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ComEd Nonprofit Organizations Impact Evaluation Report

Energy Efficiency/Demand Response Plan: Program Year 2021 (CY2021) (1/1/2021-12/31/2021)

Prepared for:

ComEd

FINAL

April 8, 2022

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Table of Contents

List of Tables and Figures

1. Introduction

This report presents the results of the impact evaluation of the CY2021 Nonprofit Organizations Program (also known as the Nonprofit Retrofits Program). It 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) analysis inputs. CY2021 covers January 1, 2021 through December 31, 2021.

2. Program Description

To participate in the Nonprofit Organizations program, the ComEd customer must be a 501(c)(3) organization, located within ComEd's service territory, whose mission involves providing direct services to at-risk populations. Eligible projects are identified by Energy Efficiency Service Providers (EESPs) and Elevate Energy (Elevate). Elevate is responsible for implementation of the program. Their engineers complete a free assessment of the customer facility and identify savings opportunities from the program measure list. Elevate then helps the participant identify installers and provides construction management oversight and inspection to ensure the measures are installed and generating savings as expected.

In CY2021, the program had 65 participants and distributed 16,889 measures, the majority of which were lighting measures (see Table 2-1).

The measures included in the Nonprofit Organizations Program (Table 2-2) are prescriptive measures. The program's approach to incentive levels and customer outreach closely mirrors the Small Business (SB) Program. The target population for the program includes churches, childcare centers, transitional housing, community-based organizations, and healthcare clinics.

Table 2-1. Number of Participants and Projects

Participation	Total
Participants	65
Installed Projects	77
Total Measures	16,889
Installed Lighting Measures	16,766
Installed HVAC Measures	123

HVAC – heating, ventilation, and air conditioning

Source: ComEd tracking data and evaluation team analysis.

The program included the measures shown in Table 2-2 and Figure 2-1.

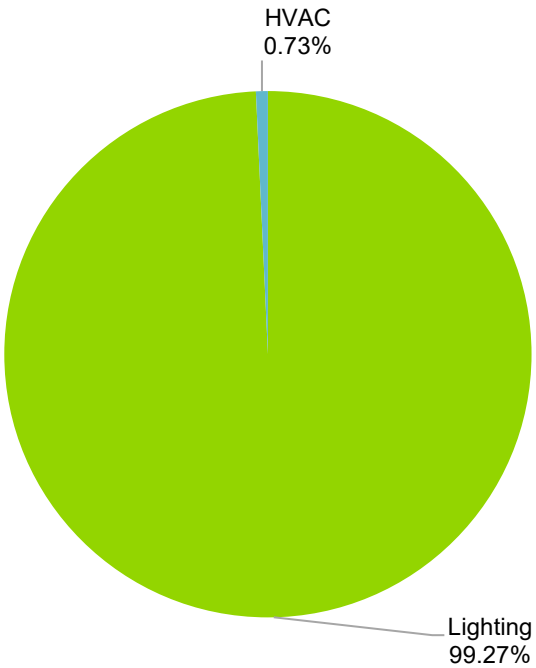
Table 2-2. Number of Measures by Type

End Use Type	Research Category	Quantity	Unit
Lighting	LED Fixture	11,637	Fixture
Lighting	LED Fixture - T12 Baseline	2,489	Fixture
Lighting	Lighting Controls	1,899	Each
HVAC	Heat Pump	20	Each
Lighting	Commercial LED Exit Signs	351	Each
HVAC	VSD - HVAC Fan	8	Each
Lighting	LED Bulb - Directional	242	Lamp
Lighting	LED Bulb - Decorative	148	Lamp
HVAC	Chiller Replacement	50	Each
HVAC	AC Replacement	25	Each
HVAC	VSD - CW Pump	20	Each
	Total	**16,889**	

Note: Research Category is arranged in the descending order of verified gross savings.
LED = light-emitting diode
VSD = variable speed drives
AC = air conditioner
CW = chilled water

Source: ComEd tracking data and evaluation team analysis

Figure 2-1. Share of Measures Installed 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 Nonprofit Organizations Program achieved in CY2021. The measures in this program do not typically produce gas savings so ComEd did not record, and the evaluation did not examine gas savings.

Table 3-1. Total Annual Incremental Electric Savings

Savings Category	Units	Ex Ante Gross Savings	Program Gross Realization Rate	Verified Gross Savings	Program Net-to-Gross Ratio (NTG)	CY2019 Net Carryover Savings	CY2020 Net Carryover Savings	Verified Net Savings†
Electric Energy Savings - Direct	kWh	4,400,922	0.99	4,347,609	0.97	N/A	N/A	4,217,181
Electric Energy Savings - Converted from Gas	kWh	0	N/A	0	0.97	N/A	N/A	0
Total Electric Energy Savings	kWh	4,400,922	0.99	4,347,609	0.97	N/A	N/A	4,217,181
Summer Peak* Demand Savings	kW	1,052	0.92	964	0.97	N/A	N/A	935

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).

* The coincident summer peak period is defined as 1:00-5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August.

