Guidehouse

ComEd Public Housing Retrofits Program Impact Evaluation Report

Energy Efficiency / Demand Response Plan:
Program Year 2020 (CY2020)
(1/1/2020-12/31/2020)

Prepared for:

ComEd

FINAL

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1. Introduction

This report presents results from the CY2020 impact evaluation of Public Housing Retrofits Program. This report summarizes the total energy and demand impacts for the program broken out by relevant measure and program structure details. The appendices provide the impact analysis methodology and details of the total resource cost (TRC) inputs. CY2020 covers January 1, 2020 through December 31, 2020.

2. Program Description

The Public Housing Retrofits Program works with public housing authorities (PHAs) in ComEd, Nicor Gas, Peoples Gas, and North Shore Gas territories to achieve electric and gas savings. The program is referred to as "Public Housing Authority" in the net-to-gross spreadsheet. The PHA itself is the program participant, though the residents of the properties are directly affected by the program through in-unit and common area upgrades. In CY2020, the program provided appliance recycling, efficient lighting, and envelope upgrades to common area spaces only, avoiding in-unit projects due to the COVID-19 pandemic.

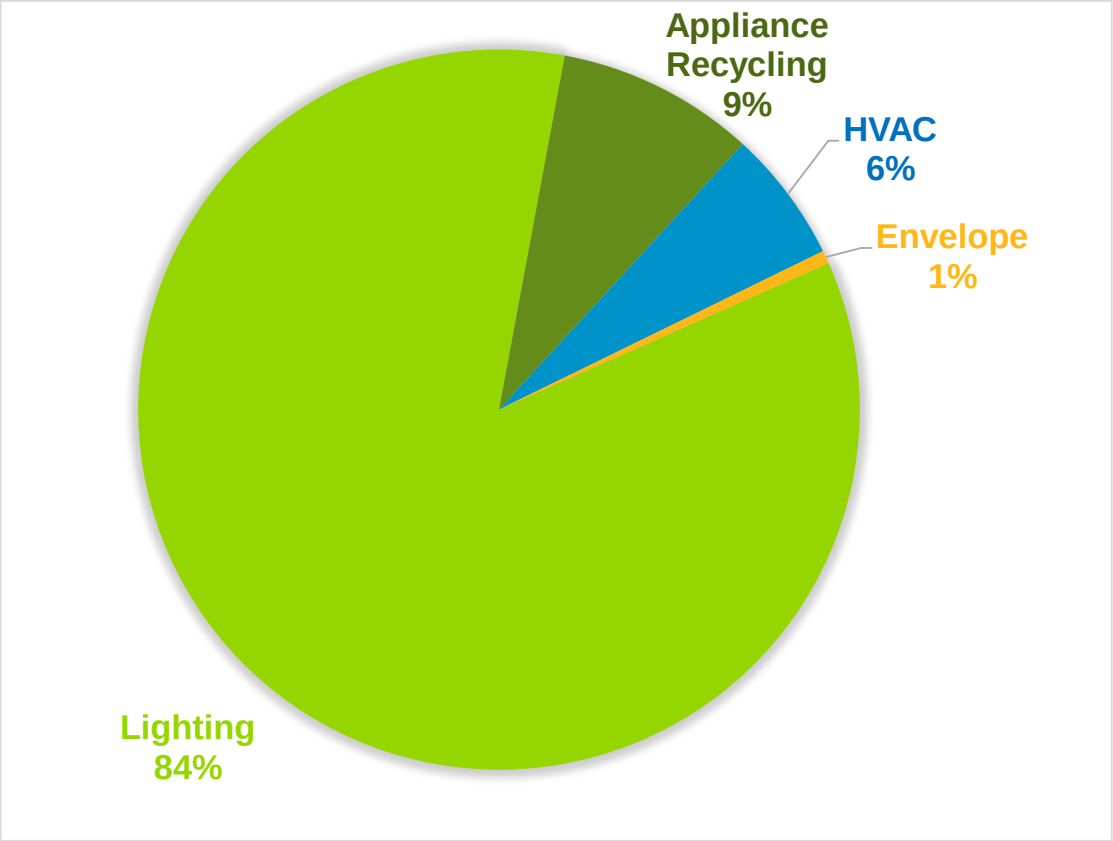
ComEd achieved electric and summer peak demand savings for 45 projects across 34 PHA properties in CY2020, installing 5,118 measures. These counts exclude gas savings-only projects, which will be detailed in gas utility evaluation reports. Table 2-1 and Figure 2-1 show the number of projects and measures the program provided.

Table 2-1. CY2020 Volumetric Findings Detail

Participation	Total
Total Projects	45
Lighting	4,329
Appliance Recycling	455
HVAC	304
Envelope	30

Source: ComEd tracking data and evaluation team analysis

Figure 2-1. Share of Installed Measures by End Use Type



Source: ComEd tracking data and evaluation team analysis

3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the Public Housing Retrofits Program achieved in CY2020. This report does not include gas savings-only projects, which will be included in gas utility evaluation reports.

