



# ComEd LED Street Lighting Impact Evaluation Report

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

Prepared for:

ComEd

**FINAL**

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## 1. Introduction

This report presents the results of the impact evaluation of the CY2021 LED Street Lighting 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

Launched in 2014, the LED Street Lighting Program encourages early retirement of high-pressure sodium, mercury vapor, and metal halide street lighting fixtures and replacement with light-emitting diode (LED) fixtures. ICF/DNV is the program implementer. Street Lighting fixtures in the program are either ComEd-owned or owned by a public sector entity (e.g., a municipality). In CY2021, the program had 276 participants and supported the adoption of 69,224 LED streetlights (see Table 2-1).

**Table 2-1. Number of Participants and Projects**

Participation	ComEd Street Lights	Public Sector Street Lights	Total
Participants	173	103	<b>276</b>
Total Measures	20,604	48,620	<b>69,224</b>
Installed Projects	193	103	<b>296</b>
Number of Units per Project	107	472	<b>579</b>

Source: ComEd tracking data and evaluation team analysis

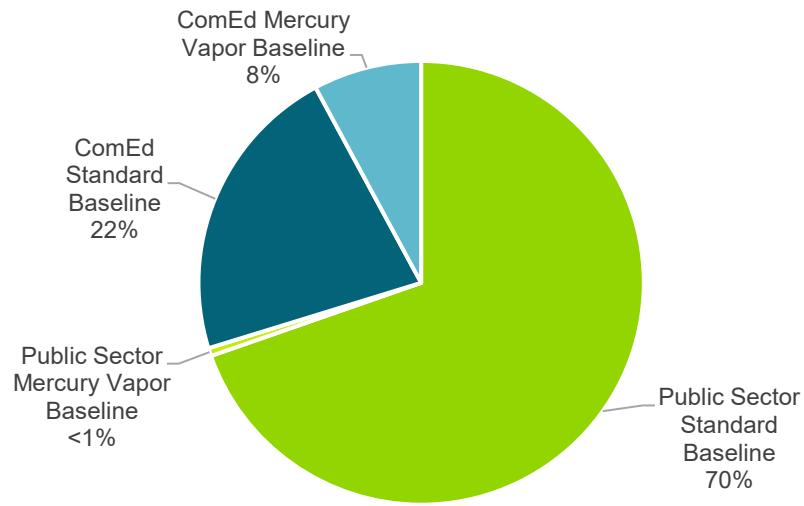
The program included the measures shown in Table 2-2 and Figure 2-1.

**Table 2-2. Number of Measures by Type**

End Use Type	Research Category	Quantity	Unit
Public Sector Street Lights	Standard Baseline	48,216	Fixtures
Public Sector Street Lights	Mercury Baseline	404	Fixtures
ComEd Street Lights	Standard Baseline	15,160	Fixtures
ComEd Street Lights	Mercury Baseline	5,444	Fixtures
<b>Total</b>		<b>69,224</b>	

Source: ComEd tracking data and evaluation team analysis

**Figure 2-1. Share of Measures Installed**



Source: ComEd tracking data and evaluation team analysis

### 3. Program Savings Detail

Table 3-1 summarizes the incremental energy and demand savings the LED Street Lighting Program achieved in CY2021. This program does not produce any 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	54,205,711	1.00	54,194,123	Varies	N/A	N/A	46,856,560
Electric Energy Savings - Converted from Gas	kWh	-	N/A	-	N/A	N/A	N/A	-
Total Electric Energy Savings	kWh	54,205,711	1.00	54,194,123	Varies	N/A	N/A	46,856,560
Summer Peak§ Demand Savings	kW	NR	NR	14	Varies	N/A	N/A	12

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

NR = not reported.

§ 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) includes primary kWh savings as a result of measure implementation. It does not include carryover savings, secondary kWh savings from wastewater treatment or electric heating penalties as they don’t 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 LED Street Lighting Program and the cumulative persisting annual savings (CPAS) for the measures installed in CY2021. The electric CPAS across all measures installed in 2021 is shown in Table 4-1. The historic rows in each table are the CPAS contribution back to CY2018. The Program Total Electric CPAS is the sum of the CY2021 contribution and the historic contribution. Figure 4-1 shows the savings across the effective useful life (EUL) of the measures.