† The "Verified Net Savings" in row one (Electric Energy Savings – Direct) include primary kWh savings as a result of measure implementation and electric heating penalties. It does not include carryover savings from CY2019 and CY2020 or secondary kWh savings from wastewater treatment as those do not apply to this program.

Source: ComEd tracking data and evaluation team analysis

4. Cumulative Persisting Annual Savings

Table 4-1 and Figure 4-1 show the measure-specific and total verified gross savings for the Nonprofit Organizations Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2021. The electric CPAS across all measures installed in CY2021 is shown in Table 4-1. The historic row in the table is the CPAS contribution back to CY2019. Figure 4-1 shows the savings across the effective useful life (EUL) of the measures. There were no gas savings for this program, so electric CPAS is equivalent to total CPAS.

The EUL values presented in the CPAS table are weighted averages based on research category. This is because fixtures and bulbs have EULs that vary based on building type. Thus the table shows some savings beyond the year that would be expected for the EUL listed in the given row.

The CPAS table accounts for midlife adjustments to all lighting measures including those with T12 baselines, according to the procedures in the Illinois Technical Reference Manual version 9.0 (IL-TRM).[1] In the IL-TRM, LED bulbs have a midlife adjustment starting in 2025, and T12 baseline fixtures have a midlife adjustment on a calculated remaining useful life (RUL) value. Appendix A contains more information on how these adjustments were calculated.

[1] In this report, unless stated otherwise, IL-TRM refers to version 9.0 (v9.0).

Table 4-1. Cumulative Persisting Annual Savings – Electric

End Use Type	Research Category	EUL	CY2021 Verified Gross Savings (kWh)	NTG*	Lifetime Net Savings (kWh)†	Verified Net kWh Savings 2018	2019	2020	2021	2022	2023	2024	2025	2026
Lighting	LED Fixture	13.9	2,996,675	0.97	40,324,240				2,906,775	2,906,775	2,906,775	2,906,775	2,906,775	2,906,775
Lighting	LED Fixture - T12 Baseline	14.2	810,918	0.97	7,895,029				786,591	786,591	786,423	715,927	586,693	508,434
Lighting	Lighting Controls	10.0	142,098	0.97	1,378,352				137,835	137,835	137,835	137,835	137,835	137,835
HVAC	Heat Pump	15.0	119,076	0.97	1,732,554				115,504	115,504	115,504	115,504	115,504	115,504
Lighting	Commercial LED Exit Signs	5.0	107,981	0.97	523,707				104,741	104,741	104,741	104,741	104,741	
HVAC	VSD - HVAC Fan	15.0	92,068	0.97	1,339,589				89,306	89,306	89,306	89,306	89,306	89,306
Lighting	LED Bulb - Directional	7.0	34,546	0.97	194,206				33,509	33,509	33,509	33,509	18,058	14,637
Lighting	LED Bulb - Decorative	5.2	18,314	0.97	84,305				17,764	17,764	17,764	17,764	2,465	2,157
HVAC	Chiller Replacement	23.0	13,939	0.97	310,968				13,520	13,520	13,520	13,520	13,520	13,520
HVAC	AC Replacement	3.0	7,663	0.97	22,299				7,433	7,433	7,433			
HVAC	VSD - CW Pump	15.0	4,332	0.97	63,034				4,202	4,202	4,202	4,202	4,202	4,202
CY2021 Program Total Electric Contribution to CPAS			**4,347,609**		**53,868,283**				**4,217,181**	**4,217,181**	**4,217,013**	**4,139,084**	**3,979,099**	**3,792,370**
Historic Program Total Electric Contribution to CPAS‡						**-**	**3,156,390**	**6,413,289**	**6,413,289**	**6,407,572**	**6,398,501**	**6,002,583**	**5,936,568**	**5,714,160**
Program Total Electric CPAS						**-**	**3,156,390**	**6,413,289**	**10,630,470**	**10,624,753**	**10,615,514**	**10,141,667**	**9,915,667**	**9,506,530**
CY2021 Program Incremental Expiring Electric Savings§										**-**	**168**	**77,929**	**159,985**	**186,730**
Historic Program Incremental Expiring Electric Savings									**-**	**5,717**	**9,071**	**395,918**	**66,015**	**222,407**
Program Total Incremental Expiring Electric Savings									**-**	**5,717**	**9,239**	**473,847**	**226,000**	**409,137**