Table 3-1. CY2020 Total Annual Incremental Electric Savings

Savings Category	Energy Savings (kWh)	Summer Peak* Demand Savings (kW)
Electricity		
Ex Ante Gross Savings	1,155,620	79
Program Gross Realization Rate	1.03	1.16
Verified Gross Savings	1,186,871	92
Program Net-to-Gross Ratio (NTG)	1.00	1.00
Verified Net Savings	1,186,871	92
Converted from Gas		
Ex Ante Gross Savings	0	NA
Program Gross Realization Rate	NA	NA
Verified Gross Savings	0	NA
Program Net-to-Gross Ratio (NTG)	1.00	NA
Verified Net Savings	0	NA
Total Electric Plus Gas		
Ex Ante Gross Savings	1,155,620	79
Program Gross Realization Rate	1.03	1.16
Verified Gross Savings	1,186,871	92
Program Net-to-Gross Ratio (NTG)	1.00	1.00
Verified Net Savings	1,186,871	92

NA = not applicable (refers to a piece of data that cannot be produced or does not apply)
*The coincident summer peak period is defined as 1:00 p.m.-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

Source: ComEd tracking data and evaluation team analysis

4. Cumulative Persisting Annual Savings

Table 4-1 shows the measure-specific and total verified gross savings for the Public Housing Retrofits Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2020. Figure 4-1 shows the savings across the useful life of the measures. The electric CPAS across all measures installed in 2020 is 1,186,871 kWh (Table 4-1). The historic row is the CPAS contribution back to CY2018. The Program Total Electric CPAS and the Program Total Gas CPAS rows are the sum of the CY2020 contribution and the historic contribution. The gas savings are claimed by the Gas utilities and are in a separate report.

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

End Use Type	Research Category	EUL	CY2020 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026
Lighting (Common Area)	Exterior LED Lighting	11.6	351,012	1.00	4,078,686			351,012	351,012	351,012	351,012	351,012	351,012	351,012
Lighting (Common Area)	Linear LED Lighting (24/7)	5.7	326,772	1.00	1,786,497			326,772	317,913	308,277	308,277	308,277	216,982	
Lighting (Common Area)	Linear LED Lighting	10.0	157,452	1.00	1,557,430			157,452	156,319	155,086	155,086	155,086	155,086	155,086
HVAC	Room AC Cover/Gap Sealer	5.0	96,703	1.00	483,513			96,703	96,703	96,703	96,703	96,703		
Appliances	Appliance Recycling	6.5	77,982	1.00	506,881			77,982	77,982	77,982	77,982	77,982	77,982	38,991
Lighting (Common Area)	Interior LED Lighting	6.3	71,660	1.00	373,506			71,660	71,660	71,660	71,660	37,880	37,880	11,107
Lighting (Common Area)	Linear Fluorescent - Delamping	11.0	59,727	1.00	597,745			59,727	59,727	56,087	52,775	52,775	52,775	52,775
Envelope (Common Area)	Insulation/Air Sealing	20.0	18,162	1.00	363,245			18,162	18,162	18,162	18,162	18,162	18,162	18,162
Lighting (Common Area)	Garage LED Lighting	14.1	14,585	1.00	205,999			14,585	14,585	14,585	14,585	14,585	14,585	14,585
Lighting (Common Area)	Linear Fluorescent - Delamping (24/7)	11.0	7,479	1.00	21,760			7,479	4,422	1,095	1,095	1,095	1,095	1,095
LED Exit Sign	LED Exit Sign	5.0	4,899	1.00	24,497			4,899	4,899	4,899	4,899	4,899		
Lighting (Common Area)	Occupancy Sensors	8.0	438	1.00	3,507			438	438	438	438	438	438	438
CY2020 Program Total Electric Contribution to CPAS		8.68	1,186,871		10,003,266			1,186,871	1,173,821	1,155,986	1,152,674	1,118,894	925,997	643,252
Historic Program Total Electric Contribution to CPAS‡						2,472,099	5,495,917	5,492,989	4,677,872	4,581,450	4,512,039	4,031,308	3,083,150	2,468,367
Program Total Electric CPAS						2,472,099	5,495,917	6,679,860	5,851,693	5,737,435	5,664,713	5,150,202	4,009,147	3,111,619
CY2020 Program Incremental Expiring Electric Savings§									13,050	17,836	3,312	33,780	192,896	282,746
Historic Program Incremental Expiring Electric Savings‡§								2,928	815,117	96,422	69,410	480,731	948,158	614,783
Program Total Incremental Expiring Electric Savings§								2,928	828,167	114,258	72,722	514,512	1,141,054	897,529