This program did not generate gas savings in CY2021, so electric CPAS is equivalent to total CPAS.



**Table 4-1. Cumulative Persisting Annual Savings – Electric**

End Use Type	Research Category	CY2021		Lifetime Net Savings (kWh)†	Verified Net kWh Savings									
		EUL Savings (kWh)	NTG*		2018	2019	2020	2021	2022	2023	2024	2025	2026	
Public Sector Street Lights	Standard Baseline	20.0	38,329,093	0.81	619,798,118				31,046,565	31,046,565	31,046,565	31,046,565	31,046,565	31,046,565
ComEd Street Lights	Standard Baseline	20.0	10,805,677	1.00	216,113,547				10,805,677	10,805,677	10,805,677	10,805,677	10,805,677	10,805,677
ComEd Street Lights	Mercury Vapor Baseline	20.0	4,769,693	1.00	59,483,603				4,769,693	4,769,693	4,769,693	2,657,325	2,657,325	2,657,325
Public Sector Street Lights	Mercury Vapor Baseline	20.0	289,660	0.81	2,533,742				234,625	234,625	234,625	107,639	107,639	107,639
<b>CY2021 Program Total Electric Contribution to CPAS</b>			<b>54,194,123</b>		<b>897,929,010</b>				<b>46,856,560</b>	<b>46,856,560</b>	<b>46,856,560</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>
<b>Historic Program Total Electric Contribution to CPAS‡</b>						<b>86,043,658</b>	<b>177,580,411</b>	<b>245,711,568</b>	<b>245,711,568</b>	<b>242,906,322</b>	<b>241,227,259</b>	<b>238,515,620</b>	<b>238,515,620</b>	<b>238,515,620</b>
<b>Program Total Electric CPAS</b>						<b>86,043,658</b>	<b>177,580,411</b>	<b>245,711,568</b>	<b>292,568,128</b>	<b>289,762,882</b>	<b>288,083,819</b>	<b>283,132,827</b>	<b>283,132,827</b>	<b>283,132,827</b>
<b>CY2021 Program Incremental Expiring Electric Savings§</b>												<b>2,239,353</b>		
<b>Historic Program Incremental Expiring Electric Savings</b>									<b>-</b>	<b>2,805,246</b>	<b>1,679,063</b>	<b>2,711,639</b>		
<b>Program Total Incremental Expiring Electric Savings</b>									<b>-</b>	<b>2,805,246</b>	<b>1,679,063</b>	<b>4,950,993</b>		

End Use Type	Research Category	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038
Public Sector Street Lights	Standard Baseline	31,046,565	31,046,565	31,046,565	31,046,565	31,046,565	31,046,565	31,046,565	31,046,565	31,046,565	31,046,565	31,046,565	31,046,565
ComEd Street Lights	Standard Baseline	10,805,677	10,805,677	10,805,677	10,805,677	10,805,677	10,805,677	10,805,677	10,805,677	10,805,677	10,805,677	10,805,677	10,805,677
ComEd Street Lights	Mercury Vapor Baseline	2,657,325	2,657,325	2,657,325	2,657,325	2,657,325	2,657,325	2,657,325	2,657,325	2,657,325	2,657,325	2,657,325	2,657,325
Public Sector Street Lights	Mercury Vapor Baseline	107,639	107,639	107,639	107,639	107,639	107,639	107,639	107,639	107,639	107,639	107,639	107,639
<b>CY2021 Program Total Electric Contribution to CPAS</b>		<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>
<b>Historic Program Total Electric Contribution to CPAS‡</b>		<b>238,515,620</b>	<b>238,515,620</b>	<b>238,515,620</b>	<b>155,277,208</b>	<b>65,419,517</b>							
<b>Program Total Electric CPAS</b>		<b>283,132,827</b>	<b>283,132,827</b>	<b>283,132,827</b>	<b>199,894,415</b>	<b>110,036,724</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>	<b>44,617,207</b>
<b>CY2021 Program Incremental Expiring Electric Savings§</b>													
<b>Historic Program Incremental Expiring Electric Savings</b>					<b>83,238,412</b>	<b>89,857,690</b>	<b>65,419,517</b>						
<b>Program Total Incremental Expiring Electric Savings</b>					<b>83,238,412</b>	<b>89,857,690</b>	<b>65,419,517</b>						

