



# ComEd Voltage Optimization Program Impact Evaluation Report

Energy Efficiency/Demand Response Plan:  
Program Year 2023 (CY2023)  
(1/1/2023-12/31/2023)

Prepared for:

ComEd

**FINAL**

**April 3, 2024**

Prepared by:  
**Carly Olig**  
Guidehouse

**Isaiah Westphalen**  
Guidehouse

**Submitted to:**

ComEd  
2011 Swift Drive  
Oak Brook, IL 60523

**Submitted by:**

Guidehouse Inc.  
150 N. Riverside Plaza, Suite 2100  
Chicago, IL 60606

**Contact:**

Charles Maglione, Partner  
703.431.1983  
[cmaglione@guidehouse.com](mailto:cmaglione@guidehouse.com)

Jeff Erickson, Director  
608.616.4962  
[jeff.erickson@guidehouse.com](mailto:jeff.erickson@guidehouse.com)

Carly Olig, Associate Director  
608.616.4810  
[carly.olig@guidehouse.com](mailto:carly.olig@guidehouse.com)

This report was prepared by Guidehouse for ComEd. The work presented in this report represents Guidehouse's professional judgment based on the information available at the time this report was prepared. Use of this report by any other party for whatever purpose should not, and does not, absolve such party from using due diligence in verifying the report's contents. Neither Guidehouse nor any of its subsidiaries or affiliates assumes any liability or duty of care to such parties, and hereby disclaims any such liability.

## Table of Contents

|                              |   |
|------------------------------|---|
| Introduction .....           | 1 |
| Program Savings Detail ..... | 1 |
| CPAS Savings .....           | 4 |

## List of Tables and Figures

|   |   |
|---|---|
| Table 1. Total Annual Incremental Electric Savings - Total..... | 1 |
| Table 2. CPAS – Electric.....                                   | 4 |

## Introduction

This report presents the results of the impact evaluation of the Voltage Optimization (VO) program from the program year from January 1 to December 31, 2023 (CY2023). The program was designed to install hardware and software systems on a significant fraction of ComEd's electric power distribution grid to achieve voltage and reactive power optimization (Volt/VAR optimization, or VVO). VVO is a smart grid technology that uses distributed sensors, two-way communications infrastructure, remote controls on substation transformer load tap changers and line capacitor banks, and integrating/optimizing software to flatten voltage profiles and lower average voltage levels on an electric power distribution grid.

Unlike energy efficiency programs that achieve savings by providing financial incentives to encourage customers to adopt energy efficient equipment or behavioral suggestions to encourage them to adopt no-cost energy-saving behaviors, the VO Program involves no direct customer engagement. Instead, savings are achieved by operating the voltage and reactive power controls on VO-enabled feeders and substations in a manner designed to maintain the voltages delivered to affected customers in the lower part of the allowable voltage range.<sup>1</sup>

## Program Savings Detail

Table 1 summarizes the incremental energy and demand savings the VO Program achieved in CY2023.

**Table 1. Total Annual Incremental Electric Savings - Total**

| Savings Category                                     | Units | Ex Ante Gross Savings* | Program Gross Realization Rate | Verified Gross Savings* | Program Net-to-Gross Ratio (NTG) | CY2021 Net Carryover Savings | CY2022 Net Carryover Savings | Verified Net Savings† |
|--|-------|------------------------|--------------------------------|-------------------------|----------------------------------|------------------------------|------------------------------|-----------------------|
| Electric Energy Savings - Direct‡                    | kWh   | 68,604,187             | 1.01                           | 68,991,654              | 1.00                             | 0                            | 0                            | 68,991,654            |
| Electric Energy Savings - Converted from Other Fuel§ | kWh   | 0                      |                                | 0                       | 1.00                             | 0                            | 0                            | 0                     |
| Electric Energy Savings - Electrification            | kWh   | 0                      |                                | 0                       |                                  | 0                            | 0                            | 0                     |
| Total Electric Energy Savings#                       | kWh   | 68,604,187             | 1.01                           | 68,991,654              | 1.00                             | 0                            | 0                            | 68,991,654            |
| Total Electric Energy Savings Including Carryover#   | kWh   | 0                      | 0.00                           | 0                       | 0.00                             | 0                            | 0                            | 0                     |
| Summer Peak**† Demand Savings                        | kW    | 12,366                 | 1.01                           | 12,456                  | 1.00                             | 0                            | 0                            | 12,456                |
| Summer Peak**† Demand Savings Including Carryover    | kW    | 0                      | 0.00                           | 0                       | 0.00                             | 0                            | 0                            | 0                     |