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting (Common Area)	Exterior LED Lighting	351,012	351,012	351,012	351,012	217,557							
Lighting (Common Area)	Linear LED Lighting (24/7)												
Lighting (Common Area)	Linear LED Lighting	155,086	155,086	155,086	2,973								
HVAC	Room AC Cover/Gap Sealer												
Appliances	Appliance Recycling												
Lighting (Common Area)	Interior LED Lighting												
Lighting (Common Area)	Linear Fluorescent - Delamping	52,775	52,775	52,775	52,775								
Envelope (Common Area)	Insulation/Air Sealing	18,162	18,162	18,162	18,162	18,162	18,162	18,162	18,162	18,162	18,162	18,162	18,162
Lighting (Common Area)	Garage LED Lighting	14,585	14,585	14,585	14,585	14,585	14,585	14,585	1,813				
Lighting (Common Area)	Linear Fluorescent - Delamping (24/7)	1,095	1,095	1,095	1,095								
LED Exit Sign	LED Exit Sign												
Lighting (Common Area)	Occupancy Sensors	438											
CY2020 Program Total Electric Contribution to CPAS		593,154	592,715	592,715	440,602	250,304	32,747	32,747	19,975	18,162	18,162	18,162	18,162
Historic Program Total Electric Contribution to CPAS‡		2,363,554	1,246,441	872,826	575,439	193,484	193,484	191,602	145,772	145,772	133,324	133,324	11,608
Program Total Electric CPAS		2,956,708	1,839,157	1,465,541	1,016,041	443,788	226,231	224,349	165,747	163,934	151,486	151,486	29,770
CY2020 Program Incremental Expiring Electric Savings§		50,098	438	-	152,113	190,298	217,557	-	12,772	1,813	-	-	-
Historic Program Incremental Expiring Electric Savings‡§		104,813	1,117,113	373,616	297,387	381,955	-	1,882	45,830	-	12,448	-	121,716
Program Total Incremental Expiring Electric Savings§		154,911	1,117,551	373,616	449,500	572,253	217,557	1,882	58,602	1,813	12,448	-	121,716

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Lighting (Common Area)	Exterior LED Lighting		-	-	-	-	-	-	-	-	-	-	-
Lighting (Common Area)	Linear LED Lighting (24/7)		-	-	-	-	-	-	-	-	-	-	-
Lighting (Common Area)	Linear LED Lighting		-	-	-	-	-	-	-	-	-	-	-
HVAC	Room AC Cover/Gap Sealer		-	-	-	-	-	-	-	-	-	-	-
Appliances	Appliance Recycling		-	-	-	-	-	-	-	-	-	-	-
Lighting (Common Area)	Interior LED Lighting		-	-	-	-	-	-	-	-	-	-	-
Lighting (Common Area)	Linear Fluorescent - Delamping		-	-	-	-	-	-	-	-	-	-	-
Envelope (Common Area)	Insulation/Air Sealing	18,162	-	-	-	-	-	-	-	-	-	-	-
Lighting (Common Area)	Garage LED Lighting		-	-	-	-	-	-	-	-	-	-	-
Lighting (Common Area)	Linear Fluorescent - Delamping (24/7)		-	-	-	-	-	-	-	-	-	-	-
LED Exit Sign	LED Exit Sign		-	-	-	-	-	-	-	-	-	-	-
Lighting (Common Area)	Occupancy Sensors		-	-	-	-	-	-	-	-	-	-	-
CY2020 Program Total Electric Contribution to CPAS		18,162	-	-	-	-	-	-	-	-	-	-	-
Historic Program Total Electric Contribution to CPAS‡		4,181	4,181	4,181	4,181	-	-	-	-	-	-	-	-
Program Total Electric CPAS		22,344	4,181	4,181	4,181	-	-	-	-	-	-	-	-
CY2020 Program Incremental Expiring Electric Savings§		-	18,162	-	-	-	-	-	-	-	-	-	-
Historic Program Incremental Expiring Electric Savings‡§		7,426	-	-	-	4,181	-	-	-	-	-	-	-
Program Total Incremental Expiring Electric Savings§		7,426	18,162	-	-	4,181	-	-	-	-	-	-	-

Note: The green highlighted cell shows program total first-year electric savings. The gray cells are blank, indicating no values or no contribution to calculating CPAS in CY2020.

*A deemed value. Source found on the Illinois Stakeholder Advisory Group (SAG) website: https://www.ilsag.info/ntg_2020.