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Lighting	LED Fixture	2,906,775	2,906,775	2,906,775	2,904,471	2,901,015	2,556,741	2,026,263	1,899,655	1,875,120			
Lighting	LED Fixture - T12 Baseline	472,388	448,357	448,357	448,134	447,801	447,801	432,504	294,828	284,203			
Lighting	Lighting Controls	137,835	137,835	137,835	137,835								
HVAC	Heat Pump	115,504	115,504	115,504	115,504	115,504	115,504	115,504	115,504	115,504			
Lighting	Commercial LED Exit Signs												
HVAC	VSD - HVAC Fan	89,306	89,306	89,306	89,306	89,306	89,306	89,306	89,306	89,306			
Lighting	LED Bulb - Directional	8,346	8,346	5,608	5,174								
Lighting	LED Bulb - Decorative	2,157	2,157	2,157	2,157								
HVAC	Chiller Replacement	13,520	13,520	13,520	13,520	13,520	13,520	13,520	13,520	13,520	13,520	13,520	13,520
HVAC	AC Replacement												
HVAC	VSD - CW Pump	4,202	4,202	4,202	4,202	4,202	4,202	4,202	4,202	4,202			
CY2021 Program Total Electric Contribution to CPAS		**3,750,032**	**3,726,001**	**3,723,264**	**3,720,303**	**3,571,348**	**3,227,074**	**2,681,299**	**2,417,015**	**2,381,854**	**13,520**	**13,520**	**13,520**
Historic Program Total Electric Contribution to CPAS‡		**5,565,889**	**2,861,142**	**2,832,098**	**2,359,680**	**2,144,340**	**1,821,329**	**1,821,329**	**1,804,311**	**-**	**-**	**-**	**-**
Program Total Electric CPAS		**9,315,921**	**6,587,144**	**6,555,362**	**6,079,984**	**5,715,688**	**5,048,403**	**4,502,628**	**4,221,326**	**2,381,854**	**13,520**	**13,520**	**13,520**
CY2021 Program Incremental Expiring Electric Savings§		**42,337**	**24,031**	**2,738**	**2,960**	**148,956**	**344,274**	**545,775**	**264,284**	**35,161**	**2,368,334**	**-**	**-**
Historic Program Incremental Expiring Electric Savings		**148,272**	**2,704,747**	**29,044**	**472,418**	**215,341**	**323,011**	**-**	**17,018**	**1,804,311**	**-**	**-**	**-**
Program Total Incremental Expiring Electric Savings		**190,609**	**2,728,778**	**31,782**	**475,378**	**364,296**	**667,284**	**545,775**	**281,302**	**1,839,471**	**2,368,334**	**-**	**-**

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Lighting	LED Fixture												
Lighting	LED Fixture - T12 Baseline												
Lighting	Lighting Controls												
HVAC	Heat Pump												
Lighting	Commercial LED Exit Signs												
HVAC	VSD - HVAC Fan												
Lighting	LED Bulb - Directional												
Lighting	LED Bulb - Decorative												
HVAC	Chiller Replacement	13,520	13,520	13,520	13,520	13,520							
HVAC	AC Replacement												
HVAC	VSD - CW Pump												
CY2021 Program Total Electric Contribution to CPAS		**13,520**	**13,520**	**13,520**	**13,520**	**13,520**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Historic Program Total Electric Contribution to CPAS‡		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Program Total Electric CPAS		**13,520**	**13,520**	**13,520**	**13,520**	**13,520**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
CY2021 Program Incremental Expiring Electric Savings§		**-**	**-**	**-**	**-**	**-**	**13,520**	**-**	**-**	**-**	**-**	**-**	**-**
Historic Program Incremental Expiring Electric Savings		**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Program Total Incremental Expiring Electric Savings		**-**	**-**	**-**	**-**	**-**	**13,520**	**-**	**-**	**-**	**-**	**-**	**-**

Note: The green highlighted cell shows program total first-year electric savings. The gray cells are blank, indicating values irrelevant to the CY2021 contribution to CPAS.

* A deemed value. Source: Illinois Stakeholder Advisory Group (SAG) website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.

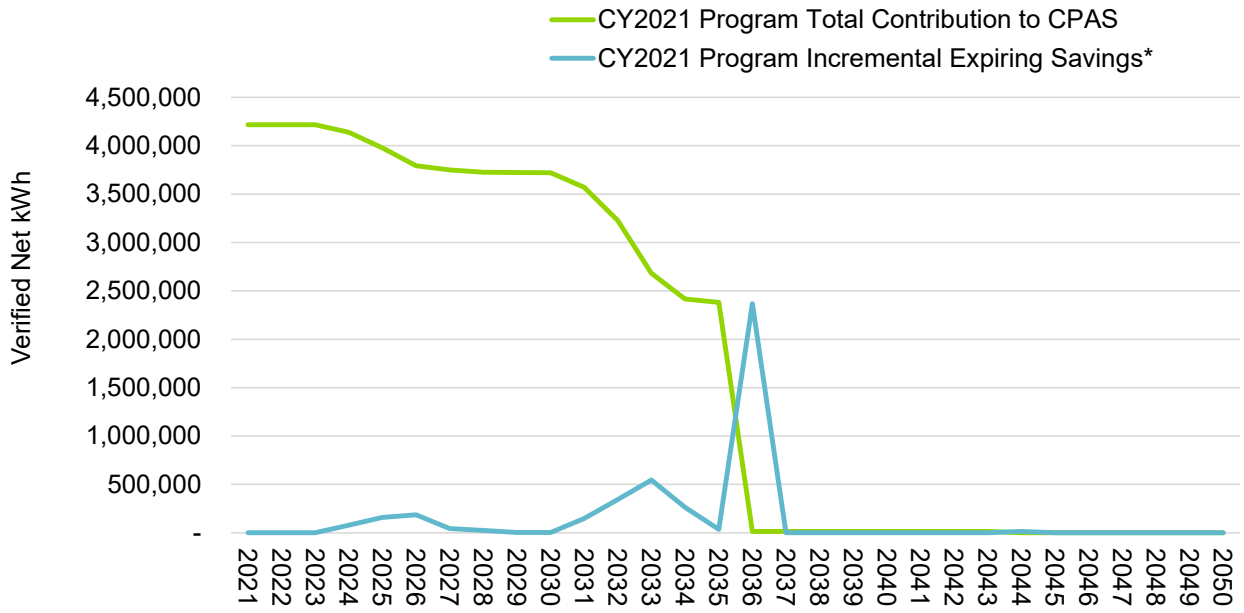
† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historic savings go back to CY2019.