End Use Type	Research Category	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050
Public Sector Street Lights	Standard Baseline	31,046,565	29,913,378										
ComEd Street Lights	Standard Baseline	10,805,677	10,805,677										
ComEd Street Lights	Mercury Vapor Baseline	2,657,325	2,657,325										
Public Sector Street Lights	Mercury Vapor Baseline	107,639	107,639										
<b>CY2021 Program Total Electric Contribution to CPAS</b>		<b>44,617,207</b>	<b>43,484,019</b>										
<b>Historic Program Total Electric Contribution to CPAS‡</b>													
<b>Program Total Electric CPAS</b>		<b>44,617,207</b>	<b>43,484,019</b>										
<b>CY2021 Program Incremental Expiring Electric Savings§</b>			<b>1,133,187</b>	<b>43,484,019</b>									
<b>Historic Program Incremental Expiring Electric Savings</b>													
<b>Program Total Incremental Expiring Electric Savings</b>			<b>1,133,187</b>	<b>43,484,019</b>									

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>.

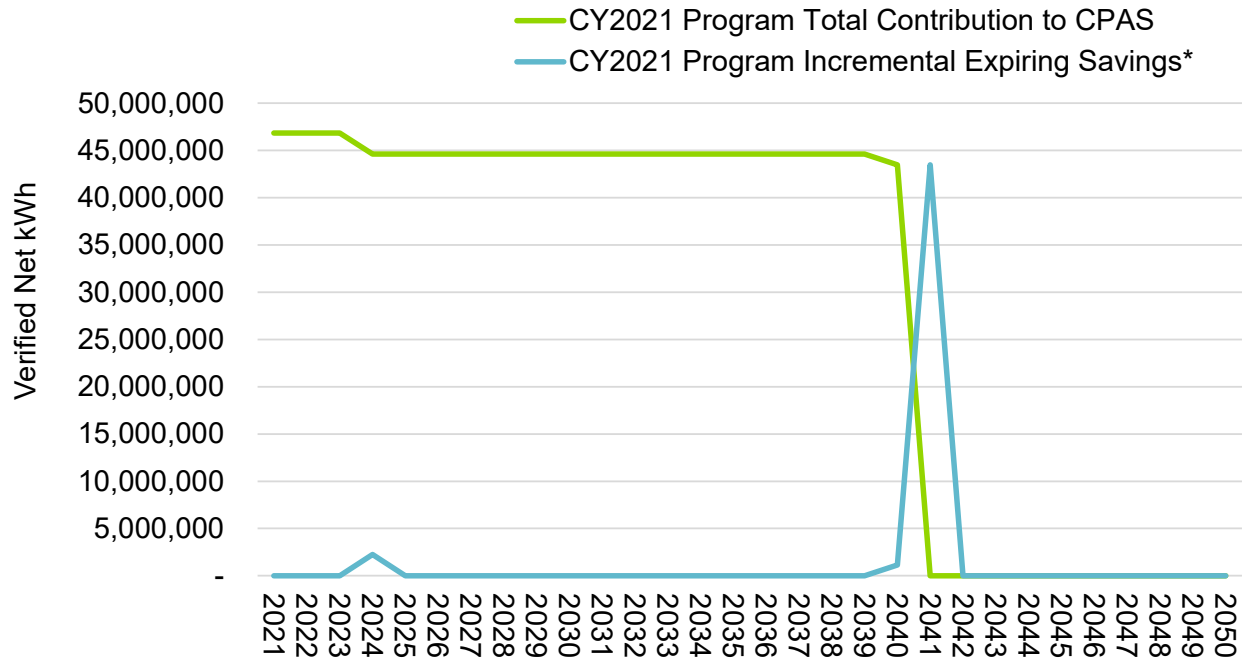
† Lifetime savings are the sum of CPAS savings through the EUL.

‡ Historic savings go back to CY2018.