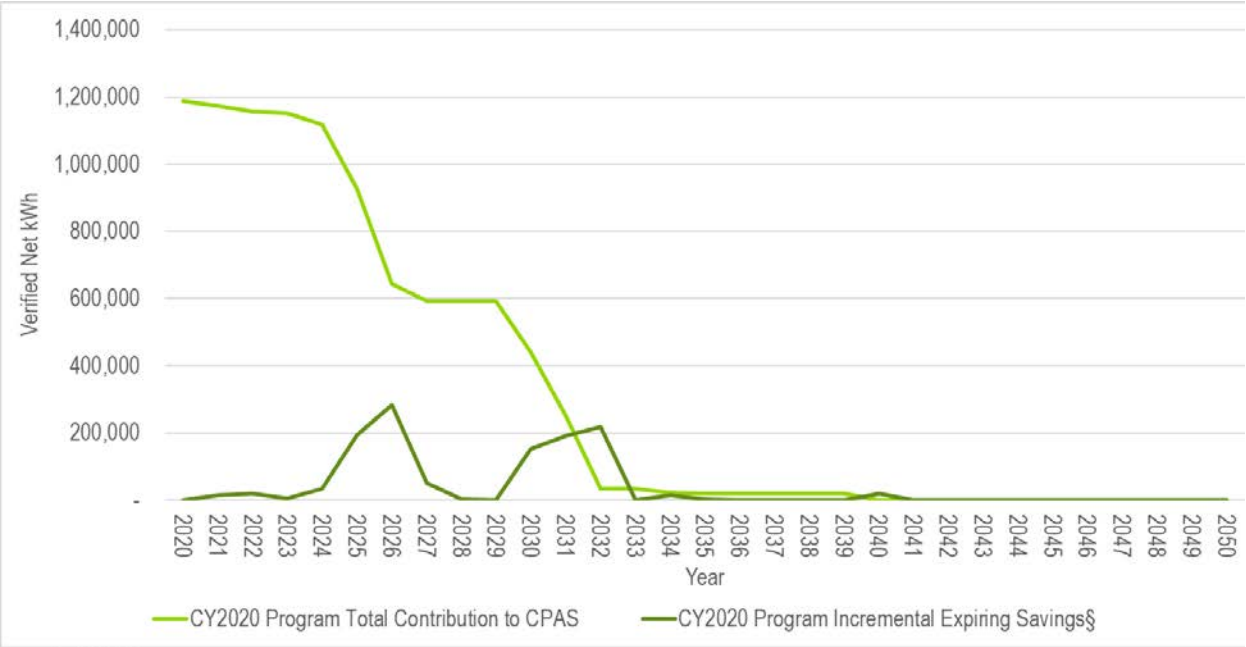
† Lifetime savings are the sum of CPAS savings through the effective useful life (EUL).

‡ Historic savings go back to CY2018.

§ Incremental expiring savings are equal to CPAS Y_{n-1} - CPAS Y_{n}.

Source: Evaluation team analysis

Figure 4-1. Cumulative Persisting Annual Savings



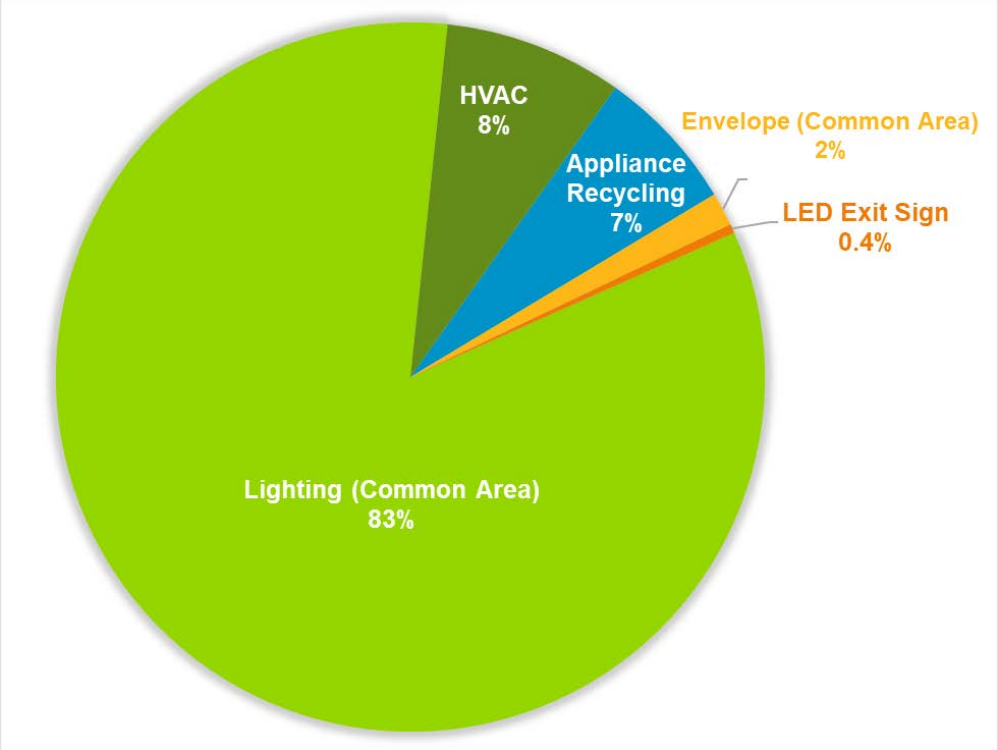
§ Expiring savings are equal to CPAS Y_{n-1} - CPAS Y_n.

Source: Evaluation team analysis

5. Program Savings by Measure

The program includes 12 measure categories across five end uses, as the following tables show. Common area lighting measures contributed the most savings (see Figure 5-1).