§ 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 included the measures shown in Table 5-1 and Figure 5-1.

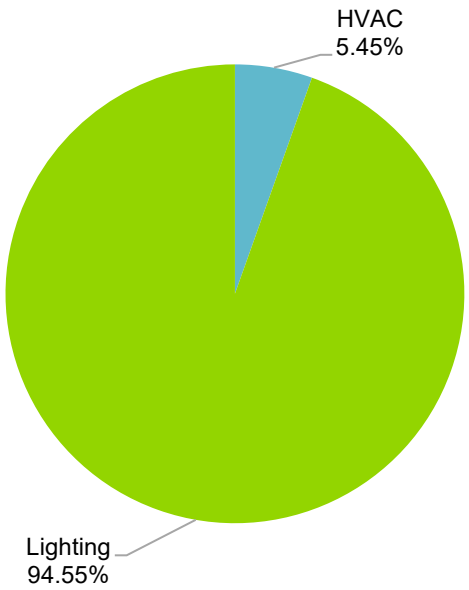
Table 5-1. Number of Measures by Type

End Use Type	Research Category	Quantity	Unit
Lighting	LED Fixture	11,637	Fixture
Lighting	LED Fixture - T12 Baseline	2,489	Fixture
Lighting	Lighting Controls	1,899	Each
HVAC	Heat Pump	20	Each
Lighting	Commercial LED Exit Signs	351	Each
HVAC	VSD - HVAC Fan	8	Each
Lighting	LED Bulb - Directional	242	Lamp
Lighting	LED Bulb - Decorative	148	Lamp
HVAC	Chiller Replacement	50	Each
HVAC	AC Replacement	25	Each
HVAC	VSD - CW Pump	20	Each
	Total	**16,889**	

Note: This is the same table as Table 2-2.

Source: ComEd tracking data and evaluation team analysis

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



Source: ComEd tracking data and evaluation team analysis

Measure-level energy and demand savings are provided in the following tables.

Table 5-2. 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	LED Fixture	3,013,287	0.99	2,996,675	0.97	2,906,775	13.9
Lighting	LED Fixture - T12 Baseline	821,198	0.99	810,918	0.97	786,591	14.2
Lighting	Lighting Controls	166,464	0.85	142,098	0.97	137,835	10.0
HVAC	Heat Pump	119,351	1.00	119,076	0.97	115,504	15.0
Lighting	Commercial LED Exit Signs	109,366	0.99	107,981	0.97	104,741	5.0
HVAC	VSD - HVAC Fan	92,281	1.00	92,068	0.97	89,306	15.0
Lighting	LED Bulb - Directional	34,626	1.00	34,546	0.97	33,509	7.0
Lighting	LED Bulb - Decorative	18,356	1.00	18,314	0.97	17,764	5.2
HVAC	Chiller Replacement	13,971	1.00	13,939	0.97	13,520	23.0
HVAC	AC Replacement	7,681	1.00	7,663	0.97	7,433	3.0
HVAC	VSD - CW Pump	4,342	1.00	4,332	0.97	4,202	15.0
	Total	**4,400,922**	**0.99**	**4,347,609**		**4,217,181**	

Note: The savings in this table account for electric heating penalties, where applicable.
* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.
Source: ComEd tracking data and evaluation team analysis

Table 5-3. 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	LED Fixture	646.57	0.92	592.29	0.97	574.52
Lighting	LED Fixture - T12 Baseline	226.77	0.92	207.73	0.97	201.50
Lighting	Lighting Controls	147.10	0.92	134.75	0.97	130.71
HVAC	Heat Pump	-1.14	0.92	-1.04	0.97	-1.01
Lighting	Commercial LED Exit Signs	15.32	0.92	14.04	0.97	13.62
HVAC	VSD - HVAC Fan	4.99	0.92	4.57	0.97	4.43
Lighting	LED Bulb - Directional	8.16	0.92	7.47	0.97	7.25
Lighting	LED Bulb - Decorative	3.78	0.92	3.47	0.97	3.36
HVAC	Chiller Replacement	1.34	0.92	1.23	0.97	1.19
HVAC	AC Replacement	-0.82	0.92	-0.75	0.97	-0.73
HVAC	VSD - CW Pump	0.00	N/A	0.00	0.97	0.00
	Total	**1,052.07**	**0.92**	**963.74**		**934.83**

