12/19W 3-Way LED (CA Interior, 50/100/150W)	Each	446.95	0.06	441.41	99%	0.05	99%	4.5.4
Lighting	7W Mini-Flood PAR20 (CA Interior, 50W)	Each	282.63	0.04	279.13	99%	0.03	99%	4.5.4
Lighting	7W Tracklight Pin Base GU5.3 (CA Interior, 50W)	Each	282.63	0.04	279.13	99%	0.03	99%	4.5.4
Consumer Electronics	Smart Strip - Tier 1 (CA)	Each	71.10	0.01	103.00	145%	0.01	145%	5.2.1
Consumer Electronics	Vending Miser (CA)	Each	1612.94	0.00	1612.94	100%	0.00	NA	4.6.2
Lighting	LED (Exterior, <30W Bollard)	Each	173.84	0.00	198.08	114%	0.00	NA	4.5.4
Lighting	LED (Exterior DD Outdoor, <=175W HID)	Each	433.96	0.00	494.47	114%	0.00	NA	4.5.4
Lighting	LED (Exterior DD Outdoor, 176-250W HID)	Each	695.37	0.00	792.32	114%	0.00	NA	4.5.4
Lighting	LED (Exterior DD Outdoor, 251-400W HID)	Each	1030.57	0.00	1174.27	114%	0.00	NA	4.5.4
Lighting	LED (Garage 24/7 Outdoor, <=175W HID)	Each	884.05	0.10	884.05	100%	0.10	100%	4.5.4
Lighting	LED (Garage 24/7 Outdoor, 176-250W HID)	Each	1416.59	0.16	1416.59	100%	0.16	100%	4.5.4

End Use Type	Research Category	Unit	Ex Ante Gross kWh/Unit Savings	Ex Ante Gross Peak kW/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings RR	Verified Gross Peak kW/Unit	Peak kW Savings RR	Source
Lighting	LED (Garage 24/7 Outdoor, 251-400W HID)	Each	2099.46	0.24	2095.95	100%	0.24	100%	4.5.4
Lighting	LED (Garage DD Outdoor, <=175W HID)	Each	342.99	0.09	342.99	100%	0.09	100%	4.5.4
Lighting	LED (Garage DD Outdoor, 176-250W HID)	Each	549.60	0.15	549.60	100%	0.15	100%	4.5.4
Lighting	Occupancy Sensor (Interior 24/7, >=100W)	Each	731.51	0.20	801.06	110%	0.37	190%	4.5.10
Lighting	1L 4ft TLED (Interior CA) - T12	Each	104.26	0.01	107.06	103%	0.01	103%	4.5.4
Lighting	1L 4ft TLED (Interior CA) - T8	Each	104.26	0.01	93.06	89%	0.01	89%	4.5.4
Lighting	2L 4ft TLED (Interior CA) - T12	Each	208.52	0.03	214.12	103%	0.03	103%	4.5.4
Lighting	2L 4ft TLED (Interior CA) - T8	Each	208.52	0.03	186.13	89%	0.02	89%	4.5.4
Lighting	3L 4ft TLED (Interior CA) - T12	Each	312.78	0.04	321.18	103%	0.04	103%	4.5.4
Lighting	3L 4ft TLED (Interior CA) - T8	Each	312.78	0.04	279.19	89%	0.03	89%	4.5.4
Lighting	4L 4ft TLED (Interior CA) - T12	Each	417.04	0.05	428.24	103%	0.05	103%	4.5.4
Lighting	4L 4ft TLED (Interior CA) - T8	Each	417.04	0.05	372.26	89%	0.04	89%	4.5.4
Lighting	2L 4ft TLED (Interior CA, Delamp 2L 8ft T12/T8) - T12	Each	522.00	0.06	582.18	112%	0.07	112%	4.5.4
Lighting	2L 4ft TLED (Interior CA, Delamp 2L 8ft T12/T8) - T8	Each	522.00	0.06	278.49	53%	0.03	53%	4.5.4
Lighting	2L 2ft TLED (Interior CA, Delamp 2L Utube T12/T8) - T12	Each	141.74	0.02	645.15	455%	0.08	455%	4.5.4
Lighting	2L 2ft TLED (Interior CA, Delamp 2L Utube T12/T8) - T8	Each	141.74	0.02	129.59	91%	0.02	91%	4.5.4
Lighting	2L 4ft TLED (Interior CA, Delamp 4L 4ft T12/T8) - T12	Each	678.74	0.08	689.94	102%	0.08	102%	4.5.4
Lighting	2L 4ft TLED (Interior CA, Delamp 4L 4ft T12/T8) - T8	Each	678.74	0.08	633.96	93%	0.08	93%	4.5.4
Lighting	4L 4ft TLED (Interior CA, Delamp 4L 8ft T12/T8) - T12	Each	1044.00	0.13	1164.35	112%	0.14	112%	4.5.4
Lighting	4L 4ft TLED (Interior CA, Delamp 4L 8ft T12/T8) - T8	Each	1044.00	0.13	556.99	53%	0.07	53%	4.5.4
Lighting	Occupancy Sensor (Interior CA, >=100W)	Each	560.91	0.05	560.91	100%	0.22	417%	4.5.10
Hot Water	Electric Aerator - Bathroom (IU)	Each	25.03	0.03	25.03	100%	0.03	100%	5.4.4