Figure 5-1. Verified Net Savings by End Use – Electric



Source: Evaluation team analysis

Table 5-1. CY2020 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)	EUL (years)
Lighting (Common Area)	Exterior LED Lighting	348,858	1.01	351,012	1.00	351,012	11.6
Lighting (Common Area)	Linear LED Lighting (24/7)	304,207	1.07	326,772	1.00	326,772	5.7
Lighting (Common Area)	Linear LED Lighting	177,717	0.89	157,452	1.00	157,452	10.0
HVAC	Room AC Cover/Gap Sealer	81,016	1.19	96,703	1.00	96,703	5.0
Appliances	Appliance Recycling	73,134	1.07	77,982	1.00	77,982	6.5
Lighting (Common Area)	Interior LED Lighting	70,042	1.02	71,660	1.00	71,660	6.3
Lighting (Common Area)	Linear Fluorescent - Delamping	55,904	1.07	59,727	1.00	59,727	11.0
Envelope (Common Area)	Insulation/Air Sealing	17,607	1.03	18,162	1.00	18,162	20.0
Lighting (Common Area)	Garage LED Lighting	14,585	1.00	14,585	1.00	14,585	14.1
Lighting (Common Area)	Linear Fluorescent - Delamping (24/7)	7,379	1.01	7,479	1.00	7,479	11.0
LED Exit Sign	LED Exit Sign	4,826	1.02	4,899	1.00	4,899	5.0
Lighting (Common Area)	Occupancy Sensors	345	1.27	438	1.00	438	8.0
	Total	1,155,620	1.03	1,186,871	NA	1,186,871	NA

Note: The savings account for electric heating penalties, where applicable.
NA = not applicable (refers to a piece of data that cannot be produced or does not apply)
*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.

Source: ComEd tracking data and evaluation team analysis

Table 5-2. CY2020 Summer Peak Demand Savings by Measure

End Use Type	Research Category	Ex Ante Gross Peak Demand Reduction (kW)	Verified Gross Realization Rate	Verified Gross Peak Demand Reduction (kW)	NTG*	Verified Net Peak Demand Reduction (kW)
Lighting (Common Area)	Linear LED Lighting (24/7)	36.27	1.06	38.56	1.00	38.56
Lighting (Common Area)	Linear LED Lighting	22.08	1.01	22.25	1.00	22.25
Lighting (Common Area)	Interior LED Lighting	8.26	1.05	8.65	1.00	8.65
Lighting (Common Area)	Linear Fluorescent - Delamping	6.94	1.04	7.25	1.00	7.25
Lighting (Common Area)	Garage LED Lighting	3.95	1.00	3.95	1.00	3.95
Lighting (Common Area)	Linear Fluorescent - Delamping (24/7)	0.88	1.01	0.89	1.00	0.89
LED Exit Sign	LED Exit Sign	0.58	1.02	0.59	1.00	0.59
Lighting (Common Area)	Occupancy Sensors	0.14	1.71	0.23	1.00	0.23
Appliances	Appliance Recycling	0.00	NA	9.69	1.00	9.69
Lighting (Common Area)	Exterior LED Lighting	0.00	NA	0.00	1.00	0.00
HVAC	Room AC Cover/Gap Sealer	0.00	NA	0.00	1.00	0.00
Envelope (Common Area)	Insulation/Air Sealing	0.00	NA	0.00	1.00	0.00
	Total	79.08	1.16	92.05	NA	92.05

*A deemed value. Source found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.
NA = not applicable (refers to a piece of data that cannot be produced or does not apply)
Source: ComEd tracking data and evaluation team analysis

6. Impact Analysis Findings and Recommendations

6.1 Impact Parameter Estimates

The evaluation team verified unit savings for each program measure using the impact algorithm sources found in the Illinois Statewide Technical Reference Manual v8.0 (TRM) v8.0. The team leveraged program tracking data to inform savings assumptions—for example, LED wattage, LED lamp type, installed measure location, boiler capacities and efficiencies, and insulation R-values. For savings calculation inputs not in the tracking data, the evaluation team relied on default assumptions from the TRM v8.0. Table 6-1 presents the key parameters and the references used in the verified gross and net savings calculations.

Guidehouse estimated the lifetime energy and demand savings by multiplying the verified savings by the EUL for each measure.

Table 6-1. Savings Parameters

Gross Savings Input Parameters	Value	Units	Deemed or Evaluated?	Source*
Quantity	Varies	No. of measures	Evaluated	Tracking Database
NTG	100	%	Deemed	SAG Consensus
Gross Savings per Unit, Sampled Deemed Measures	Varies	kWh/kW	Deemed	TRM v8.0 – Errata
Gross Savings per Unit, Sampled Non-Deemed Measures	Varies	kWh/kW	Evaluated	Evaluation Team Analysis
Verified Realization Rate on Ex Ante Gross Savings	Varies	NA	Evaluated	Evaluation Team Analysis
EUL	Varies	Years	Mixture	TRM v8.0 – Errata

* TRM is the Illinois Statewide Technical Reference Manual version 8.0 from http://www.ilsag.info/technical-reference-manual.html. The NTG values can be found on the Illinois SAG website: https://www.ilsag.info/ntg_2020.