\* The "Ex Ante Gross Savings" and "Verified Gross Savings" in row one (Electric Energy Savings - Direct) and row six (Summer Peak Demand Savings) exclude gross carryover savings from CY2021 and CY2022.

† The "Verified Net Savings" in row one and row six exclude carryover savings as they don't apply to this program.

‡ The Electric Energy Savings - Direct includes primary kWh savings from efficient measures (includes efficiency savings from electrification measures but excludes the electrification savings), secondary kWh savings from wastewater treatment, and electric heating penalties.

§ Gas savings converted to kWh by multiplying Therms \* 29.31 (which is based on 100,000 Btu/Therm and 3,412 Btu/kWh) and/or propane savings converted to kWh by multiplying Gallons \* 26.77 (which is based on 91,333 Btu/Gallon and 3,412 Btu/kWh). The evaluation team will determine which other fuel savings will be converted to kWh and counted toward ComEd's electric savings goal while producing the portfolio-wide Summary Report.

|| Electrification savings from electrification measures excluding direct efficiency savings. Calculated from net electric savings from increase in kWh consumption and decrease in gas consumption from electrification (kWh equivalent).

<sup>1</sup> The bulk of the energy savings that occurs is expected to occur on the customer side of the meter, although additional savings are expected from reduced current flows along the full length of the affected circuits.

# Total Electric Energy Savings is the sum of the Electric Energy Savings - Direct, the Electric Energy Savings Converted from Other Fuel, and the Electrification Savings from electrification. Note: This row does not include carryover gross savings, but the next one includes carryover verified gross savings, for the purpose of recalculating the gross realization rate resulting from including carryover savings (same for the peak demand savings).

\*† The Peak Demand Savings are savings occurring at coincident Summer Peak period, defined as 1:00-5:00 PM Central Prevailing Time on non-holiday weekdays, June through August. This definition is in accordance with PJM requirement.

Note: The NTG value is deemed in a SAG process and is documented here: <https://www.ilsag.info/evaluator-ntg-recommendations-for-2023>.

Source: *Evaluation team analysis*

## Cumulative Persisting Annual Savings

Table 2 shows the cumulative persisting annual savings (CPAS) for the measures installed in CY2023. The electric CPAS across all measures installed in 2023 is shown in Table 2.

**Table 2. CPAS – Electric**

| Savings Category  | Verified Gross Savings (kWh) | Lifetime Net Savings (kWh) <sup>†</sup> | CPAS Verified Net kWh Savings |             |             |             |             |             |             |             |             |             |             |             |
|---|------------------------------|---|-------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
|   |                              |   | 2018                          | 2019        | 2020        | 2021        | 2022        | 2023        | 2024        | 2025        | 2026        | 2027        | 2028        |             |
| CY2023 Program Total Contribution to CPAS                   | 68,991,654                   | 1,034,874,812                           |                               |             |             |             |             |             | 68,991,654  | 68,991,654  | 68,991,654  | 68,991,654  | 68,991,654  | 68,991,654  |
| Historic Program Total Contribution to CPAS <sup>‡</sup>    |                              |   | 66,014,049                    | 250,055,552 | 466,051,868 | 737,003,608 | 916,985,992 | 916,985,992 | 916,985,992 | 916,985,992 | 916,985,992 | 916,985,992 | 916,985,992 | 916,985,992 |
| Program Total CPAS  | 68,991,654                   | 1,034,874,812                           | 66,014,049                    | 250,055,552 | 466,051,868 | 737,003,608 | 916,985,992 | 985,977,646 | 985,977,646 | 985,977,646 | 985,977,646 | 985,977,646 | 985,977,646 | 985,977,646 |
| CY2023 Program Incremental Expiring Savings <sup>§</sup>    |                              |   |                               |             |             |             |             |             | 0           | 0           | 0           | 0           | 0           | 0           |
| Historic Program Incremental Expiring Savings <sup>  </sup> |                              |   |                               |             |             |             |             | 0           | 0           | 0           | 0           | 0           | 0           | 0           |
| Program Total Incremental Expiring Savings <sup>#</sup>     |                              |   |                               |             |             |             |             | 0           | 0           | 0           | 0           | 0           | 0           | 0           |

