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ComEd Voltage Optimization Program Impact Evaluation Report

Energy Efficiency/Demand Response Plan: Program Year 2022 (CY2022) (1/1/2022-12/31/2022)

Prepared for:

ComEd

FINAL

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Introduction

This report presents the results of the impact evaluation of the Voltage Optimization (VO) program for the program year from January 1 to December 31, 2022 (CY2022). The program was designed to install hardware and software systems on a significant portion of ComEd's electric power distribution grid to achieve a combination of conservation voltage reduction (CVR)[1] and volt/var optimization (VVO).[2] VVO is a smart grid technology that uses distributed sensors (e.g., end of line meters); two-way communications infrastructure; intelligent distribution automation controls on substation transformer load tap changers, line capacitor banks, and line voltage regulators; 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.[3]

Program Savings Detail

Table 1 summarizes the incremental energy and demand savings the Voltage Optimization Program achieved in CY2022.

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)	CY2020 Net Carryover Savings	CY2021 Net Carryover Savings	Verified Net Savings†
Electric Energy Savings - Direct‡	kWh	179,078,803	1.01	179,982,384	1.00	0	0	179,982,384
Electric Energy Savings - Converted from Gas§	kWh	0		0	1.00	0	0	0
Electric Energy Savings - Indirect from Fuel Switching (through Electrification)||	kWh	0		0		0	0	0
Total Electric Energy Savings#	kWh	179,078,803	1.01	179,982,384	1.00	0	0	179,982,384
Secondary Water Savings	kWh	0		0		0	0	0
Summer Peak*† Demand Savings	kW	35,669	1.00	35,780	1.00	0	0	35,780

* Ex ante and verified gross savings exclude gross carryover savings from CY2020 and CY2021.
† The "Verified Net Savings" in row one (Electric Energy Savings - Direct) excludes carryover savings as they do not apply to this program.
‡ The Electric Energy Savings - Direct includes primary kWh savings from efficient measures (includes efficiency savings from fuel switching measures but excludes the fuel switching 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

[1] CVR reduces end-user voltage using load-tap changers, voltage regulators, and capacitors to reduce consumer energy consumption.

[2] VVO coordinates the capacitor bank operation to flatten feeder voltage drop, reduce distribution losses, and improve power factors.

[3] 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.

Btu/kWh). The evaluation team will determine which gas savings will be converted to kWh and counted toward ComEd's electric savings goal while producing the portfolio-wide Summary Report.
|| Electrification savings from fuel switching measures excluding direct efficiency savings calculated from net electric savings from an increase in kWh consumption and decrease in gas consumption from fuel switching (kWh equivalent).
Total Electric Energy Savings is the sum of the Electric Energy Savings - Direct, the Electric Energy Savings Converted from Gas, and the Electrification Savings from fuel switching.
*† The Peak Demand Savings are savings occurring at coincident Summer Peak period, defined as 1:00 p.m. - 5:00 p.m. Central Prevailing Time on non-holiday weekdays, June through August. This definition is in accordance with PJM requirement.
Note: The NTG value is deemed through a SAG process and is sourced here: https://www.ilsag.info/evaluator-ntg-recommendations-for-2022. VO is not a customer-facing program, so there is no free ridership or spillover, and the NTG ratio is 1.0.
Source: Evaluation team analysis

Cumulative Persistent Annual Savings

Table 2 shows the cumulative persisting annual savings (CPAS) for the measures installed in CY2022.

Table 2. CPAS – Electric

			CPAS Verified Net kWh Savings										
Savings Category	Verified Gross Savings (kWh)	Lifetime Net Savings (kWh)†	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
CY2022 Program Total Contribution to CPAS	179,982,384	2,699,735,756					179,982,384	179,982,384	179,982,384	179,982,384	179,982,384	179,982,384	179,982,384
Historic Program Total Contribution to CPAS‡			66,014,049	250,055,552	466,051,868	737,003,608	737,003,608	737,003,608	737,003,608	737,003,608	737,003,608	737,003,608	737,003,608
Program Total CPAS	179,982,384	2,699,735,756	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
CY2022 Program Incremental Expiring Savings§								0	0	0	0	0	0
Historic Program Incremental Expiring Savings||							0	0	0	0	0	0	0
Program Total Incremental Expiring Savings#							0	0	0	0	0	0	0

Savings Category	Verified Gross Savings (kWh)	Lifetime Net Savings (kWh)†	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
CY2022 Program Total Contribution to CPAS	179,982,384	2,699,735,756	179,982,384	179,982,384	179,982,384	179,982,384	179,982,384	179,982,384	179,982,384	179,982,384	0	0	0
Historic Program Total Contribution to CPAS‡			737,003,608	737,003,608	737,003,608	737,003,608	670,989,559	486,948,056	270,951,740				
Program Total CPAS	179,982,384	2,699,735,756	916,985,992	916,985,992	916,985,992	916,985,992	850,971,943	666,930,440	450,934,124	179,982,384	0	0	0
CY2022 Program Incremental Expiring Savings§			0	0	0	0	0	0	0	0	179,982,384	0	0
Historic Program Incremental Expiring Savings||			0	0	0	0	66,014,049	184,041,503	215,996,316	270,951,740	0	0	0
Program Total Incremental Expiring Savings#			0	0	0	0	66,014,049	184,041,503	215,996,316	270,951,740	179,982,384	0	0

Note: The 15-year EUL shown here aligns with the Illinois Technical Reference Manual version 10.0 (IL-TRM v10.0) which is in effect for CY2022.[4] However, IL-TRM v11.0 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."[5] This renewal is expected to apply to these feeders with a 15-year renewal in 2037 and a 10-year renewal in 2052, for a total EUL of 50 years.
† Lifetime savings are the sum of CPAS savings through the EUL.
‡ Historical savings go back to CY2018.
§ Incremental expiring savings are equal to CPAS Yn-1 - CPAS Yn.
|| Historic incremental expiring savings are equal to Historic CPAS Yn-1 – Historic CPAS Yn.
Program total incremental expiring savings are equal to current year total incremental expiring savings plus historic total incremental expiring savings.
Source: Evaluation team analysis

[4] See Measure 6.2.1, Volume 4, Version 10.0 of the IL-TRM.
[5] See Measure 6.2.1, Volume 4, Version 11.0 of the IL-TRM.