Source: Evaluation team analysis

6.2 Other Impact Findings and Recommendations

The evaluation team developed several recommendations based on findings from the CY2020 evaluation listed below. These findings suggest ways to improve the measure-level realization rates. Table 6-2 presents the end use-level realization rates and program savings percentages to give context to the team's recommendations. Exterior LED lighting represents 30% of program savings and has a realization rate of 1.01, and Linear LED Lighting (24/7) represents 28% of program savings and has a realization rate of 1.07. Linear LED Lighting represents 13% of program savings and has a realization rate of 0.89.

Table 6-2. Measure-Level Savings and Realization Rates

Research Category	Realization Rate	Percentage of Verified Net Savings
Exterior LED Lighting	1.01	30%
Linear LED Lighting (24/7)	1.07	28%
Linear LED Lighting	0.89	13%
Room AC Cover/Gap Sealer	1.19	8%
Appliance Recycling	1.07	7%
Interior LED Lighting	1.02	6%
Linear Fluorescent - Delamping	1.07	5%
Insulation/Air Sealing	1.03	2%
Garage LED Lighting	1.00	1%
Linear Fluorescent - Delamping (24/7)	1.01	1%
LED Exit Sign	1.02	<1%
Occupancy Sensors	1.27	<1%

Source: Evaluation team analysis

6.2.1 Multiple Lighting Categories

Finding 1. Across multiple measure categories,[1] the ex ante savings applied assumptions from the TRM v8.0 for Mid-Rise Multifamily (MF) regardless of the building type provided in the tracking database and the number of reported stories.

Recommendation 1. The evaluation team recommends that the implementer apply the building type provided in the tracking database.

6.2.2 Linear LED Lighting

Linear common area LEDs account for 42% of ex ante kWh savings and 66% of ex ante kW savings. For non-24/7 linear LED lighting, the realization rate was 0.89 for kWh and 1.01 for kW. For 24/7 linear LED lighting, the realization rate was 107% for kWh and 106% for kW.

Finding 2. For three measures, the ex ante estimates applied T8 baseline wattage assumptions from the TRM v8.0 for projects with T12 baseline fixtures. Verified savings estimates rely on T12 baseline wattages from Section 4.5.12 of the TRM v8.0, resulting in higher kWh and kW savings as compared to the ex ante estimates.

6.2.3 Recommendation 2. The evaluation team recommends that the implementer apply T12 instead of T8 baseline assumptions for linear LED lighting, using Section 4.5.12 of the TRM v8.0. Exterior LED Lighting

Exterior common area LEDs account for 30% of total ex ante kWh savings. The gross savings realization rate for exterior LED lighting was 1.01 for kWh. There were no demand savings for these measures because exterior applications typically only operate during off-peak hours. While some exterior fixtures may operate 24/7, yielding demand savings, the program did not install such measures in CY2020.

Finding 3. For 165 measures, the ex ante estimates applied baseline and efficient wattages from Section 4.5.3 of the TRM v8.0 for exterior common area LEDs replacing 251 W-400 W high intensity discharge (HID) bulbs. The verified savings analysis applied baseline and efficient wattages from Section 4.5.4 of the TRM v8.0 for all measures, resulting in higher verified kWh savings as compared to the ex ante estimates.

Recommendation 3. The evaluation team recommends that the implementer apply the TRM-recommended baseline and efficient wattages from Section 4.5.4 of the TRM v8.0 for all common area LEDs replacing HIDs.

6.2.4 Room Air Conditioner Cover and Gap Sealer

Room air conditioner (AC) cover and gap sealer measures account for 7% of ex ante kWh savings. The gross savings realization rate for room AC cover/gap sealer was 1.19 for kWh savings. There are no demand savings for this measure because savings occur during the heating season.

[1] Measure categories included Interior LEDs, Linear LEDs, Linear Fluorescent Delamping, LED Exit Signs, Occupancy Sensors, and Air Conditioner (AC) covers.

Finding 4. For all measures, the ex ante estimates provided savings values without documentation on the terrain and shielding assumptions. Further, the program tracking database was missing variables for the terrain and shielding classes needed to perform table lookups in the TRM. The verified savings analysis relied on building type (e.g., mid-rise, high-rise) to establish terrain and shielding classes that align with building conditions, resulting in higher verified kWh savings as compared to the ex ante estimates. It is unclear how the ex ante and verified assumptions for shielding and terrain differ based on the lack of project documentation.

Recommendation 4. The evaluation team recommends that the implementer include terrain and shielding class assignments in the program tracking database for room AC cover/gap sealer measures.

Finding 5. For 220 measures, the ex ante estimates applied assumptions from the TRM v8.0 for Mid-Rise MF regardless of the building type provided in the tracking database and the number of reported stories. The verified savings applied the building type provided in the tracking database.

Recommendation 5. The evaluation team recommends that the implementer apply the building type provided in the tracking database.

6.2.5 Appliance Recycling

Recycled appliances account for 6% of total ex ante kWh savings. The gross savings realization rate for appliance recycling was 1.07 for kWh. Ex ante estimates did not claim kW savings for these measures.