N/A = not applicable (refers to a piece of data that cannot be produced or does not apply).
* A deemed value. Source: Illinois SAG website: **https://www.ilsag.info/evaluator-ntg-recommendations-for-2021**.
Source: ComEd tracking data and evaluation team analysis

6. Impact Analysis Findings and Recommendations

The issues that had the largest effect on adjusting ex ante gross savings were as follows:

- **Building type (Findings 1, 2, and 3):** Building type discrepancies were one of the key drivers behind the final program energy and demand realization rates. The evaluation team found the discrepancy was driven by ex ante savings calculations using inputs associated with a different building type than the tracking data listed.
- **Electric heating penalty (Findings 5 and 6):** Guidehouse found that some measures in the final dataset were installed in electrically heated homes, which indicated the measure needed an electric heating penalty value incorporated into its final savings value. The evaluation team found this was not done for the ex ante savings, impacting the energy realization rate.

The evaluation team developed several recommendations for the program based on findings from the CY2021 evaluation.

6.1 Building Type[2]

Finding 1. The evaluation team found that all measures installed in a cooled space in project IDs 10006355, 10007871, and 10008736 use some incorrect HVAC interactive factor values in relation to the listed building type. In all measures except for the projects' 24/7 lighting measures, the incorrect inputs were the waste heat factor for energy (WHFe), waste heat factor for demand (WHFd), and summer peak coincidence factor (CF). This led to an energy measure-level realization rate of 1.04, and demand measure-level realization rates of 0.6 for bulbs and fixtures and 0.48 for lighting controls. The two 24/7 measures had incorrect WHFe and WHFd values, which led to an energy measure-level realization rate of 1.04 and a demand measure-level realization rate of 1.25. According to the tracking data and supporting documents, these three projects were installed in a religious building. However, the tracking data listed and used values in the ex ante savings equations that matched the restaurant building type. Table 6-1 compares these values in more detail. The evaluation team used the religious building type WHFe, WHFd, and CF values in the verified savings calculations.

> **Recommendation 1.** The program should ensure their savings calculations correctly align with the correct building type inputs as deemed in the IL-TRM. Savings input values provided in the tracking data should also match the IL-TRM deemed values.

Table 6-1. Religious Building vs. Restaurant Savings Inputs

Source	WHFe	WHFd	CF (interior)	CF (24/7)
Religious Building (IL-TRM)	1.12	1.37	0.48	1.00
Tracking Data	1.08	1.10	1.00	1.00
Restaurant (IL-TRM)	1.08	1.10	1.00	1.00

[2] The evaluation team confirmed with the IC the tracking data's Space_Type field aligns with the supplemental file's Property Type field, thus indicating it describes the overall property's building type. The supplemental file's Space Type field is more specific to the measure's building type and was used to determine the IL-TRM load shape in savings calculations. When the supplemental file's Space_Type was 'Interior – Standard' or blank, the evaluation team used the Property Type field to determine the load shape.

Source: Evaluation team analysis of tracking data and IL-TRM

Finding 2. The evaluation team identified a few instances where the project documentation's worksheet did not align with the tracking data values for 24/7 lighting measures. Project ID 10008298 had one fixture marked as a 24/7 measure in the worksheet, but this was not noted in the tracking data nor the provided in the supplemental property type worksheet. The savings special hours and CF input values associated with 24/7 lighting were not used in the ex ante savings value. The evaluation team used hours and CF values associated with 24/7 lighting in the verified savings calculation, resulting in an energy measure-level realization rate of 2.25 and a demand measure-level realization rate of 1.49. Project IDs 10006355 and 10007738 each contained a measure that used hours and CF values associated with 24/7 lighting in their ex ante savings equations. There is no note of this in the tracking data or associated project documentation. The evaluation team was able to confirm with the implementation contractor (IC) that these two measures were continuously on, so their savings were not affected.

> **Recommendation 2.** The program should make sure the tracking data and the project documentation align for all measures. The worksheet has space to identify 24/7 lighting measures, which can be an easy solution.

Finding 3. The evaluation team found project ID 10007738 had an indoor measure in an uncooled space that used an incorrect CF value, resulting in a demand measure-level realization rate of 0.99. The tracking data used a CF value of 0.67, which matches the unknown building type CF value. However, the IL-TRM instructs that a CF value of 0.66 should be used for any lighting measure installed in an uncooled space. The evaluation team used the IL-TRM uncooled building CF value (0.66) in the verified savings equation.

> **Recommendation 3.** The program should use the uncooled building CF value for any applicable measures installed in an interior uncooled space.

Finding 4. The evaluation team found project ID 10006355 had one measure that changed savings between the Wave 1 and Year End datasets. During Wave 1 this measure was treated as an interior religious building measure, but the year end data changed to treat it as an exterior measure. The verified savings for this measure were calculated using exterior measure savings inputs, so the realization rate for this measure was 1.00.

> **Recommendation 4.** The program should ensure they provide additional notes in the Project Overview sheet when measure savings are changed between the Wave 1 and Year End datasets. The evaluation team relied on the final savings reported in the Year End dataset. The program should provide additional notes on building type change to avoid risk of an evaluation adjustment of savings.