§ Incremental expiring savings are equal to CPAS Y<sub>n-1</sub> - CPAS Y<sub>n</sub>.

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 evaluation team analyzed savings for the LED Street Lighting Program at a strata level, with projects for ComEd-owned equipment forming one strata and projects for publicly owned equipment forming the second strata. An additional distinction is made by subdividing savings in each stratum into two measure bins: those with a mercury vapor baseline versus the more typical high-pressure sodium baseline. This distinction is made so that the evaluation team can account for a midlife baseline adjustment that applies when the LED replaces a mercury vapor fixture.

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

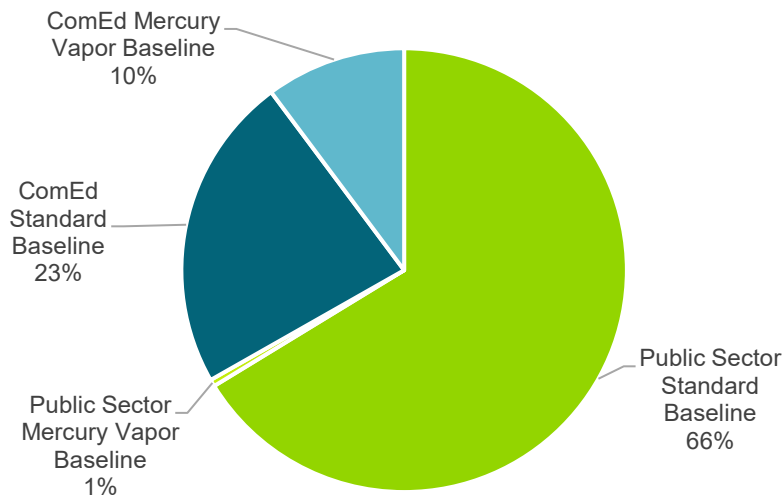
**Table 5-1. Number of Measures by Type**

End Use Type	Research Category	Quantity	Unit
Public Sector Street Lights	Standard Baseline	48,216	Fixtures
Public Sector Street Lights	Mercury Baseline	404	Fixtures
ComEd Street Lights	Standard Baseline	15,160	Fixtures
ComEd Street Lights	Mercury Baseline	5,444	Fixtures
<b>Total</b>		<b>69,224</b>	

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 Measure – Electric**



Source: ComEd tracking data and evaluation team analysis

Measure-level energy and demand savings are provided in Table 5-2 and Table 5-3. Note that fundamentally LED Streetlight is the only measure covered by this program. The subsequent subdivision of this measure is an artifact of how net and lifetime savings are allocated.

**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)
Public Sector Street Lights	Standard Baseline	38,337,043	1.00	38,329,093	0.81	31,046,565	20.0
Public Sector Street Lights	Mercury Baseline	289,721	1.00	289,660	0.81	234,625	20.0
ComEd Street Lights	Standard Baseline	10,808,176	1.00	10,805,677	1.00	10,805,677	20.0
ComEd Street Lights	Mercury Baseline	4,770,771	1.00	4,769,693	1.00	4,769,693	20.0
<b>Total</b>		<b>54,205,711</b>	<b>1.00</b>	<b>54,194,123</b>		<b>46,856,560</b>	<b>20.0</b>

\* 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)
Public Sector Street Lights	Standard Baseline	NR	N/A	14.44	0.81	11.70
Public Sector Street Lights	Mercury Vapor Baseline	NR	N/A	-	0.81	-
ComEd Street Lights	Standard Baseline	NR	N/A	-	1.00	-
ComEd Street Lights	Mercury Vapor Baseline	NR	N/A	-	1.00	-
<b>Total</b>		<b>NR</b>	<b>N/A</b>	<b>14.44</b>		<b>11.70</b>

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

NR = not reported.

\* 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

Overall, the LED Streetlighting Program is well implemented with each measure carefully and accurately documented. The issue that generated a small adjustment to ex ante gross savings is an inconsistency with the reported number of heads on poles versus the verified number of heads installed.

The evaluation team developed the following recommendations based on findings from the CY2021 evaluation.