Finding 6. For one custom project representing 53% of measures (n=862), the measure quantity in the program tracking database (455 appliances) was inconsistent with supporting project documentation (300 appliances). The verified savings analysis relied on the measure quantity from the supporting documentation, resulting in lower verified kWh savings compared to ex ante estimates.

Recommendation 6. The evaluation team recommends that the implementer ensure measure quantities align with supporting project documentation for future custom projects.

Finding 7. For one project, representing 53% of measures (n=862), ex ante estimates used a custom savings approach. In this approach, the ex ante estimates excluded savings from recycled refrigerators more than 10 years old. For appliances less than 10 years old, the ex ante estimates assumed that 50% of those appliances were replaced with a standard model refrigerator. The evaluation team has two concerns with this custom approach:

1. The approach does not claim savings for recycling older appliances, which do qualify for savings according to the TRM v8.0.
2. This approach does not properly account for replacement refrigerators (i.e., all units should have a replacement refrigerator, assuming these are all primary refrigerators).

The verified savings analysis relied on the TRM v8.0 rather than a custom approach. The verified analysis applied time-of-sale (TOS) algorithms from the TRM for appliances with an equipment age exceeding the EUL of 17 years and appliance recycling algorithms for those with

an equipment age less than the EUL for refrigerators, resulting in higher verified kWh savings compared to the ex ante estimates.

Recommendation 7. The evaluation team recommends that the implementer switch from a custom approach to a TRM-based approach for appliance recycling measures. The team recommends including savings from all recycled appliances regardless of its potential for purchase through the secondary market. If available, include information in the tracking database supporting whether the unit was replaced with a new unit and apply applicable algorithms (e.g., TOS, ER) from the TRM v.8.0. It is reasonable to assume in a multifamily application that all refrigerators are primary and replaced with another refrigerator model.

Finding 8. For all measures, the ex ante estimates did not claim any demand savings. The verified savings analysis included demand savings as recommended in the TRM v8.0, resulting in higher verified kW savings as compared to the ex ante estimates.

Recommendation 8. The evaluation team recommends that the implementer calculate demand savings for recycled refrigerators per the TRM.

6.2.6 Interior LED Lighting

Interior common area LEDs account for 6% of ex ante kWh savings and 9% of ex ante demand savings. The gross savings realization rate for interior LED lighting was 1.02 for kWh savings and 1.05 for kW savings.

6.2.7 Linear Fluorescent - Delamping

Delamping measures account for 5% of ex ante kWh and 9% of kW ex ante savings. For non-24/7 delamping projects, the gross savings realization rate for linear fluorescent delamping was 1.07 for kWh and 1.04 for kW. For 24/7 delamping projects, the gross savings realization rate for linear fluorescent delamping was 1.01 for both kWh and kW.

Finding 9. For nine measures, the ex ante estimates applied wattage assumptions that vary from what is recommended in Section 4.5.2 of the TRM v8.0. Verified savings estimates applied wattage assumptions per Section 4.5.2 of the TRM v8.0, resulting in lower kWh and kW savings as compared to the ex ante estimates.

Recommendation 9. The evaluation team recommends that the implementer use the TRM-recommended wattage assumptions from Section 4.5.2 of the TRM v8.0 for linear fluorescent delamping.

6.2.8 Attic Insulation and Air Sealing

The ex ante database combines savings from attic insulation and air sealing measures. Together, these two measures account for 2% of ex ante kWh savings. All insulation and air sealing projects are in gas-heated buildings with window AC units, meaning the ex ante kWh savings are based solely on the reduction in furnace fan runtime and not as a result of cooling system savings. As such, there are no demand savings for these measures. The gross savings realization rate was 1.03 for kWh.

Finding 10. For all measures, the ex ante savings estimates combined insulation and air sealing savings, making the key drivers of differences between the ex ante and verified savings

for each measure type unclear. Verified savings estimates relied on assumptions recommended by the TRM v8.0, resulting in higher verified kWh savings as compared to the ex ante estimates.

Recommendation 10. The evaluation team recommends that the implementer calculate and report savings for insulation and air sealing as separate measures or provide instruction on how to separate ex ante savings into the two components to be able to identify key areas that drive differences between the ex ante and verified savings.

6.2.9 Garage LED Lighting

Garage LED lighting accounts for 1% of ex ante kWh savings and 4% of ex ante demand savings. The gross savings realization rate for garage LED lighting was 1.00 for both kWh and kW savings.

6.2.10 LED Exit Signs

LED exit signs account for less than 1% of ex ante kWh savings and 1% of kW ex ante savings. The gross savings realization rate for LED exit signs was 1.02 for both kWh and kW.

Finding 11. For 11 measures, the ex ante estimates applied wattage assumptions that vary from what is recommended in Section 4.5.2 of the TRM v8.0. Verified savings estimates applied wattage assumptions per Section 4.5.2 of the TRM v8.0, resulting in lower kWh and kW savings as compared to the ex ante estimates.