6.2 Electric Heating Penalty

Finding 5. The evaluation team found the tracking data did not provide ex ante values for electric heating penalties. Verified electric heating penalty values were calculated for measures with electric heating system fuel types and these values were incorporated into the total verified energy savings. Verified electric heating penalties were calculated for the population-level data using the IL-TRM and then had the program-level realization rate applied. The evaluation team calculated electric heating penalties for all measures that were not exterior; uncooled spaces and interior measures were all assumed to be in heated buildings. This reduced the energy realization rate for measures installed in an electrically heated building.

> **Recommendation 5.** The program should report electric heating penalty values in the tracking data for buildings that are electrically heated, where applicable. It is Guidehouse's understanding that the program will coordinate with ComEd to continue reporting electric heating penalties for electrically heated buildings going forward.

Finding 6. The evaluation team found the tracking data fields for heating system fuel and heating system type were filled out for exterior measures. Measures installed in an exterior location do not have associated heating system fuels or types. This had the potential to impact savings for measures that are installed in buildings with electric heat dependent on how the eTrack system calculates heating penalty.

> **Recommendation 6.** Fill the heating system fuel tracking data field with N/A or another marker to note the measure is exterior and does not have heating systems to account for. The default for heating system type should be blank and then only specified for interior measures by the IC when the measures are reported. This process will help improve all program ex ante savings calculations that rely on an accurate heating system type or fuel, including heating penalty.

6.3 Tracking Data

Finding 7. The evaluation team was unable to identify the reason for a discrepancy in savings values for all measures in project ID 10007898. The verified savings calculations for this project used savings inputs and algorithms from the IL-TRM for its associated low rise office building type. The project's electric energy realization rate was 0.87.

> **Recommendation 7.** The program should ensure that inputs and algorithms used for ex ante savings align with the IL-TRM and should provide additional documentation to support values and assumptions not found in the IL-TRM.

Finding 8. The evaluation team found project ID 10007898 listed the building as natural gas heated in the provided post-application documentation, while the tracking data noted the project as having electric heating. Guidehouse discussed discrepancies between applications and the tracking data with the IC the program during the Wave 1 evaluation. Per the guidance from the IC, the evaluation team used the tracking data as the most reliable source for general information. The evaluation team calculated electric heating penalties for this project in accordance with the heating system fuel provided in the tracking data. Incorporating electric heating penalties into the verified energy savings reduced the energy realization rate for this project.

Finding 9. The evaluation team found three LED fixture measures had baseline descriptions in the supplemental data file that did not match the project documentation's measure worksheet. Guidehouse discussed discrepancies between worksheets and tracking data with the IC during the Wave 1 evaluation. Guidehouse used the worksheet's information for these measure-specific details as the IC provided guidance the worksheet had the most up-to-date information.[3] The evaluation team used the descriptions from the worksheet in its analysis, ruling out the need for one measure to have a T12 midlife adjustment. This misalignment did not have an impact on savings. Table 6-2 shows the misalignments in more detail.

[3] Efficient wattage values are the exception. The worksheets are automated with the standard efficient wattage of bulb types; however, some projects may have more accurate project-specific values listed in the tracking data.

Recommendation 8. The program should ensure project documentation aligns with the tracking data, especially for key savings information.

Table 6-2. Baseline Description Discrepancy

Project ID	Tracking Data Baseline Description	Worksheet Baseline Description
10007657	2 Lamp 4ft T8 troffer	2L4T5 Vapor Tight
10007657	2 Lamp 4ft T12	2 Lamp 4ft T8
10007657	wallpacks 150W	wallpacks 70W

Source: Tracking data and supplemental project documentation

Finding 10. The evaluation team found the documentation associated with project ID 10008977 was not descriptive of measure-specific details. Guidehouse used supplemental Air-Conditioning, Heating, and Refrigeration Institute (AHRI) certificates from ComEd to source custom input values. The evaluation team used the heating seasonal performance factor of the baseline equipment ($HSPF_{base}$) value provided in the measure workbook but found it did not align with the IL-TRM corresponding value. The team also found the tracking data left the values for $EFLH_{cool}$ blank and used the IL-TRM value for the project's building type. This project had a realization rate of 1.00.

Recommendation 9. The program should ensure all project documentation needed to support ex ante savings is provided. The program should also verify the savings inputs used align with the IL-TRM where possible.

Appendix A. Impact Analysis Methodology

This appendix outlines the verified savings analysis. This program is evaluated using a sampling method and requires midlife adjustments due to lighting measures.

A.1 File Review Methodology

The evaluation team used a sampling and file review methodology to calculate verified program savings. To determine the sample size, each project in the population was placed into a small, medium, or large stratum based on total reported ex ante savings per project. The evaluation team ensured the sample was representative of the population by:

1. Selecting small, medium, and large savings thresholds that resulted in a roughly equal amount of savings in each stratum
2. Confirming the stratum-to-total savings ratio for the sample was in a similar proportion to the stratum-to-total savings ratio for the population as a whole

This methodology resulted in a total file review sample of 20 projects, including five large projects, six medium projects, and nine small projects, targeting 90% confidence at 10% precision. The sample project IDs shown in Table A-1 were randomly selected using a random number generator in Excel from among the projects in each stratum. Table A-2 shows a count of the population and sample projects in each stratum.