End Use Type	Research Category	Unit	Ex Ante Gross kWh/Unit Savings	Ex Ante Gross Peak kW/Unit Savings	Verified Gross kWh/Unit Savings	kWh Savings RR	Verified Gross Peak kW/Unit	Peak kW Savings RR	Source
Hot Water	Electric Aerator - Kitchen (IU)	Each	102.72	0.03	102.72	100%	0.03	100%	5.4.4
Hot Water	Electric Pipe Insulation - DHW (IU)	Per Linear Foot	22.72	0.00	22.72	100%	0.00	100%	5.4.1
Hot Water	Electric Showerhead (IU)	Each	359.09	0.04	359.09	100%	0.04	100%	5.4.5
HVAC	Electric T-Stat. - Heat Pump (IU)	Each	492.10	0.00	492.39	100%	0.00	NA	5.3.11
HVAC	Electric T-Stat. - Resistance (IU)	Each	836.60	0.00	837.07	100%	0.00	NA	5.3.11
Lighting	5W LED Candelabra (IU Exterior, 40W)	Each	83.94	0.00	83.94	100%	0.00	100%	5.5.6
Lighting	6W LED (IU Exterior, 40W)	Each	55.16	0.01	55.16	100%	0.01	100%	5.5.8
Lighting	8W LED Flood (IU Exterior, 65W)	Each	136.70	0.02	136.70	100%	0.02	100%	5.5.6
Lighting	9W LED (IU Exterior, 60W)	Each	81.54	0.01	81.54	100%	0.01	100%	5.5.8
HVAC	Prog. T-Stat - Gas - Furnace (IU)	Each	37.10	0.00	37.26	100%	0.00	NA	5.3.11
HVAC	Reprog. T-Stat - Gas - Furnace (IU)	Each	37.10	0.00	37.26	100%	0.00	NA	5.3.11
Lighting	11W LED (IU Interior, 75W)	Each	32.13	0.00	32.13	100%	0.00	100%	5.5.8
Lighting	15W LED (IU Interior, 100W)	Each	43.60	0.00	43.60	100%	0.00	100%	5.5.8
Lighting	5W LED Candelabra (IU Interior, 40W)	Each	41.97	0.00	41.97	100%	0.00	100%	5.5.6
Lighting	6/12/19W 3-Way LED (IU Interior, 50/100/150W)	Each	58.25	0.01	58.25	100%	0.01	100%	5.5.6
Lighting	6W LED (IU Interior, 40W)	Each	17.59	0.00	17.59	100%	0.00	100%	5.5.8
Lighting	6W LED Globe (IU Interior, 40/60W)	Each	28.30	0.00	28.33	100%	0.00	98%	5.5.6
Lighting	7W LED Mini-Flood PAR20 (IU Interior, 50W)	Each	37.31	0.00	37.31	100%	0.00	100%	5.5.6
Lighting	7W LED Tracklight Pin Base GU5.3 (IU Interior, 50W)	Each	37.31	0.00	37.31	100%	0.00	100%	5.5.6
Lighting	7W LED Tracklight (IU Interior, 50W)	Each	37.31	0.00	37.31	100%	0.00	100%	5.5.6
Lighting	8W LED Flood (IU Interior, 65W)	Each	49.46	0.01	49.46	100%	0.01	100%	5.5.6
Lighting	9W LED (IU Interior, 60W)	Each	26.01	0.00	26.01	100%	0.00	100%	5.5.8
Consumer Electronics	Smart Strip - Tier 1 (IU)	Each	71.10	0.01	71.07	100%	0.01	100%	5.2.1
Lighting	LED Exit Sign	Each	184.87	0.02	184.87	100%	0.02	100%	4.5.5

Source: Navigant Analysis of CY2018 Tracking Data

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	Verified Gross Savings (kWh)	Verified Gross Peak Demand Reduction (kW)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG	Verified Net Savings (kWh)	Verified Net Peak Demand Reduction (kW)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
Consumer Electronics	Advanced Power Strip (Tier 1)	Each	9,711	7.0	690,225	77.46	0.00	0.00	0.95	655,713	73.58	0.00	0.00
Hot Water	Bathroom Aerator	Each	491	9.0	12,288	12.29	0.00	0.00	1.00	12,288	12.29	0.00	0.00
Hot Water	DHW Pipe Insulation	Linear Feet	950	15.0	21,581	2.46	0.00	0.00	0.95	20,502	2.34	0.00	0.00
Hot Water	Kitchen Aerator	Each	448	9.0	46,065	13.16	0.00	0.00	1.00	46,065	13.16	0.00	0.00
Lighting	LED Lighting	Lamp	82,761	10.5	5,380,408	474.83	(272,397)	(67,849)	0.95	5,111,388	451.09	(258,777)	(64,456)
Lighting	LED Lighting (Incandescent)*	Lamp	69,490	9.5	2,687,498	271.96	(211,149)	(45,799)	0.95	2,553,123	258.36	(200,592)	(43,509)
Lighting	TLED Lighting (T12)*	Lamp	10,974	8.2	2,672,995	322.72	(137,826)	(50,860)	0.95	2,539,345	306.58	(130,934)	(48,317)
Lighting	TLED Lighting (T8)	Lamp	2,744	8.2	545,852	65.90	(28,011)	(10,394)	0.95	518,560	62.61	(26,611)	(9,874)
Lighting	Occupancy Sensor	Each	30	8.0	21,870	9.81	(3,121)	(304)	0.95	20,777	9.32	(2,965)	(289)
HVAC	Programmable/Reprogrammable Thermostat	Each	1,560	4.9	85,088	0.00	0.00	0.00	0.90	76,579	0.00	0.00	0.00
Hot Water	Showerhead	Each	643	10.0	230,897	25.88	0.00	0.00	0.92	212,425	23.81	0.00	0.00
Consumer Electronics	Vending Miser	Each	1	5.0	1,613	0.00	0.00	0.00	0.95	1,532	0.00	0.00	0.00

*The CY2018 contribution to CPAS for these measures varies over time. See CPAS tables in Section 4.

Source: ComEd tracking data and Navigant team analysis.