Recommendation 11. The evaluation team recommends that the implementer use the TRM-recommended wattage assumptions from Section 4.5.2 of the TRM v8.0 for LED exit signs.

Appendix A. Impact Analysis Methodology

The evaluation team calculated gross verified savings for the Public Housing Retrofits Program by applying savings algorithms from the TRM v8.0. The team determined verified gross savings for each program measure by:

- Reviewing the savings algorithm inputs in the measure workbook for agreement with the TRM v8.0 and TRM v8.0 Errata.
- Validating savings algorithms were applied correctly.
- Prioritizing project-specific information to inform savings calculations where the TRM v8.0 advises to use actual values. For variables where project information did not include project-specific actual values, the team relied on defaults from the TRM v8.0.
- Cross-checking per-unit savings values in the tracking data with the verified values in the measure workbook or in the team's calculations if the workbook did not agree with the TRM v8.0.
- Multiplying the verified per-unit savings value by the quantity reported in the tracking data.

The team calculated verified net energy and demand (coincident peak and overall) savings by multiplying the verified gross savings estimates by a net-to-gross (NTG) ratio of 1.0. For CY2020, the Public Housing Retrofits Program's NTG estimate was defined by a consensus process through the Illinois SAG.

Appendix B. Total Resource Cost Detail

Table B-1 shows the TRC 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) is not included in this table and will be provided to the evaluation team later.

Table B-1. Total Resource Cost Savings Summary

End Use Type	Research Category	Units	Quantity	EUL (years)*	ER Flag†	Gross Electric Energy Savings (kWh)	Gross Peak Demand Reduction (kW)	Gross Gas Savings (Therms)	Gross Secondary Savings due to Water Reduction (kWh)	Gross Heating Penalty (kWh)	Gross Heating Penalty (Therms)	NTG (kWh)	NTG (kW)	NTG (Therms)	Net Electric Energy Savings (kWh)	Net Peak Demand Reduction (kW)	Net Gas Savings (Therms)	Net Secondary Savings due to Water Reduction (kWh)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
Lighting (Common Area)	Exterior LED Lighting	Lamps	539	11.6	No	351,012	0.00	NA	NA	0	0	1.00	1.00	1.00	351,012	0.00	NA	NA	0	0
Lighting (Common Area)	Linear LED Lighting (24/7)	Fixtures	1,943	5.7	No	326,772	38.56	NA	NA	0	-1,820	1.00	1.00	1.00	326,772	38.56	NA	NA	0	-1,820
Lighting (Common Area)	Linear LED Lighting	Fixtures	1,040	10.0	No	157,452	22.25	NA	NA	0	-1,585	1.00	1.00	1.00	157,452	22.25	NA	NA	0	-1,585
HVAC	Room AC Cover/Gap Sealer	Each	304	5.0	No	96,703	0.00	NA	NA	0	0	1.00	1.00	1.00	96,703	0.00	NA	NA	0	0
Appliances	Appliance Recycling	Each	455	6.5	No	77,982	9.69	NA	NA	0	0	1.00	1.00	1.00	77,982	9.69	NA	NA	0	0
Lighting (Common Area)	Interior LED Lighting	Fixtures	597	6.3	No	71,660	8.65	NA	NA	0	-471	1.00	1.00	1.00	71,660	8.65	NA	NA	0	-471
Lighting (Common Area)	Linear Fluorescent - Delamping	Lamps	120	11.0	No	59,727	7.25	NA	NA	0	-1,092	1.00	1.00	1.00	59,727	7.25	NA	NA	0	-1,092
Envelope (Common Area)	Insulation/Air Sealing	Square Feet	74,102	20.0	No	18,162	0.00	NA	NA	0	0	1.00	1.00	1.00	18,162	0.00	NA	NA	0	0
Lighting (Common Area)	Garage LED Lighting	Fixtures	13	14.1	No	14,585	3.95	NA	NA	0	0	1.00	1.00	1.00	14,585	3.95	NA	NA	0	0
Lighting (Common Area)	Linear Fluorescent - Delamping (24/7)	Lamps	6	11.0	No	7,479	0.89	NA	NA	0	-122	1.00	1.00	1.00	7,479	0.89	NA	NA	0	-122
LED Exit Sign	LED Exit Sign	Each	67	5.0	No	4,899	0.59	NA	NA	0	-25	1.00	1.00	1.00	4,899	0.59	NA	NA	0	-25
Lighting (Common Area)	Occupancy Sensors	Each	4	8.0	No	438	0.23	NA	NA	0	-2	1.00	1.00	1.00	438	0.23	NA	NA	0	-2
	Total			NA		1,186,871	92	NA	NA	0	-5,117	1.00	1.00	1.00	1,186,871	92	NA	NA	0	-5,117

NA = not applicable (refers to a piece of data that cannot be produced or does not apply)

*The total of the EUL column is the weighted average measure life (WAML) and is calculated as the sum product of EUL and measure savings divided by total program savings.

† Early replacement (ER) measures are flagged as YES; otherwise a NO is indicated in the column.

Source: ComEd tracking data and evaluation team analysis