Table A-1. Sampled Project IDs and Sizes

Project_Id	Sample Bins
10007199	Large
10007888	Large
10008298	Large
10008252	Large
10007898	Large
10008977	Medium
10008326	Medium
10007601	Medium
10007871	Medium
10007695	Medium
10006355	Medium
10008241	Small
10007891	Small
10007657	Small
10008091	Small
10007654	Small
10007738	Small
10007396	Small
10007603	Small
10008736	Small

Source: Evaluation team analysis

Table A-2. Sample and Population Project Count

Stratum	Population Project Count	Sample Project Count
Small	52	9
Medium	18	6
Large	7	5
Total	**77**	**20**

Source: Tracking data and evaluation team analysis

The evaluation team worked with ComEd and the IC to ensure all applicable project documentation folders had been uploaded to eTrack or the ShareFile before beginning the file review process. The team then compared the tracking data to the provided final applications and final worksheets in the project folders. The team also looked through invoices, pre-upgrade materials, and photos to achieve a complete understanding of the program documentation. The evaluation team discussed apparent discrepancies with ComEd and the IC to determine the root cause and to suggest a resolution to prevent future discrepancies.

Once the file review was complete and discrepancies were resolved, the evaluation team calculated verified gross energy and demand savings values using the equations provided in the IL-TRM for all measures in the sample. The evaluation team rolled up the sample savings and realization rates on a stratum level and applied the stratum-level realization rates to all population projects in each stratum. The total program-level energy and demand savings are the sum of the verified savings across all strata and were used to obtain the program-level realization rates. The final program kWh precision for this analysis was 1%. The savings roll-up process from sample to population can be seen in Table A-3.

Table A-3. Population Savings Rollup

Stratum	Population Ex Ante kWh	Population Ex Ante kW	Sample Ex Ante Gross kWh	Sample Ex Ante Gross kW	Verified Gross kWh	Verified Gross kW	Gross RR kWh	Gross RR kW	Population Ex Post kWh	Population Ex Post kW	Relative Precision
Small	1,441,497	352	320,423	68.54	320,623	68	1.00	0.99	1,442,397	347.72	0%
Medium	1,526,553	381	466,037	101.85	469,451	79	1.01	0.78	1,537,738	297.26	1%
Large	1,432,871	319	1,115,912	287.90	1,098,602	288	0.98	1.00	1,410,644	318.76	2%
Total	**4,400,922**	**1,052**	**1,902,372**	**458.29**	**1,888,676**	**435**	**1.00**	**0.92**	**4,390,779**	**963.74**	**1%**

RR = realization rate

Source: Tracking data and evaluation team analysis

Finally, the evaluation team calculated heating penalties and midlife adjustments per the IL-TRM. More details on midlife adjustments can be seen in Appendix A.2. The tracking data's ex ante values did not include heating penalties; values needed due to HVAC-lighting interaction for measures installed in heated buildings. The team used the IL-TRM algorithm and HVAC interactive factors to adjust the electric savings for all measures in electrically heating buildings. The evaluation team also used the IL-TRM algorithm and HVAC interactive factors to calculate a gas heating penalty value for all measures in gas heated buildings, but these values are only presented in the TRC table. Electric and gas heating penalties were calculated for all measures that were not exterior; the team assumed an uncooled space would still be heated.

A.2 Midlife Adjustment

Three measure types in this program require midlife adjustments to their energy savings: LED fixtures with a T12 baseline, directional LED lamps, and decorative LED lamps. Table A-4

shows the percentage adjustments and years that the adjustments take effect for each measure. To calculate the midlife adjusted values, the evaluation team applied the percent adjustments (see Table A-4 to a measure's ex ante energy savings summed with applicable electric heating penalties. This produced an adjusted ex ante value that accounted for heating penalty. Then the team applied the program-level realization rate to the adjusted savings value to get the adjusted verified savings.

The bulbs have deemed percentages of 61% and 60% for decorative and directional bulbs respectively, with CPAS adjustments taking effect in 2025. The fixtures have an adjustment of 57% and a variable adjustment year calculated using the algorithm described below.

Table A-4. LED Lamp Adjustment Factors

Measure Type	Adjustment Factor Applied to Annual kWh Savings	Year From Which Adjustment is Applied
LED Fixture	57%	Varies*
LED Bulb - Decorative	61%	2025
LED Bulb - Directional	60%	2025

* This value is the RUL, which varies between individual measures based on the associated building type.

Source: IL-TRM

LED fixtures with a T12 baseline use the IL-TRM method of a 57% adjustment factor applied to annual energy savings for the RUL of the measure. ComEd and the IC provided the evaluation team with supplemental tracking data details that allowed the evaluation team to identify any fixture measures with a T12 baseline. Each measure's RUL was determined as one-third of the baseline lifetime hours—40,000 hours for T12 fixtures per the IL-TRM—divided by the individual measure's efficient average hours of use per year. The evaluation team then applied 57% of the first-year savings to the RUL and continued this value for the remainder of the individual measure's EUL. Details on the T12 baseline fixtures' RUL values can be seen in Table A-5. They are broken out by building type, as the efficient average annual hours of use value varies by building type in the IL-TRM.