  

| Savings Category  | Verified Gross Savings (kWh) | Lifetime Net Savings (kWh) <sup>†</sup> | CPAS Verified Net kWh Savings |             |             |             |             |             |             |             |             |            |      |   |
|---|------------------------------|---|-------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------|------|---|
|   |                              |   | 2029                          | 2030        | 2031        | 2032        | 2033        | 2034        | 2035        | 2036        | 2037        | 2038       | 2039 |   |
| CY2023 Program Total Contribution to CPAS                   | 68,991,654                   | 1,034,874,812                           | 68,991,654                    | 68,991,654  | 68,991,654  | 68,991,654  | 68,991,654  | 68,991,654  | 68,991,654  | 68,991,654  | 68,991,654  | 68,991,654 | 0    | 0 |
| Historic Program Total Contribution to CPAS <sup>‡</sup>    |                              |   | 916,985,992                   | 916,985,992 | 916,985,992 | 916,985,992 | 850,971,943 | 666,930,440 | 450,934,124 | 179,982,384 |             |            |      |   |
| Program Total CPAS  | 68,991,654                   | 1,034,874,812                           | 985,977,646                   | 985,977,646 | 985,977,646 | 985,977,646 | 919,963,597 | 735,922,094 | 519,925,778 | 248,974,038 | 68,991,654  | 0          | 0    | 0 |
| CY2023 Program Incremental Expiring Savings <sup>§</sup>    |                              |   | 0                             | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 0           | 68,991,654 | 0    | 0 |
| Historic Program Incremental Expiring Savings <sup>  </sup> |                              |   | 0                             | 0           | 0           | 0           | 66,014,049  | 184,041,503 | 215,996,316 | 270,951,740 | 179,982,384 | 0          | 0    | 0 |
| Program Total Incremental Expiring Savings <sup>#</sup>     |                              |   | 0                             | 0           | 0           | 0           | 66,014,049  | 184,041,503 | 215,996,316 | 270,951,740 | 179,982,384 | 68,991,654 | 0    | 0 |

Note: The 15-year EUL shown here aligns with IL-TRM v11.0 which also allows VO savings to be renewed every 15 years to a maximum of 50 years “after verifying that VO is still operational on the feeder in a manner consistent with the operation that led to the original TRM savings estimate.”<sup>2</sup> This renewal is expected to apply to these feeders with a 15-year renewal in 2038, another 15-year renewal in 2053, and a 10-year renewal in 2063, for a total EUL of 50 years.

<sup>†</sup> Lifetime savings are the sum of CPAS savings through the EUL.

<sup>‡</sup> Historical savings go back to CY2018.

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

<sup>||</sup> Historic incremental expiring savings are equal to Historic CPAS Y<sub>n-1</sub> – Historic CPAS Y<sub>n</sub>.

<sup>#</sup> Program total incremental expiring savings are equal to current year total incremental expiring savings plus historic total incremental expiring savings.

Source: Evaluation team analysis

<sup>2</sup> See Measure 6.2.1, Volume 4, Version 11.0 of the IL-TRM.