**Finding 1.** The number of street light heads on poles reported in the database does not appear to be linked to the ex ante savings calculation. Most measure instances are reported as one-to-one head per installation and the disconnect does not impact the savings estimate for these instances. However, there are four instances (LDSB-595, LDSB-600, LDSB-612, and LDSB-664) where the evaluation could not duplicate ex ante savings using the reported head count. For these four instances, the evaluation verified savings calculations used online mapping tools to verify the number of heads on poles.

**Recommendation 1.** Confirm the fixture quantity used in the savings calculation is linked to the heads on pole data field in the database.

**Finding 2.** The file review found 88 instances where the number of streetlight heads reported in the database differs from what can be verified using online mapping tools. The evaluation team used street view data to visually verify the number of heads on poles for projects in our sample.

**Recommendation 2.** Take additional care in tracking the number of heads installed per pole.

## Appendix A. Impact Analysis Methodology

The evaluation team determined verified gross savings for each program measure by:

- Reviewing the program database to ensure all necessary measure specifications are included and fixture wattages align with reported fixture type.
- Verifying the reported measure quantity with invoices, as able.
- Verifying the measure quantity and number of heads on poles with via online mapping tools, as able.
- Applying the savings algorithm from Illinois Technical Reference Manual v9.0 (IL-TRM).<sup>1</sup>
- Where savings reported in the database do not agree with the verified values in Guidehouse's calculations, cross-checking IL-TRM deemed inputs with the implementer's supporting calculations and other project files.

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

- Final ComEd CY2021 tracking data:  
LDSB\_CY2021\_Analysis\_EndOfYear\_22\_02\_16\_PII\_REMOVED.xlsx.
- IL-TRM for deemed input parameters such as hours of use and baseline fixture watts.
- Program applications, measure specification sheets, and project invoices.

Net savings are determined by multiplying the verified gross savings estimates by the program-specific net-to-gross (NTG) ratios as approved by the Illinois SAG.<sup>2</sup>

To achieve the 90% confidence interval and 10% maximum relative precision, Guidehouse selected 15 projects for a full desk and file review. The sampled projects were selected from the public and private sectors. The evaluation team developed realization rates for the program based on the verified savings for the sampled projects. The realization rate for the sampled projects was then extrapolated to the remainder of projects to determine the program realization rate. The final verified savings resulted in 90% confidence interval and 0.03% relative precision, which is within the 90/10 target.

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<sup>1</sup> In this report, unless stated otherwise, IL-TRM refers to version 9.0 (v9.0).

<sup>2</sup> Source: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2021>.

## 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	Gross	Gross			NTG (kWh)	NTG (kW)	NTG (Therms)	Net Electric	Net Peak	Net Gas Savings (Therms)	Net			
						Electric Energy Savings (kWh)	Peak Demand Reduction (kW)	Gross Gas Savings (Therms)	Secondary Savings due to Water Reduction (kWh)	Gross Heating Penalty (kWh)				Gross Heating Penalty (Therms)	Energy Savings (kWh)		Demand Reduction (kW)	Secondary Savings due to Water Reduction (kWh)	Net Heating Penalty (kWh)	Net Heating Penalty (Therms)
Public Sector Street Lights	Standard Baseline	Fixture	48,216	20.0	NO	38,329,093	14.44	0	0	0	0	0.81	0.81	N/A	31,046,565	11.70	0	0	0	0
Public Sector Street Lights	Mercury Vapor Baseline‡	Fixture	404	20.0	YES	289,660	0.00	0	0	0	0	0.81	0.81	N/A	234,625	0.00	0	0	0	0
ComEd Street Lights	Standard Baseline	Fixture	15,160	20.0	NO	10,805,677	0.00	0	0	0	0	1.00	1.00	N/A	10,805,677	0.00	0	0	0	0
ComEd Street Lights	Mercury Vapor Baseline‡	Fixture	5,444	20.0	YES	4,769,693	0.00	0	0	0	0	1.00	1.00	N/A	4,769,693	0.00	0	0	0	0
<b>Total</b>				<b>20.0</b>		<b>54,194,123</b>	<b>14</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>				<b>46,856,560</b>	<b>12</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>

N/A = 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.

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

Source: ComEd tracking data and evaluation team analysis