Table A-5. RUL of T12 Baseline LED Fixtures

TRM Measure Name	Space_Type	Hours	RUL
LED Fixture - T12 Baseline	Childcare	2860	4.7
LED Fixture - T12 Baseline	Elementary School	3038	4.4
LED Fixture - T12 Baseline	Healthcare Clinic	3890	3.4
LED Fixture - T12 Baseline	High School	3038	4.4
LED Fixture - T12 Baseline	MF Mid Rise	5216	2.6
LED Fixture - T12 Baseline	Office - Low Rise	2698	4.9
LED Fixture - T12 Baseline	Religious Building*	2085	6.4
LED Fixture - T12 Baseline		8766	1.5
LED Fixture - T12 Baseline	Unknown	3379	3.9
LED Fixture - T12 Baseline	Warehouse	3135	4.3

* This building type's RUL is weighted because one fixture is on continuously and has a different hours value.

Source: Evaluation team analysis of tracking data and IL-TRM

A.3 Effective Useful Life

The EUL of LED bulbs and fixtures is defined in the IL-TRM as the energy efficient measure's lifetime hours divided by average operating hours per year. The EUL value is capped at 15 years for fixtures and 10 years for bulbs. Table A-6 shows the IL-TRM deemed lifetime hours for energy efficient fixtures and bulb types. The average operating hours per year are based on building type, as defined in the IL-TRM.

Table A-6. LED Efficient Lifetime Hours by Measure Type

Measure Type	Lifetime (Hours)	Product Life Maximum (Years)
LED Fixture	50,000	15
LED Bulb - Decorative	17,000	10
LED Bulb - Directional	25,000	10

Source: IL-TRM

These EUL values define how long a measure's savings last in the CPAS table. To properly capture all the program's savings, the evaluation team created a CPAS table that separated out fixtures and bulbs by building type because the EUL varies based on building type. The team then rolled up the CPAS table by measure type, resulting in the savings-weighted average EUL values first seen in Table 4-1.

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. This table does not include additional required cost data (e.g., measure costs, program-level incentives, and non-incentive costs). ComEd will provide this data 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	LED Fixture‡	Fixture	11,637	13.9	NO	2,996,675	592.29	0	0	-9,667	-96,281	0.97	0.97	0.97	2,906,775	574.52	0	0	-9,377	-93,392
Lighting	LED Fixture - T12 Baseline‡	Fixture	2,489	14.2	NO	810,918	207.73	0	0	-8,387	-26,029	0.97	0.97	0.97	786,591	201.50	0	0	-8,136	-25,248
Lighting	Lighting Controls	Each	1,899	10.0	NO	142,098	134.75	0	0	-23,982	-991	0.97	0.97	0.97	137,835	130.71	0	0	-23,263	-961
HVAC	Heat Pump	Each	20	15.0	NO	119,076	-1.04	0	0	0	0	0.97	0.97	0.97	115,504	-1.01	0	0	0	0
Lighting	Commercial LED Exit Signs	Each	351	5.0	NO	107,981	14.04	0	0	-1,133	-5,424	0.97	0.97	0.97	104,741	13.62	0	0	-1,099	-5,261
HVAC	VSD - HVAC Fan	Each	8	15.0	NO	92,068	4.57	0	0	0	0	0.97	0.97	0.97	89,306	4.43	0	0	0	0
Lighting	LED Bulb - Directional‡	Lamp	242	7.0	NO	34,546	7.47	0	0	0	-321	0.97	0.97	0.97	33,509	7.25	0	0	0	-311
Lighting	LED Bulb - Decorative‡	Lamp	148	5.2	NO	18,314	3.47	0	0	0	-223	0.97	0.97	0.97	17,764	3.36	0	0	0	-216
HVAC	Chiller Replacement	Each	50	23.0	NO	13,939	1.23	0	0	0	0	0.97	0.97	0.97	13,520	1.19	0	0	0	0
HVAC	AC Replacement	Each	25	3.0	NO	7,663	-0.75	0	0	0	0	0.97	0.97	0.97	7,433	-0.73	0	0	0	0
HVAC	VSD - CW Pump	Each	20	15.0	NO	4,332	0.00	0	0	0	0	0.97	0.97	0.97	4,202	0.00	0	0	0	0
	Total					**4,347,609**	**964**	**0**	**0**	**-43,170**	**-129,269**				**4,217,181**	**935**	**0**	**0**	**-41,875**	**-125,391**

* 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.

‡ The EUL for this measure varies over time. See the CPAS table (Table 4-1).

§ The kWh savings account for electric heating penalties, where applicable. The electric heating penalties columns show the magnitude of adjustments applied to the program savings. Gas heating penalties represent the program therms heating penalties. The therms penalties are not required to be applied to the program savings.

Source: ComEd tracking data and evaluation team analysis